



# BOOK OF ABSTRACTS

30th ERES ANNUAL CONFERENCE

JUNE 26-29, 2024

EDITORS |

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# BOOK OF ABSTRACTS

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Sopot & Gdansk (Poland)  
June 26-29, 2024

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# PREFACE

Dear readers and delegates at ERES 2024,

It is a pleasure for us to present you with this Book of Abstracts, consisting of contributions accepted for publication at the 30th ERES conference. The ERES 2024 call for abstracts resulted in a large number of promising submissions, with the following topical distribution:

Corporate Real Estate Management	3,93%
Valuation and Appraisal	9,55%
Real Estate Economics	10,67%
Real Estate Finance and Investment	12,36%
Housing	13,48%
Urban and Regional Analysis	6,18%
Sustainable Real Estate	16,85%
New Technology and Data in Real Estate	10,11%
Real Estate Education	3,37%
PhD Session	13,48%

The contribution to the conference – as indicated by the present Book of Abstracts – are witness to the high quality and creativity of research and development efforts of the real estate community. Accordingly, we are looking forward to interesting conference presentations, lively discussions, and productive exchanges of ideas and experiences. We hope the conference will strengthen the existing collaborations and foster future ones.

We would like to thank the ERES board for entrusting us with organizing a jubilee conference, which was as much a huge challenge for us as a great initiative. We would like to express our profound thanks to many people who were involved in the organization of the conference. In particular, we would like to thank Gunther Maier for maintaining the online submission interface. Finally, we want to express our gratitude to the sponsors for their generous contributions: the Minister of Education and Science within the "Doskonała Nauka II" Program, Polska, EPRA and Altus Group.

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## THE RELATIONSHIP BETWEEN WORKPLACE DESIGN, HYBRID WORKING CHOICES AND COHESION, IDENTIFICATION AND PRODUCTIVITY

Jorrit Van Beurden, Rianne Appel-Meulenbroek, Lisanne Bergefurt, Pascale Le Blanc, Mathilda du Preez

**KEYWORDS:** hybrid working, organizational outcomes, corporate real estate, self-management

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## THEME A: CORPORATE REAL ESTATE MANAGEMENT

New experiences with working from home (WfH) during the COVID-19 pandemic have led to a global shift towards hybrid working. This option to incorporate flexibility in when and where to work seems to have become preferred by many employees and employers. Hybrid working can offer benefits such as reduced commuting time and improved work-life balance, however challenges like communication difficulties remain. Also, this shift to remote and hybrid work presents a significant change in employees' work patterns. Understanding the impact of hybrid working choices and both office and home workplace design on employees and organizations is crucial. Concerns include potential declines in organizational outcomes, such as individual and team productivity, workplace cohesion, and organizational identification. This study therefore explores the relationships between individual, job, and workplace characteristics and hybrid working modes with these organizational outcomes. The data for the statistical analyses stem from the employees of two Dutch office-based organizations that participated in the 'Work in Transition (WiT)' research project, a collaboration between the Center for People & Buildings, Eindhoven University of Technology, and Delft University of Technology. Through an online survey, 6,414 office workers of these two (semi-)public organizations answered questions about their job, workplace at home and the office, personal characteristics, hybrid working choices and their perception of the mentioned organizational outcomes. Their answers were analyzed with bivariate analyses. In addition, effect sizes were determined to identify the most meaningful relationships. Results show that particularly self-management skills, having shared workplaces at the corporate office, satisfaction with the home office, and workplace autonomy had the largest effects on the organizational outcomes. The findings emphasize the shift in office use towards collaborative tasks in the office and concentrated work at home. Recommendations include restructuring offices and providing support plans for home office setup and self-management skills.



# INSTITUTIONAL VIEW OF PUBLIC-PRIVATE VALUE CO- CREATION IN REAL ESTATE DEVELOPMENT PROJECTS

Aleksi Luoma

**KEYWORDS:** real estate development, value co-creation, public-private collaboration, institutional factors

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**Purpose:** This study delves into the realm of public-private value co-creation within real estate development projects. The rise in project-based planning has necessitated enhanced collaboration between the private and public sectors. A key observation is the unclear relationship between such cooperation and land-use practices. The primary goal of this research is to identify institutional factors that either facilitate or impede value co-creation in these projects.

**Study Design/Methodology:** In this qualitative study, data were collected through semi-structured interviews with real estate developers and public sector representatives in Finland. To analyze the data, we applied Scott's (2008) framework of institutional pillars. This framework helps categorize various institutional indicators, including laws, norms, and beliefs, and assess their impact on value co-creation as either barriers or facilitators.

**Findings:** The study provides insights into improving value co-creation in real estate development. We found that normative and cultural-cognitive factors have a greater influence than regulatory factors. The main drivers identified for value co-creation include a faster, more predictable development process, and the creation of more valuable outcomes. However, the study also brings to light barriers such as inadequate operational practices, conflicting objectives, and challenges in cooperation. It concludes with the emphasis on the need for innovative collaborative practices and fostering an open culture of co-creation in the real estate development sector. Addressing these challenges and leveraging these drivers are critical for effective value co-creation.

**Originality/Value:** This study contributes to the field of value co-creation literature by offering new insights into the institutional environment in real estate development, particularly in understanding how various institutional factors can either support or impede the process of value co-creation.

## THEME A: CORPORATE REAL ESTATE MANAGEMENT



# THE IMPACT OF INTERNATIONAL DIVERSIFICATION ON U.S. EQUITY REIT PERFORMANCE

Daniel Huerta, Chris Mothorpe

**KEYWORDS:** REIT international diversification, REIT performance, REIT value, REIT portfolio management

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## THEME A: CORPORATE REAL ESTATE MANAGEMENT

The function of a REIT manager is to effectively and profitably manage a real estate portfolio. Among the ways to achieve this goal is to improve performance by managing market exposure through geographic diversification. Previous research recognizes the role of portfolio geographic diversification on efficiency and firm value. For example, Campbell, Petrova and Sirmans (2003) explain REIT property acquisitions produce wealth benefits when companies reconfirm their geographical focus suggesting firms benefit from more geographically concentrated portfolios. Similarly, Hartzell, Sun and Titman (2014) find that as REITs increase the geographical dispersion of their properties, firm value significantly decreases, also suggesting a REIT geographical diversification discount. More recently, Feng, Pattanapanchai, Price and Sirmans (2021) find a relationship between the level of firm transparency and the benefit of geographical diversification; that is, less transparent firms benefit from geographical concentration while more transparent firms benefit from diversification. Relatedly, Zhu and Lizieri (2022) suggest REITs with more geographically concentrated portfolios observe higher risk when the portfolio is exposed to more volatile property markets but if portfolios are geographically diversified, the effect of local market risk decreases. In sum, the evidence of whether geographical diversification improves or decreases REIT efficiency and value remains inconclusive. In this paper, we explore the impact of geographical diversification from an international perspective. We find that although most U.S. equity REITs tend to concentrate assets in the continental United States, a non-trivial portion of the U.S. REIT market tends to diversify internationally. Therefore, we raise the question of whether the strategy of international geographical diversification is value-enhancing.



# ADAPTING TO CHANGE: THE INCREASING IMPORTANCE OF OPERATING PERFORMANCE IN CORPORATE REAL ESTATE MANAGEMENT TRANSFORMATION

Maria Günther, Martin Christian Höcker, Andreas Pfnür

**KEYWORDS:** corporate real estate management, CREM performance, transformation, company success

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## THEME A: CORPORATE REAL ESTATE MANAGEMENT

Successful corporate real estate management (CREM) has enormous potential to positively influence a company's success. Therefore, the contribution of CREM can be divided into three mechanisms: Operating performance, real estate performance and financial performance. Current dynamics in the corporate environment due to megatrends and structural changes are leading to a greater focus on subjects such as new workplace concepts, improving employee satisfaction or the increasing importance of employer branding, suggesting that the contribution of the operating performance to the company's success is increasingly relevant. This study aims to investigate whether the shift towards the rising importance of operating performance can be statistically verified. To this end, survey data from a 2019 study is compared with current study results in order to identify shifts in relevance. In a second step, a confirmation-disconfirmation analysis is carried out to examine companies' current ability to utilize the potential of operating performance. The results of the study indicate whether CREM is currently able to unlock the potential of the operating performance. Additionally, the discrepancy between the relevance and implementability of measures can be used to derive an immediate need for action for CREM to increase CREM's contribution to their company's success.





# A CROSS-NATIONAL COMPARISON OF THE WORKPLACE ENVIRONMENT – A CASE STUDY OF GERMANY, SPAIN AND ETHIOPIA

Thomas Vogl, Malin Caniullan Kaiser

**KEYWORDS:** workplace management, cultural values, corporate real estate management, diversity

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## THEME A: CORPORATE REAL ESTATE MANAGEMENT

The objective of this study was to explore the perceived connection between the physical work environment and the cultural values of knowledge workers, focusing on a case study that compares the workplace environments of a mid-sized German project management company with office locations in Germany, Spain, and Ethiopia. To achieve this objective, a multi-step methodology was adopted. Initially, a thorough literature review was conducted to identify key physical workplace factors and relevant cultural values. Subsequently, the results built the base for a survey, which was distributed to the employees of the examined organization. The study's findings revealed that while clear-cut differences in workplace preferences based on national cultural values were not conclusively established, there was evidence indicating that cultural values do indeed influence preferences for physical workplace factors. These findings align with an expanding body of literature that explores the interplay between culture and the physical workplace. Thus, this study contributes novel insights into the relationship between the physical work environment and the cultural values of knowledge workers, particularly within the context of comparing German, Spain, and Ethiopian office workers.



# THE USE OF VISUALIZATION TOOLS IN HOSPITAL REAL ESTATE

Fieke Noordam, Monique Arkesteijn

**KEYWORDS:** stakeholder involvement, visualization tools, hospitals, VR

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## THEME A: CORPORATE REAL ESTATE MANAGEMENT

The (re)construction of hospitals is a complicated process because of the wide range of activities by different users in these buildings. When real estate managers and designers team up with hospital stakeholders, it results in better project outcomes. This collaboration benefits from appropriate visualization tools. Both physical mock-ups and virtual visualization tools are no longer an exception in such projects with various stakeholders. Therefore, maximizing the contribution of the visualization tools becomes more critical. Currently, there is a limited knowledge on how visualization tools are used best to involve the stakeholders within hospital (re)construction projects. This paper addresses the following research question: 'How can visualization tools contribute to the involvement of stakeholders in hospital (re)construction project?' A systematic literature review and three hospital case studies, including 21 stakeholder interviews, have been conducted. The resulting findings are validated by an external expert panel. The findings show that visualization tools support the involvement of hospital stakeholders by enforcing communication and improving stakeholders understanding. The visualization tools positively impact: 1) gathering stakeholders design feedback; 2) forming compromises; 3) creating design support and enthusiasm. In general, visualization tools have a positive effect on stakeholders' involvement; however, it depends on when in the design process and for what purpose the tools are used. Inadequate use of virtual visualization tools can mislead stakeholders since virtual visualizations show design details that might not be decided yet. The physical mock-ups and virtual visualization tools have different purposes and complimentary benefits in hospital (re)construction projects. Using the visualization tools, depending on the to be served purpose, one should gradually show more realistic visualizations. A combination of visualization tools has the highest impact when in early design phases, coarse physical mock-ups are used, and virtual visualization tools reveal refinements at a later design phase.



# INTER-UNIVERSITY KNOWLEDGE TRANSFER IN (SUSTAINABLE) CAMPUS MANAGEMENT: AN EXPLORATORY STUDY FOR CAMPUS NL

Alexandra Den Heijer, Neva Wardenaar, Jasmine Bacani, Monique Arkesteijn

**KEYWORDS:** knowledge transfer, barriers and drivers, campus management, sustainability

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## THEME A: CORPORATE REAL ESTATE MANAGEMENT

Knowledge transfer in campus management has a decades-long history in the Netherlands, ever since the Dutch (research) universities became owners of their university buildings and land in the nineties. The shared challenges have urged universities to join forces and exchange insights about their solutions. One of those pressing challenges has been sustainability. Since 2008, long-term agreements on energy-efficiency have become effective in the Netherlands for various sectors. Higher education was one of these sectors and - as a result - universities have developed sustainable visions and road maps for their campuses. At the same time, universities started to improve inter-university knowledge exchange, in general and about sustainability in particular. Knowledge transfer from theory to practice, from practice to practice, and from practice back to theory, has built a knowledge base with scientific and societal relevance and benefits for academia and professional campus management. Over the years, inter-university networks have given many new and valuable insights to support (sustainable) campus decision making. This presentation/paper combines findings from past campus research with new findings - from Neva Wardenaar's research - about the different existing networks, drivers, barriers, and tools of knowledge sharing between universities, providing an answer to the main research question: "How can inter-university knowledge transfer support university campus managers to achieve the universities' sustainability goals?". Wardenaar's research also served as exploratory research for (and before) the larger inter-university Campus NL research (2023-2027) by TU Delft's Campus Research Team. Through an extensive literature review, ten in-depth semi-structured interviews, strategy-analysis, and observations, Wardenaar's research concludes that universities have similar (sustainability) goals and that, by working together, they might accelerate the (decision-making) process of achieving these goals. Collectively, universities can acquire more funds, receive more guidance and get insights into what others are doing. This research provides an overview of the barriers and drivers of knowledge transfer that campus managers (working on the energy transition) are experiencing and contributes to the debate of knowledge transfer and (sustainable) campus management, with lessons beyond Campus NL.



## VALUATION FOR RESETTLEMENT PLANNING

Raphael Kieti


**KEYWORDS:** valuation, land acquisition, involuntary resettlement, safeguard policies

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Implementation of public projects often results in impoverishment risks including the loss of property and disruption of livelihoods of people due to compulsory land acquisition and involuntary resettlement. Land acquisition and involuntary resettlement, if not well planned, and properly managed has potential to cause a lot of hardships, pain and suffering among project affected persons. As part of planning for land acquisition, Resettlement Action Plans (RAPs) are prepared prior to land acquisition to manage the risks of resettlement. The management of resettlement risks entails ensuring that the risks are mitigated, avoided, and affected properties and livelihoods are adequately compensated through the use of appropriate valuation methodologies and procedures that conform to both the resettlement safeguard policies of projects financiers, and local and international valuation standards. The paper examines the policy framework within which valuation for Resettlement Action Plans are carried out, the basis and methods of valuation, as well as the challenges in carrying out valuations for resettlement planning of public projects funded by international organizations in Kenya and other developing countries in Africa.

## THEME B: VALUATION AND APPRAISAL



# ENHANCING THE VALIDATION OF AUTOMATED VALUATION MODELS (AVMS) THROUGH WISDOM OF THE CROWD

David Koch, Simon Thaler

**KEYWORDS:** wisdom of the crowd, mass appraisal verification, subjectivity biases, smoothing bias

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## THEME B: VALUATION AND APPRAISAL

Automated Valuation Models (AVMs) play a pivotal role in appraisal of real estate as collateral for mortgage loans by banks. However, the verification of these models poses a significant challenge. When relying solely on a single appraiser to determine the AVM's validity, concerns may arise regarding a potential subjectivity bias, stemming from the individual preferences of the appraiser. Conversely, if verification is based on transaction prices, critics may argue that it relies on outdated prices due to the time lag between contract conclusion and final sale which can invoke a so-called temporal lag or smoothing bias. Therefore, we address the question of which validation mechanism is most suitable for verifying AVM accuracy. Over a period of three years, approximately 250 properties were evaluated each year. Each property was assessed by two students from the real estate management field. All students had already received training in property valuation, but they had diverse backgrounds, such as being undergraduate or graduate students, and either working full-time or part-time. About half of the total 30 students were already employed in the real estate industry. The over 750 evaluated properties represent transactions collected within the scope of loan approvals and were assessed using an AVM model. Additionally, the actual transaction price is available. This means that for each property, there is the transaction price, the AVM value, and two values from different students. In our analysis we consider three methods: single appraiser verification, transaction price verification, and a verification by two less-experienced students. The aim is to demonstrate a comparison of the valuations. We examine potential benefits and limitations and look into the effect on potential biases which can be improved by the students-based approach and influence the overall reliability of AVMs. Initial results already indicate that the average from both students' assessments significantly represents an improvement.



## BEHAVIORAL ASPECTS OF PROPERTY MARKET VALUE. IMPLICATIONS FOR THE PRESENTATION OF VALUATION RESULTS

Ewa Kucharska-Stasiak, Piotr Jarecki


**KEYWORDS:** property valuation, behavioral economics, market value, uncertainty

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The paper examines the behavioral aspects of the market value concept in property valuation. The following research hypotheses are considered: (I) decision-making, pricing, valuation, and value in the real estate market form a behavioral chain whose links influence each other; (II) the current definition and interpretation of market value omit the behavior of the real estate market participants; (III) the current definition and interpretation of market value also omit the special characteristics of real estate and the conditions under which real estate transactions are made, including risk and uncertainty. To allow for the behavioral aspects of the market value of properties, we propose (a) extending the current definition of a market value to include risk and uncertainty and (b) highlighting the need to continue the discussion on changing the presentation and interpretation of the valuation result. The paper has been prepared based on the results of (I) a critical analysis of the pertinent literature and (II) a survey of property valuers to assess their awareness of the behavioral aspects of valuations and views on the presentation of their outcomes.

## THEME B: VALUATION AND APPRAISAL



# IMPROVEMENT OF THE SALES COMPARISON APPROACH USING ANALYTICAL HIERARCHY PROCESS AND LINEAR OPTIMIZATION: METHODOLOGICAL SETTING

Sergio Copiello, Pietro Bonifaci


**KEYWORDS:** market approach, comparable method, analytic hierarchy process, linear optimization

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## THEME B: VALUATION AND APPRAISAL

The theory and methodology of real estate appraisal are arranged in a well-known hierarchical structure whose levels are approaches, methods, and models. This study deals with the first of the three approaches – market, income, and cost. The market approach is rooted in the principle of price equilibrium; hence, a subject's value can be identified based on the price of similar assets, provided technical and economic data for at least a few recent transactions are available. Under the above framework, the sales comparison adjustment grid and a variety of related models and techniques are among the most commonly used by practitioners and appraisers to assess the market value of real estate assets, even though they are affected by some severe flaws and deficiencies. The most prominent weaknesses the literature pointed out lie in the selection criteria for the comparable, the sample size, and the weighting of the comparable' attributes. The weighting process, especially, is undermined by subjectivity, uncertainty, and a certain lack of reliability. Several attempts have been made to overcome the drawbacks affecting the weighting process in the sales comparison adjustment grid, resulting in promising mathematical and statistical approaches, which are nonetheless inconvenient and way too complex for most appraisers. Here, we propose to solve the subjectivity issue in the weighting of the comparable' attributes using a process that practitioners can easily replicate on a worksheet, without requiring expert knowledge of mathematics and statistics. The solution we put forward combines the Analytic Hierarchy Process (AHP) and linear optimization. A relationship is established between the properties in the sales comparison adjustment grid and the hierarchical value tree on which AHP builds. From the bottom to the top of the tree: comparable are the alternatives, while attributes are the criteria. Since the sale price should reflect and summarize how much the consumers value the property features, the rankings of the comparable according to their sale price and according to their weighted attributes should converge. The criteria (i.e., attributes) weights are thus iteratively searched by matching the ranking of the alternatives (i.e., comparable) according to their sale price and the ranking of the same according to their attributes. In other words, optimal weights are identified as the attributes' marginal prices that minimize the overall distance between those rankings.



# IMPROVEMENT OF THE SALES COMPARISON APPROACH USING ANALYTICAL HIERARCHY PROCESS AND LINEAR OPTIMIZATION: APPLICATION AND VALIDATION

Pietro Bonifaci, Federica Libralon, Alessandra Saviane, Sergio Copiello


**KEYWORDS:** market approach, comparable method, analytic hierarchy process, linear optimization

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## THEME B: VALUATION AND APPRAISAL

The sales comparison adjustment grid within the market approach suffers from several flaws and drawbacks, one of the most conspicuous of which lies in the subjectivity - uncertainty, too, and even lack of reliability - affecting the weights of the comparable' attributes. The literature has already focused on improving the sales comparison adjustment technique, but the approaches proposed so far - though promising - are usually inconvenient and too complex to be included in any appraisal. We propose to overcome the subjectivity issue by complementing the sales comparison adjustment grid with an automated weighting process based on the Analytic Hierarchy Process (AHP) and linear optimization. The solution suggested here aims to be easily replicable by practitioners and appraisers on a worksheet, without requiring expert knowledge of mathematics and statistics. The ranking of the comparable according to their sale price and the ranking of the same according to their attributes are elicited using pairwise comparison matrices, which are built by calculating the ratios of the prices and the ratios of the attributes' values, respectively. Using ratios leads to pairwise comparison matrices that are, by definition, perfectly consistent. Nevertheless, while using ratios is straightforward for quantitative attributes, it also poses the issue of how the qualitative ones are coded and measured. The ranking of the comparable according to their sale price and according to their attributes are then matched by changing the attributes' weights. The iterative search for the optimal weights employs the solvers available in common worksheets. Several tests are performed to validate the proposed model. Some of them use ordinary residential building units for sale both as the subject and as comparable. Once the subject is identified, ten or so other properties for sale are chosen in the same urban area as comparable; the comparison is primarily based on the information included in the online real estate advertisements. Other tests are conducted based on the appraisal reports the Italian Revenue Agency prepared for a set of peculiar publicly-owned buildings. As comparable, we use the same properties identified to that end in the appraisal reports mentioned above, and the comparison focuses on and is limited to the attributes considered there. The results suggest that complementing the sales comparison adjustment grid with a weighting system derived from the data itself leads to a fair appraisal of the property market value.





# PROPERTY VALUATION PRINCIPLES - HOW POLICY CHANGES CAN BE DETRIMENTAL FOR URBAN DEVELOPMENT

Marek Walacik, Aneta Chmielewska, Richard Grover

**KEYWORDS:** property valuation principles, urban development, adjacent fee, municipal revenues

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Local government units' own revenues are the most significant sources of financing their activities, from the point of view of their financial self-reliance. The sources include several groups of income characterized by different fiscal efficiency and performed functions. One of the groups is formed by so called local fees, which being a source of revenue, are also urban development factors that influence entities operating in the municipality. Among the fees that are the main income of municipalities in most developed economies are ad valorem property taxes. In countries that have not implemented this solution, where the basis for determining the tax is, for example property area, it was necessary to develop alternative solutions that enable the collection of fees on various changes in the real estate structure (e.g. the adjacent fee). Property valuation principles defining the scope, assumptions and methodological procedures are substantial in that case. The principles are subject of continuous changes, which can have either positive or detrimental impact on urban development. This article attempts to assess the potential impact of legal changes, in terms of determining the value of real estate for the purpose of the adjacent fee collection on the municipal revenues and consequently urban development policy implementation.

## THEME B: VALUATION AND APPRAISAL



# OPPORTUNITIES TO USE NCA (NECESSARY CONDITION ANALYSIS) TO ANALYZE PRICES IN THE HOUSING MARKET

Radosław Cellmer, Andrzej Muczyński


**KEYWORDS:** necessary condition analysis, housing, real estate market, causality

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## THEME B: VALUATION AND APPRAISAL

Necessary Condition Analysis (NCA) is a new research method increasingly used in various social, medical and technical science research fields. With conventional regression-based research methods, the research problem is identifying causal relationships in an equation determining the effect of explanatory variables on the dependent variable. On the other hand, NCA uses the logic of necessity to create theoretical causal statements. This means stating that if a certain level of a condition is not present, a certain level of an outcome will also not be current, with other factors unable to compensate for the missing condition. The research presents the possibility of using the NCA method to analyze the conditions for achieving a certain level of property prices. For this purpose, relevant hypotheses derived from the logic of necessity are proposed, and ways of testing them are presented. The necessity condition relates to the presence of a certain level of quantitative and qualitative property characteristics necessary to achieve a price effect. This takes into account the fact that the relationship between property characteristics and prices is sometimes linear. The research was based on data on residential property prices in selected Polish cities. As a result, several property characteristics were established, the appropriate level of which is a prerequisite for the property price to reach a certain level in a given local market. As a result of the research, it was discussed whether applying the NCA method could provide new information to market participants (developers) and decision supporters (managers, valuers, etc.).



## **DETERMINING THE VALUE OF THE PROPERTY, TAKING INTO ACCOUNT THE LOCATION OF THE AVERAGE PRICE BETWEEN THE EXTREME PRICES**

Ewelina Nawrocka, Michał Eckstein

**KEYWORDS:** methods, location, average price

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In Polish law, which regulates the valuation of real estate, four main approaches are distinguished: comparative, income, cost, and mixed. Each approach encompasses specific valuation methods. This presentation focuses on the comparative approach. Within this approach, three methods are recognized: pairwise comparison, median price adjustment, and market statistical analysis. Recent amendments in legal provisions, among other changes, pertain to the method of adjusting the average price. The objective of this study is to develop a new methodology to support Polish property appraisers in real estate valuation. The research outcome comprises mathematical formulas recommended for practical application in adjusting the average price method, while considering the location of the average price within the range between the minimum and maximum prices of similar real estate.

## **THEME B: VALUATION AND APPRAISAL**



# LOCAL PRICE INDEX FOR UNDEVELOPED LAND IN GERMANY

Matthias Soot, Alexandra Weitkamp

**KEYWORDS:** index, undeveloped land, spatial weighting

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DOI: [10.15396/eres2024-104](https://doi.org/10.15396/eres2024-104)

Prices of undeveloped land are the basis for property tax in most German federal states. The taxation is based on standard land values, which are primarily based on realized purchase prices of undeveloped land. On a nationwide level price index exists. The observation and presentation of price trends over time (economic cycle) for undeveloped land in local markets presents a challenge. The main reasons for this are the low number of transactions, the influence on pricing caused by the seller (e.g. subsidy by the local authority or focused sale in a new development area), the strong dependence of prices on the quality of the location, which overlaps with the economic situation. Various options for mapping price trends are discussed. In particular, the use of weighting functions via similarities (spatial and functional similarities) are discussed. The derivation of the index series is examined using decision tree-based methods such as Random Forest and compared to a mean and median average with smoothing function. The results show that the price trend can be well understood. Nevertheless, all methods show a very high uncertainty per index number, which does not represent a significant development despite a large price trend.

## THEME B: VALUATION AND APPRAISAL



# REGIONAL ECONOMIC DIVERSIFICATION AND CAP RATES: EVIDENCE FROM THE U.S. PROPERTY MARKET

Johannes Braun, Karim Rochdi

**KEYWORDS:** cap rate, diversification

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DOI: [10.15396/eres2024-140](https://doi.org/10.15396/eres2024-140)

## THEME B: VALUATION AND APPRAISAL

Despite the existence of alternative, more sophisticated approaches, the capitalization rate (cap rate) constitutes the center of practitioners' evaluation of real estate assets to this date. A cap rate translates the current income of a property into a justified transaction price, considering both risks of the respective property as well as its growth opportunities. In light of the importance of the concept for practitioners world-wide, availability of recent academic research on the constituting factors of cap rates is rather sparse. Several existing studies focus on the intertemporal variance in cap rate time series (see for example Evans (1990), or Jud and Winkler (1995)). Another branch of research seeks to explain differences in the cap rate cross-section of different real estate sub-sectors (see for example Ambrose and Nourse (1993), Plazzi et al. (2010), or Beracha et al. (2017)). The third aspect evoking past academic research interest is the geographic cross-sectional variance of cap rates. Chichernea et al. (2008) use Real Capital Analytics (RCA) multifamily cap rate data and find a strong relationship to supply constraints for the cross-section of U.S. metropolitan statistical areas (MSAs). Fisher et al. (2021) performs an analysis on U.S. equity real estate investment trusts, showing that those companies with property portfolios in high-density areas have lower implied cap rates. Białkowski, Titman, and Twite (2023) find for the office sector that cap rates are lower for wealthier cities, and lower for CBD markets compared to suburban markets, utilizing data for 33 developed and developing countries. Taking up the existing research on geographic variance in cap rates, this study attempts to analyze the impact of economic diversification on cap rates. More precisely, the relationship between the degree of diversification across different NAICS industries in U.S. MSAs and the cap rates of the sub-sectors office, retail, industrial, and multi-family is studied. For this means, cap rate averages by sub-sector are regressed on a measure for economic diversification by MSA, using RCA transaction cap rate data as the dependent and NAICS industry diversification as the independent variable, along with a sample of controls in a panel framework for the time period between 2011 and 2022. Preliminary results suggest a negative relationship between economic diversification and cap rates, indicating real estate in MSAs with higher focus on specific industries are traded at a discount compared to real estate in diversified MSAs. Market participants seem to consider industry diversification as a systematic risk factor and therefore demand a premium for properties in well-diversified areas.



# ENHANCING AUTOMATED VALUATION MODELS: INTEGRATING HEATING ENERGY DEMAND ANALYSIS FOR REAL ESTATE PROPERTY VALUATION

Robert Lasser, Fabian Hollinetz


**KEYWORDS:** Automated Valuation Models (AVM), real estate valuation, heating energy demand, machine learning

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## THEME B: VALUATION AND APPRAISAL

In the realm of Automated Valuation Models (AVM) for real estate, incorporating nuanced features can significantly enhance the accuracy of property valuation. We are introducing a novel feature in our AVM framework aimed at capturing the impact of heating energy demand on the market value of real estate properties. Leveraging a combination of machine learning techniques and statistical modeling, our approach involves two key steps. First, utilizing a robust dataset of real estate transactions, we employ XGBoost models to predict heating energy demand for properties lacking such information. This imputation process enables us to generate comprehensive estimates of heating energy demand across a diverse range of properties. Secondly, we integrate tensor interaction effects within Generalized Additive Models (GAM) to analyze the relationship between heating energy demand and property value, considering crucial factors such as the construction year of the real estate objects. By incorporating tensor interaction effects, we are able to capture complex nonlinear relationships and interactions, allowing for a more nuanced understanding of how heating energy demand influences property valuation over time. Through the implementation of this advanced feature, our AVM framework offers real estate practitioners and stakeholders a more comprehensive tool for accurately assessing property values. This research contributes to the evolving landscape of real estate valuation methodologies, demonstrating the efficacy of combining machine learning with statistical modeling techniques to capture multifaceted influences on property value.



# USING BIG DATA TO RELATE FLUCTUATIONS IN REAL ESTATE PRICES WITH THE GREEN HOMES DIRECTIVE: A CASE STUDY ENCOMPASSING THE ITALIAN TERRITORY

Laura Gabrielli, Aurora Greta Ruggeri, Massimiliano Scarpa

**KEYWORDS:** market value, energy class, artificial neural network, property valuation

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## THEME B: VALUATION AND APPRAISAL

The energy performance of buildings has emerged as a critical factor in the real estate sector, intertwining environmental sustainability with market pricing. Therefore, this study aims to explore the relationship between a building's energy performance, as indicated by its energy class, and its market value. Leveraging a web-parsing automated procedure, the authors gathered approximately 200,000 observations of properties currently listed for sale across Italy, capturing both asking prices and energy class specifications. Through the analysis of this extensive dataset, an Artificial Neural Network was trained to develop a predictive tool for estimating property market values based on various building characteristics, with particular emphasis on understanding the impact of energy class on market prices. In conclusion, this research opens the debate on the significance of energy class in evaluating the market value of buildings, especially within the context of the European Green Homes Directive.



# SYSTEM DYNAMICS IN REAL ESTATE: BRIDGING SUSTAINABLE DEVELOPMENT AND INVESTMENT STRATEGIES

Martin Schnauss, Patrick Spieler

**KEYWORDS:** system dynamics, sustainability, simulation rating

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Real estate valuation involves a variety of methodologies, but the recursive dynamics inherent in real estate development are often overlooked. These dynamics involve feedback effects that significantly affect the life cycle of a property. This paper presents the application of system dynamics methodology to real estate valuation, highlighting its utility in setting priorities for sustainable real estate development. Moreover, this approach facilitates the projection of a property's evolution in terms of its environmental, social and governance (ESG) compliance, taking into account the evolving nature of a property's rating. Such ratings are critical to investors, including funds, who need to make informed decisions about the long-term development of properties and their fit within investment portfolios. Therefore, the methodology discussed here goes beyond traditional Discounted Cash Flow (DCF) methods by providing a more holistic and dynamic framework for understanding and predicting the multiple impacts on real estate valuations.

## THEME B: VALUATION AND APPRAISAL





# MEASURING LOCATIONAL QUALITY FOR COMMERCIAL REAL ESTATE

Gunther Maier, Karin Wagner

**KEYWORDS:** commercial real estate, location, valuation, Open Streetmaps

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

DOI: [10.15396/eres2024-228](https://doi.org/10.15396/eres2024-228)

The question what determines location quality of some real estate property is an essential one at the interface between real estate economics and regional science. Because of its heterogeneity, the question is particularly tricky in the context of commercial real estate. The Austrian Central Bank has begun to develop and implement price, rent and yield indices for commercial real estate in Austria. To make commercial prices and rents comparable in a hedonic sense, we capture locational quality effects. In this paper we will present the approach for measuring locational quality that we developed in the context of the indices. The applied tool relies on spatial information from Open Streetmaps. Indicators are developed therefrom, which are evaluated in the context of traded properties. In this paper we will present a first, preliminary evaluation based on a limited set of observations reported by financial institutions.

## THEME B: VALUATION AND APPRAISAL



# ANALYZING THE INFLUENCE OF STAR CLASSIFICATION AND COVID-19 ON VALUE PER ROOM IN TURKISH HOTELS: A 2018 - 2023 PERSPECTIVE

Celal Erdogdu, Kerem Yavuz Arslanli

**KEYWORDS:** hotel, valuation, room, Turkey

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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Valuing hotel properties requires a comprehensive understanding of dynamic pricing strategies, market dynamics, investment value drivers, and valuation methodologies. This process is critical for investors and hotel managers to make informed decisions on room pricing and overall hotel investment strategies. This study examines the changes in per-room rates of hotels in Turkey between 2018 and 2023, specifically assessing changes by star class and the impact of the COVID-19 pandemic on resort and city hotels. Our research analyzes in detail the impact of the pandemic on pricing strategies in the hotel industry and the price sensitivity of hotels by star class. Our findings provide valuable insights for hotel operators, investors, and tourism policymakers and provide recommendations for more effective pricing strategy planning in the industry.

## THEME B: VALUATION AND APPRAISAL



## REDUCING VALUATION BIAS THROUGH EXPERT-NOVICE COLLABORATION: A QUALITATIVE EXPLORATION

Hassan Liman, Abdul-Rasheed Amidu, Deborah Levy

**KEYWORDS:** valuation bias, expert-novice collaboration, property valuation, professional development

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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Research into valuer behavior implies that property valuation is dependent the judgement of valuers. This often results in valuers being susceptible to different forms of biases. One of the factors that cause bias in valuation is expert valuers' reliance on the use of heuristics in the valuation decision-making process. Drawing upon in-depth, semi-structured interviews with expert and novice commercial property valuers in New Zealand, this study explores how collaboration between valuers with varying levels of expertise can mitigate subjective biases inherent in property valuations. The study highlights the unique contributions novices can make when questioning the decisions of experts. In particular, the research findings show that when working with highly intuitive, heuristic-driven senior colleagues, the analytical, process-driven younger valuers may question the decisions of their seniors when they think those decisions do not conform with rationality. Thus, this collaborative approach contributes to novices' professional growth and prompts experts to critically reassess their value assessments, thereby enhancing the objectivity of property valuations. The findings of this study have implications for the resourcing of valuation firms and the promotion of collaborative learning environments to enhance the credibility and integrity of the valuation process.

## THEME B: VALUATION AND APPRAISAL



# HOW NEGATIVE ATTRIBUTES OF NOISE AFFECT THE SALES IN THE TEL AVIV MARKET TODAY

Deborah Leshinsky, Robert Simons

**KEYWORDS:** property values, negative attributes of noise, sales value and Hedonic

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Tel Aviv boasts a diverse population. The beaches are clean and full of white sand. Its UNESCO designated Bauhaus architecture has won the city the title: "The White City." This article concentrates on the relationship between noise and the vibrant city of Tel Aviv. This study quantifies the effect of noise on the sale prices of Tel Aviv. This paper demonstrates the negative attributes of noise on the sales value of property values. Negative attributes include but not limited to: School and kindergarten noise, dust and pollution, Active construction, places of worship such as Mosques and location to hospitals and supermarkets. A technique to add originality to this paper is by implementing innovative modelling and estimation techniques. For example a major criticism on hedonic modelling refers to lack of empirical arguments which would account for key demand and local economic drivers. The database will include 100,000 hedonic values. Theoretically speaking this paper attempts to explore the different noise levels on the sales market of Tel Aviv.

## THEME B: VALUATION AND APPRAISAL



# AN ALTERNATIVE PSYCHOANALYTIC REFLECTION ON THE IRISH RESIDENTIAL PROPERTY BUBBLE

Clare Branigan

**KEYWORDS:** real estate bubble, social unconscious, socio-economic crisis

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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We explore the role of repressed ancestral suffering in driving institutional and broader societal responses to contemporary events. We demonstrate how a traumatic past becomes interwoven in the fabric of the social order, rendering state and parastatal organizations and their leaders powerless. This is manifest in the recent destructive Irish real estate bubble, and its associated economic and social consequences. The concept of intergenerational transmission of trauma is key to our analysis. We show how the Irish obsession with owning property and land is a psychic attempt to transcend the traumatic past to 'inhabit' an idealized pre-colonial land leading to emergent feelings of empowerment, euphoria and omnipotence. We also explain why the property bubble is being re-enacted so soon with no apparent learning. In addition, we highlight the potential for an enhanced understanding of this bubble with insights from novels, drama, and poetry.

**THEME C:**  
**REAL ESTATE**  
**ECONOMICS**



## **BANK MUNICIPAL BOND HOLDINGS AND MORTGAGE LENDING STANDARDS**

Vahid Saadi, Omar Rachedi

**KEYWORDS:** mortgage originations, municipal bonds, lending standards, geographical diversification


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We show in this paper that tax exemptions on income from municipal bonds distort bank mortgage lending standards. Banks in states with a larger tax exemption hold more municipal bonds on their balance sheets. These holdings expose banks to local risks, in particular to real estate risk as municipal bonds are financed to a large extent via property tax revenues with a large elasticity with respect to house prices. We show that banks with a higher share of municipal bonds on their balance sheets divert their mortgage originations out of their home states by relaxing their mortgage lending standards. We provide evidence that this geographical diversification is costly in that banks with higher municipal bond holdings lend to low FICO score and high debt-to-income ratio borrowers away from their home states without a corresponding risk premium in interest rates charged.

### **THEME C:**

## **REAL ESTATE ECONOMICS**



## **BARGAIN OR BUST? PRICES, DISCOUNTS, AND RETURNS IN THE MARKET FOR REAL ESTATE FORECLOSURES**

Alexander Daminger, Simon Wiersma


**KEYWORDS:** foreclosure discount, distressed property, real estate investment

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This paper examines the foreclosure discount and investor returns in Berlin's housing market, using a comprehensive dataset of transactions from 1984 to 2022. We employ two methods to measure the impact of foreclosure on property prices and returns. First, we estimate the foreclosure discount over time using hedonic regressions that control for property and neighborhood characteristics. Second, we compare the returns of distressed and non-distressed properties by matching repeat sales of similar properties based on their hedonic characteristics. Our findings reveal a substantial discount for foreclosed apartments of 39%. However, we also show that this discount varies considerably over time. Moreover, we demonstrate that investments in foreclosed properties yield higher returns than investments in similar non-foreclosed ones, especially for shorter holding periods. These returns exceed typical transaction costs, implying market inefficiencies.

**THEME C:  
REAL ESTATE  
ECONOMICS**



# TESTING THE INFLATION HEDGING PROPERTIES OF REAL ESTATE, STOCKS, PRECIOUS METALS AND OIL: EVIDENCE USING WAVELET QUANTILE CORRELATION

Aya Nasreddine, Yasmine Essafi Zouari

**KEYWORDS:** inflation hedging, wavelet quantile correlation, indirect real estate, investment horizon

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Using the wavelet quantile correlation (WQC) methodology, we measure the suitability of gold, silver, oil, stocks as well as the French and the G7 countries indirect real estate to hedge against global and energy inflation. The WQC allows us to deal with time-varying characteristics of time series and to capture tail dependence. Besides, it has the advantage of dissolving the correlation structure between asset returns and inflation across different timescales, enabling us to consider different investment horizons. Recorded results over the 2000-2023 period show that the response to inflationary pressures varies according to the asset class, the holding period as well as the type of inflation considered. Whereas precious metals seem to be suitable over short term maturities, French listed real estate displays interesting inflation hedging features as the investment horizon lengthens. Oil emerges as an equivocal hedge against both global and energy inflation.

**THEME C:**  
**REAL ESTATE**  
**ECONOMICS**





# THE IMPACT OF PROXIMITY TO ENCLOSED FRESH FOOD MARKET ON HOUSING PRICES IN HONG KONG

Ervi Liusman, Kwong Wing Chau, Y. L. Wong

**KEYWORDS:** fresh food market, housing prices, external effects, Hong Kong

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This study examines the impact of proximity to enclosed fresh food markets on nearby housing prices in Hong Kong. Fresh food markets are commonly found in residential areas in Asia for the convenience of shoppers. However, the presence of these markets can also pose health and hygiene hazards to nearby occupants. This study aims to investigate the net external effect of fresh food markets on nearby housing prices, which has not been explored before. The empirical results of this study suggest that the net external effects of enclosed fresh food markets on nearby housing prices are non-linear. This study found that larger enclosed fresh food markets, in terms of total floor area, have a stronger net positive external effect on nearby housing prices. Additionally, private enclosed fresh food markets were found to have a stronger net positive external effect compared to public ones. Furthermore, older enclosed fresh food markets were found to have a stronger net positive external effect compared to newer ones. In addition, the study also found evidence that enclosed fresh food markets with air conditioning systems have a net negative external effect on nearby housing prices.

**THEME C:**  
**REAL ESTATE**  
**ECONOMICS**



# MONETARY POLICIES AND CARRY TRADE ON THE REAL ESTATE MARKET IN THE UK: A REAPPRAISAL

Alain Coen, Philippe Guardiola

**KEYWORDS:** monetary policies, REIT, real estate prices, carry trade

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The aim of this article is to analyze the impact of the monetary policies of the UK, US and EU on the UK's real estate market, during the last two decades, since 2000. Using unsmoothed returns, we examine the effect of variations of money supply and government bond yields on office, retail and industrial total returns, using REITs as an investment channel. More precisely, with a dynamic VAR modeling, we shed new light on the movements of REITs prices, stock prices and real estate prices. Our results report that UK money supply growth and interest rate decrease have a strong positive impact on office and retail prices across the country, while limited for industrial. The ECB's decisions have the opposite effect as they seem to create a capital flight toward the EU.

## THEME C: REAL ESTATE ECONOMICS



## CONSTRUCTING A REAL-TIME PRICE INDEX FOR THE BELGIAN HOUSING MARKET USING ONLINE LISTINGS DATA

Sven Damen, Peter Reusens, Joren Vandenberg, Tijmen van Kempen, Frank Vastmans

**KEYWORDS:** price index, residential real estate, listing data

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

DOI: [10.15396/eres2024-121](https://doi.org/10.15396/eres2024-121)

This paper presents a novel approach to constructing a real-time price index for the Belgian residential housing market using data from online real estate platforms. Online listing data have the key advantage that they are available real-time, approximately 6 months earlier than the official transaction data. A price index based on this data therefore allows policymakers and other stakeholders to make more informed and accurate decisions. By linking scraped listing data for the period 2014 to 2023 originating from several different online platforms to transaction data, we analyze the disparities between listing and sales price indices. Using information on time on market, the probability of sale and the number of listings we control for these disparities and develop a listing price index that aligns closely with a sales price index. Furthermore, we show that monitoring trends in time on market and probability of sale can serve as valuable indicators for predicting short term changes in housing prices.

**THEME C:**  
**REAL ESTATE**  
**ECONOMICS**



## EXPLORING PROFITABILITY: A PRELIMINARY STUDY ON REAL ESTATE DEVELOPERS' REACTIONS TO MARKET PRESSURES

Marianne Wyrwoll, Elisabeth Beusker


**KEYWORDS:** real estate development, profitability analysis, market pressure

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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The escalating costs associated with construction and financing, coupled with increasingly stringent legal and regulatory requirements, exert substantial pressure on real estate development companies. Consequently, a discernible surge in insolvency rates has been observed within the real estate development sector. This study aims to systematically investigate the adaptive strategies employed by real estate developers in response to the challenging market conditions, specifically focusing on alterations in their profitability analyses. An online survey was conducted among real estate developers based in Germany. The survey considered different types of real estate developers, company sizes, and asset classes. The results suggest that there have been changes in the way real estate developers view profitability, particularly in their choice of profitability indicators. Influential factors include both external factors, such as regulatory changes and crises, and internal factors, such as personnel changes within the company.

## THEME C: REAL ESTATE ECONOMICS



# THE EFFECT OF AN ADJUSTMENT IN THE LIST PRICE ON THE FINAL OUTCOME OF THE HOUSING MARKETS

Ksenija Bogosavljevic, Steven B.Caudill, Anita K. Pennathur


**KEYWORDS:** list price, time on the market, housing markets, causal effect

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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Setting the list price when selling a house is generally a finely-honed decision for both the seller and the real estate broker. An accurate initial price provides the optimal balance between setting the price that is low enough to attract several buyers while pricing it high enough to receive what she believes is the true value of the property. Yet, the initial pricing decision is not set in stone. A seller may set the price too low, and then realize that she has underpriced, given the interest shown by potential buyers of her property. On the other hand, she may have overestimated the value of her property, and her listing may not have much activity. In either scenario, the seller has the option to change the price to reset to the market interest, either by increasing or decreasing the initial list price. Our study examines the influence of price fluctuations on the results of sales transactions. We analyze a sample of transactions that took place in Clayton, Cobb, DeKalb, Fayette, Forsyth, Fulton, Henry, and Rockdale counties from 2016 to 2018. Our analysis reveals that 27% of transactions display a drop in price, while 5% show an increase in price relative to the initial listing price. We apply Inverse Probability Regression Adjustment to estimate the average causal effect of a binary treatment (Change in Price) on sales outcomes, specifically sales price and time on the market. Our analysis indicates that promptly reducing the price of an overvalued property will lead to a higher selling price and shorter marketing time.

## THEME C: REAL ESTATE ECONOMICS



## MEASURING STRUCTURAL VACANCIES: A QUANTITATIVE AND QUALITATIVE APPROACH FOR THE GERMAN OFFICE MARKET

Carsten Lausberg, Cay Oertel, Artur Tarassow

**KEYWORDS:** vacancy, structural vacancy, office market, Germany

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Since the Covid-19 pandemic, vacancy rates have increased in many office markets around the world. This is reflected in the nominal vacancy rate, which market researchers and consultants regularly publish in their market reports. However, this does not accurately reflect the true vacancy for two reasons: first, it includes both natural ('good') and structural ('bad') vacancies, and second, it does not include hidden vacancies. As a result, in times of crisis, vacancies are underestimated, which can lead to wrong decisions by market participants. We construct a model to measure both types of vacancies. First, we indirectly estimate the natural vacancy rate using a quantitative rent adjustment model. Then we calculate the structural vacancy rate as the difference between the nominal and the natural vacancy rate using market data by BulwienGesa for the 14 largest German office markets from 1990 to 2023. After that, we use interviews with real estate managers and other market experts in combination with real estate market data to estimate the hidden vacancies in individual office markets. The results are incorporated into the overall model as a correction factor.

## THEME C: REAL ESTATE ECONOMICS



## GLOBAL INQUIRY INTO TRANSPARENCY IN THE REAL ESTATE MARKETS

Grazyna Wiejak-Roy, Bastiaan Reydon, Peter Ache, Neubrand Eva  
Katharina, Kavanagh James

**KEYWORDS:** market efficiency, market failure, retail

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The research is concerned with the perception, definition, and measurement of transparency in real estate markets and exploring any transparency deficits. Understanding market transparency, beyond the current measures available for selected countries and selected property sectors only, should help improve policies aimed at improving market efficiency. From a global perspective, the results of this research aim to inform policymakers to support the more vulnerable members of society who are often deprived of their real estate rights due to market opacity. The research uses a global comparative study to examine the level of transparency in real estate markets and identifies key differences between national markets due to the regulatory, economic, political, social, and cultural environment in which sellers and buyers operate. The determination of market transparency focuses on informational market efficiency. To obtain evidence, data is collected using an international online survey and 'purposive sampling' technique of subject matter experts. These include professionals working in the field of land administration and management and in property surveying across the private and public sectors as well as in the higher education sector. Members of FIG, RICS, IVSC, CASLE and TEGOVA are specifically approached for their input.

## THEME C: REAL ESTATE ECONOMICS



## REGIONAL EARLY WARNING SYSTEMS AND PREDICTION MODELS FOR AUSTRIA AND GERMANY

Oscar Fernandez, Martin Prinz, Wolfgang Brunauer, Karin Wagner

**KEYWORDS:** early warning systems, asset pricing method, interest elasticity, supply elasticity

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Although price indices are an important tool for the observation of real estate developments, they lack the potential of indicating possible market exaggerations or “bubble formation”. Several research approaches are commonly used to determine such deviations from market equilibria, among others there are 'asset pricing models' and 'supply-demand models'. We develop a framework of early warning systems for Austria and Germany based on scientifically sound approaches. We explain specific challenges such as finding proper instruments for supply and demand modelling, the treatment of submarkets with sparse or unreliable data, and the application in long-time prediction models.

## THEME C:

## REAL ESTATE ECONOMICS





## MANAGING THE BIAS VARIANCE TRADE-OFF IN REGIONAL HOUSE PRICE INDICES

Fabrice Kreuzbichler, Wolfgang Brunauer, Karin Wagner, Ronald Weberndorfer

**KEYWORDS:** price index, double imputation, regionalization, bias variance trade-off

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The Austrian Central Bank (OeNB) has been publishing the Austrian residential property price index for many years now. Several years ago, there has been a change in the underlying methodology, from the “dummy method” to a “double imputation method”. While with the former approach, the regionalization of the index had been bound to the model regions (as it is derived from an evaluation of model parameters), the new methodology allows for arbitrary granularization. Now we explore methods for regionalization, and their impact on the bias-variance trade-off. Furthermore, we investigate the possible impact on the construction of early warning systems for the Austrian housing markets, which can in turn be used for systemic risk analyses.

**THEME C:**  
**REAL ESTATE  
ECONOMICS**



# THE ENDOWMENT EFFECT AND HOUSING MARKETS: EMPIRICAL EVIDENCE FROM POLAND

Mateusz Tomal

**KEYWORDS:** behavioral economics, endowment effect, market disequilibrium, Polish housing market

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## THEME C: REAL ESTATE ECONOMICS

Housing goods and housing market decisions are extremely complex. This complexity means that standard economic theory is inadequate to fully understand housing market mechanisms. Mainstream economics assumes that buyers and sellers are willing to transact at market price. However, friction between the demand and supply sides of the housing market is often evident, leading to an imbalance and, consequently, a reduction in the number of transactions. Behavioral economics offers an attempt to explain housing market disequilibrium. Behavioral economists emphasize that the deviation of sellers' and buyers' valuations from the market price is, among others, due to the so-called endowment effect. The endowment effect is defined as a behavioral bias resulting in higher valuations of goods, we own relative to goods we do not own. To date, empirical studies have mostly looked at the endowment effect for simple goods such as mugs or pens. There is a lack of theoretical and empirical considerations of the endowment effects in different segments of the housing market. Consequently, the purpose of this paper is twofold: (i) to develop a theoretical model explaining the magnitude of endowment effects in the sales and rental housing markets, with a distinction between primary and secondary markets; (ii) to assess the presence of endowment effects in Poland's sales and rental housing markets. The empirical research indicated that the endowment effect significantly shapes the Polish residential market. On the sales housing market it amounts on average to 11.95%, i.e. PLN 72,086, while in the rental market, it amounts on average to 7.69%, that is, PLN 212. This difference in the strength of the endowment effect between the sales and rental markets proved to be statistically significant in favor of the former. The endowment effect is also significantly smaller, on average, in primary markets, where sellers treat the dwellings, they sell as exchange goods. In this case, its magnitude averaged 10.46% (PLN 63,199) in the sales market and 6.20% (PLN 170) in the rental market. When the supply side treated the object of the transaction as a consumer good, the endowment effect averaged 13.45% (PLN 80,973) in the sales market and 9.17% (PLN 254) in the rental market. Finally, the study did not confirm the hypothesis that the endowment effect varies depending on the housing market cycle phase.



# THE REACTION OF SWEDISH REAL ESTATE MARKET TO THE LAST YEARS EVENTS - EVIDENCE FROM THE PAST FOR THE FUTURE?

Jonas Hurm, Johannes Raabe, Sebastian Stefani

**KEYWORDS:** Sweden, prediction, residential housing market, VAR and ECM

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## THEME C: REAL ESTATE ECONOMICS

The Swedish residential real estate market has undergone significant transformations over the years, with historical structural shifts driven by evolving regulations leading to market fluctuations. Analyzing these changes, we can categorize the market's evolution into four distinct phases: pre-1993 marked by market liberalization, the 2008 global financial and economic crisis, and the 2016 increase in the main refinancing rate. Understanding these historical milestones is crucial for shaping our perspective on the current state of the market and forecasting its future trajectory. Key determinants influencing the Swedish real estate market are drawn from literature, encompassing factors such as banks' refinancing rates, household income, welfare indicators, and price factors. These determinants have historically played crucial roles in shaping market trends and dynamics. The question arises: do these determinants persist over time, and can we derive predictive models based on this knowledge? Of particular interest is the proactive stance taken by the Swedish central bank, which raised the main refinancing rate earlier than its European and American counterparts. This divergence raises intriguing questions about the unique characteristics of the Swedish market and how it responds to external economic factors. A hypothesis emerges: despite substantial changes, the identified determinants retain their long-term significance in influencing the Swedish real estate market. This hypothesis forms the basis for our exploration into the continuity of these determinants amidst evolving economic landscapes and regulatory frameworks. Understanding the historical context and determinants allows us to navigate the complexities of the market. It also provides a foundation for developing robust forecasting models that can adapt to changing circumstances. As we delve into this exploration, we aim to unravel the enduring factors that shape the Swedish real estate landscape, contributing valuable insights to stakeholders navigating this dynamic and resilient market. Our research focuses on the Swedish residential housing market due to its distinct features, notably diverse transition processes. This market offers a compelling case study due to its unique blend of regulatory frameworks, monetary policies, and historical trends. By selecting this dataset, we aim to validate robust methodologies while gaining insights into a market that holds relevance on both national and international scales. Our data modeling approach involves a systematic application of Vector Auto-regressive (VAR) and Error Correction Model (ECM) frameworks, as outlined in existing literature. Simultaneously, we constructed these models, aligning with established methodologies, to gain insights into the complex relationships within the dataset. The VAR models capture dynamic interdependence's among variables over time, providing a comprehensive understanding of the data's behavior. In parallel, the ECM models address long-term equilibrium relationships and short-term dynamics, contributing to a nuanced understanding of underlying patterns. The integration

of these models does not involve providing them with data in the traditional sense but rather focuses on their structural construction and alignment with recognized methodologies. This methodical approach allows us to uncover relationships, trends, and patterns within the dataset without explicitly mentioning the providing process. By adopting this approach, we aim to derive robust insights and contribute to the advancement of knowledge within the domain, adhering to well-established methodologies in the literature. The results of our models underscore the enduring significance of determinants in the market. Through a comprehensive analysis of both the aggregate and individual phases within the models, we observed that the identified influencing factors continue to play a pivotal role in shaping market dynamics. These findings serve as the foundation for our aspiration to construct more precise and reliable forecast models. The holistic analysis enabled us to track the dynamics of determinants across various phases. Despite changes in the market over time, our models demonstrate that certain influencing factors remain consistently effective. This understanding of long-term stability empowers us to develop informed forecast models based on reliable data and structured assumptions. Our primary focus now is to build precise forecast models based on the insights gained from our existing models. These models aim not only to consider current market conditions but also to integrate long-term stability and historical development patterns. By employing rigorous methodologies and carefully incorporating the identified determinants, we aim to create models that are not only robust but also future-oriented. Our goal is to contribute valuable insights to strategic decision-making in an ever-evolving market environment through these forecast models. In an upcoming study, our aim is to develop a model for forecasting the development of net asset values of REIT's and the market capitalization of shares of real estate companies in relation to the Swedish and later the European economic area. This requires modeling the performance of commercial and residential real estate and thus transferring the models to the commercial sector.



# THE CENTRAL BUSINESS DISTRICT PROXIMITY EFFECT ON HOUSING PRICES: A BUCHAREST CASE STUDY

Ion Anghel, Costin Ciora, Elena Ionascu

**KEYWORDS:** housing market, central business district, pricing premium

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Urban economic theory predicts that house prices decline with distance from the central business district. Although the price premium in the housing market has been extensively researched, it remains unclear what the influence of central business district (CBD) has on housing prices. This paper aims to provide new insights into the impact of the CBD proximity to dwellings on house prices by focusing on the Bucharest residential market. Over the past few years, Bucharest's office space market experienced significant growth, but with a greater concentration in certain city areas, affecting the entire real estate market surrounding the office centers. Using transaction data on the Bucharest residential market, this study explores, for the first time, the influence of proximity to the central business district on housing prices, quantifying the price premium and the difference in market time for residential apartments.

## THEME C: REAL ESTATE ECONOMICS



# DETECTING HOUSING BUBBLES IN POLAND

Radoslaw Trojanek

**KEYWORDS:** housing prices, house price indices, rental indices, bubbles

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The paper investigates Poland's potential house price bubbles from Q1 1996 to Q1 2024 using new house and rent price indices based on over 4 million listings. The recursive housing bubble identification procedures developed by Phillips, Shi, and Yu (2015) test will be used to test whether the explosive behavior of house prices in Poland is linked to household incomes and rents. Earlier studies confirmed explosive house price behavior during the 2006–2007 period, which was not justified by fundamentals on the city level. The paper aims to investigate the phenomenon of a longer time and aggregated housing price data in Poland.

**THEME C:**  
**REAL ESTATE**  
**ECONOMICS**



## SOCIAL CAPITAL, FINANCIAL SUPPORT AND HOUSING FOR IMMIGRANTS IN THE UK

Yi Wu, Kusum Mundra

**KEYWORDS:** social capital, UK immigrants, financial help, homeownership

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Immigrant homeownership is an important factor for immigrant's integration and assimilation for any large immigrant receiving country and there is increasing evidence on the role of social capital on housing outcomes as well as other financial well-being of immigrant groups. This paper uses detail and rich UK data from the Household Longitudinal Study (UKLS) to first, measure social capital in various dimensions using rich micro level data from the UK and then further identify the channels through which networks operate for immigrant groups and the strength of these networks. Second, this paper looks at what is the role of social capital on immigrant homeownership in the UK. We found that immigrants weak ties, proportion of close friends, plays strong role in financial support for the immigrants.

**THEME C:**

**REAL ESTATE  
ECONOMICS**



## DISTRIBUTIONAL CONSEQUENCES OF RENT REGULATION

Nicola Stalder, Lukas Hauck, Simon Buechler, Maximilian von Ehrlich

**KEYWORDS:** rent regulation, housing demand, residential real estate market, distributional consequences

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This paper examines the distributional consequences of rent regulation. We estimate counterfactual free market rents for households benefiting from rent control in their current tenancy. The gap between the paid rent and free market rent represents the benefit that a household draws from the rent control policy. We document how this measure is allocated along various household characteristics, providing novel evidence on the distributional consequences of rent control policies. Our results show that rent control mainly benefits older renters at the expense of younger ones.

**THEME C:**  
**REAL ESTATE  
ECONOMICS**





## REAL ESTATE FUND DISPERSION AND MARKET DISPERSION

Stephen Lee

**KEYWORDS:** dispersion, beta risk, non-market risk, real estate funds

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This paper investigates the relationship between the return dispersion of two types of real estate funds (Balanced and Specialist) and the return dispersion of the UK commercial real estate market. Using quarterly data over the period from 2002: Q1 to 2022:Q4, we draw a number of conclusions. First, we find that market dispersion is time varying and dominated by non-market risk. Second, Specialist funds show greater fund dispersion than Balanced funds. Third, when we regress Balanced fund dispersion against market dispersion and the two types of risk, we find that Balanced fund dispersion is significantly related to beta risk. In contrast, Specialist display a significant relationship with non-market risk. In other words, Balanced funds offer “beta” performance while Specialist funds offer “alpha” performance. Lastly, the empirical results show that the relationship between market dispersion and real estate fund dispersion is not straight forward, it depends on the type of fund and type of dispersion.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT



# THE POTENTIAL OF JAPANESE FARMLAND IN REAL ESTATE PORTFOLIOS

Noriko Ashiya, Miyazaki Kenji

**KEYWORDS:** Japanese farmland, agricultural policy, real estate portfolio management

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## THEME D: REAL ESTATE FINANCE AND INVESTMENT

Japanese farmland has not been seen as an investment nor as a factor of agricultural production, as many privileged owners just abandon it while farmland property rights cannot be transferred easily due to the law; even so, Japanese farmland has the potential to become a long-term investment with the support of policy enhancement that will push forth farmland activation to possibly create a Japanese Food Valley. Using publicly accessible farmland data, this study analyzes the performance and portfolio diversification benefits of farmland in Japan over the 1986-2022 period. Statistics of the returns on farmland in general disappoint us with numbers around zero; however, there could have been portfolio diversification benefits for farmland components mixed with residential, commercial, or industrial land, even though some correlations are derived from data formed by modified criteria consistent with farmland regulations and the asset market bubble unique to Japan. Distinctively, the Hokkaido district with positive annual returns is found to have a significant negative correlation with other assets, reflecting greater portfolio diversification benefits. As a reference, this study also investigates the relationship between the returns on farmland and other traditional assets such as stocks and bonds. Farmland capital gain yields were not significantly correlated with those of stocks, although they showed some similarities to the significant correlations found between farmland and general land, reflecting the possibility of portfolio risk reduction. Significant correlations amongst the farmland and bonds reflect further portfolio diversification benefits, depending on the different characteristics of the two types of farmland values and the resulting positive/negative correlation coefficients. Such farmland value can be seen as a reflection of the distance from Tokyo, even though this is still within the scope of a hypothesis and needs our future consideration to establish scientific proof.



## IMPORT COMPETITION AND BANK PORTFOLIO REBALANCING

Vahid Saadi

**KEYWORDS:** mortgage lending, import competition, bank portfolio reallocation, financial crisis

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This paper shows that the rise in import competition from China forced U.S. banks to rebalance their credit portfolios away from business loans and towards mortgage lending during the period from 1999 to 2006. I show that while aggregate mortgage lending declines in exposed counties, banks that are more exposed to the rise in import competition increase their mortgage origination significantly in non-exposed areas and expand their geographical reach into new counties. Mortgages originated by such banks in new counties are more likely to be high-interest loans issued to low-FICO score, high-LTV (loan-to-value) borrowers that would have otherwise been credit rationed. Overall, the findings show that banks that are more exposed experience a rebalancing of their loan portfolio towards residential loans during the sample period. These results highlight the role of increased import competition from China for the rapid increase in size and riskiness of the U.S. mortgage market prior to the 2007-09 mortgage crisis.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT



## EXPLORING CLIMATE RISK, RISK RETENTION, AND CMBS: UNDERSTANDING THEIR INTERPLAY

Yildiray Yildirim, Bing Zhu

**KEYWORDS:** commercial mortgage-backed security, climate hazards, default risk, risk retention rule

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In this study, we investigate the impact of climate hazards on Commercial Mortgage-Backed Securities (CMBS), particularly in the context of the 'originate-to-distribute' model and the 2017 risk retention rule. Our findings reveal a significant behavioral shift in CMBS deal originators due to climate shocks. We observe that when faced with climate events, loan originators expedite the sale of loans impacted by these events before they are bundled into securities. However, this trend changes under the risk retention rule, where underwriters exhibit a reluctance to originate and include climate-impacted loans in retention deals. This behavior indicates a more cautious approach towards loan origination in the face of climate risks. Moreover, our study highlights that underwriter, under the risk retention rule, tend to have a reduced exposure to climate hazards in their loan portfolios. Consequently, risk retention deals show a price advantage with a lower premium for climate risk. This can be explained by a notable decrease in the default risk associated with climate hazards post implementation of the retention rule.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT



## THE LIQUIDITY OF UK COMMERCIAL REAL ESTATE

Fernanda Antunes, Matthew Pollock, Michael White

**KEYWORDS:** liquidity, commercial real estate, UK, time on the market

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The trade of commercial real estate is distinguished by its intrinsic costs and time-consuming nature, which carries implications for the performance and risk associated with real estate investments. The Time on the Market (ToM), representing the duration a property actively remains listed, constitutes a pivotal metric for evaluating market liquidity within the real estate sector. Our research investigates the temporal aspects of commercial real estate transactions in the United Kingdom, employing data derived from CoStar and scrutinizing a sample encompassing approximately 6,500 transactions spanning the interval from 2013 to 2023. Our findings reveal fluctuations within the ToM indicator. For instance, in 2023, the median duration on the market for office properties amounted to 220 days, whereas for industrial properties, this metric was notably lower at 165 days. This observed variation underscores the inherently dynamic nature inherent in commercial real estate transactions, emphasizing the imperative of comprehending and gauging market liquidity by means of the ToM metric.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT



## BEHAVIOURAL ADAPTATION TO SEISMIC DISRUPTIONS: EXPLORATORY EVIDENCE FROM REAL ESTATE INVESTMENT TRUSTS


Muhammed Bolomope, Abdul-Rasheed Amidu, Olga Filippova,  
Deborah Levy

**KEYWORDS:** real estate investment, adaptation, seismic disruption, New Zealand

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## THEME D: REAL ESTATE FINANCE AND INVESTMENT

High-magnitude earthquakes are major disruptors that significantly influence property investment preference in seismic regions. Whereas rational regulatory policies are consistently proposed to enhance investors' adaptation to seismic hazards, scholars have noted that the adaptive response of property investors often deviates from the rational expectations of policymakers. Therefore, by leveraging the behavioral perspective on investment decision-making, this study explores the adaptive strategies of New Zealand Real Estate Investment Trusts (NZ REITs) to seismic disruptions. The study is based on the documentary analysis of the annual reports of NZ REITs, with forty-eight annual reports analyzed for content that described how the REITs responded to high-magnitude seismic events that threatened their well-established business operation models over an extended period (from 2009 to 2019). The study findings indicate that notwithstanding the provisions of rational, seismic-related regulations, the adaptive response of NZ REITs to seismic disruption is driven by asset demand and influenced by behavioral factors such as loss aversion location bias, herding and anchoring. By highlighting the complementary significance of rational and intuitive considerations, the findings from this study suggest that NZ REITs are not only compliant but dynamic in their response to seismic disruptions. The research findings could enhance policy formulation and implementation towards ensuring a holistic response to seismic disruptions.



# INVESTIGATING GLOBAL CITIES AS FOREIGN REAL ESTATE INVESTMENT LOCATIONS: A GRAVITY MODELLING APPROACH

Rong Wang, Anupam Nanda, Eero Valtonen


**KEYWORDS:** real estate investment, cross-border capital flows, global cities, gravity model

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In the context of expanding global economic liberalization and the emergence of an integrated global financial market, there has been a consistent upward trend in global real estate investment over the last few decades. While the previous studies examined the locational choices of foreign real estate investment across countries, there remains a paucity of literature analyzing foreign real estate investment at the sub-national level. In this paper, we focus on the notion that real estate is 'local' and investigate the scale and determinants of foreign investment flows between real estate markets at the city level, employing a gravity modelling framework. The study utilizes a dataset of the bilateral real estate investment flows across over 40 cities, spanning the period from 2005 to 2021. The result indicates that the economic size of cities boosts the scale of investment flows, and the distance has significant effects on foreign real estate flows. In addition, the finding also reveals that the disparity in real estate market transparency between the markets has a positive association with foreign real estate investment flows.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT



# REAL ESTATE AS CAPITAL SECURITY IN PERIODS OF LOW AND HIGH INFLATION. COINTEGRATION ANALYSIS

Rafal Wolski, Piotr Karp

**KEYWORDS:** investments, real estate, inflation, cointegration

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In the face of uncertainty in global markets and fluctuating levels of inflation, a variety of financial tools are becoming increasingly important to protect capital from loss of value. In this context, questions arise not only about what to invest in in order to achieve the highest investment returns, but also how to verify which investment can be the best hedge in a high or low inflation environment. This leads to questions not only about which instrument may be the best, but in particular how real estate investments compare to this. The empirical analysis on quarterly data for 2006 - 2023 was carried out taking into account the non-stationarity of the processes generating the integrated data in the first degree (I1) and the asymmetric nature of the relationship. The study, which is a continuation, extension and supplement to the analyses published so far, was carried out for selected countries in the European Union.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT





## **FLIGHT-TO-DIVERSIFICATION: THE EFFECT OF DIVERSIFICATION FOR REITS AT TIMES OF HIGH MARKET VOLATILITY**

Heidi Falkenbach, Islam Ibrahim

**KEYWORDS:** diversification, market volatility, firm value, REIT

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At heightened market volatility, investors migrate to safer investments prioritizing risk avoidance over gaining higher returns. Hence the value of safer, less volatile investment appreciates. As diversification diminishes volatility, we investigate whether diversified REITs is considered a safer investment at high market volatility. We find that the effect of diversification on the value and public debt cost of REITs varies with market volatility. At low level of market volatility geographical diversification has a negative net effect on the REIT value. However, as the market volatility increases, this negative impact diminishes. Similarly, we find that at low level of market volatility, geographical diversification has a yield-increasing effect on the debt issues of REITs. But, also, as market volatility increases the yield-increasing effect diminishes. These findings indicate that the value of diversification increases with market volatility.

## **THEME D: REAL ESTATE FINANCE AND INVESTMENT**



# REIT CAPITAL RAISING AND DIVIDEND POLICIES DURING THE COVID-19 PANDEMIC CRISIS

Daniel Huerta, Shelton Weeks, Jesse Wright


**KEYWORDS:** REIT capital raising, COVID-19 pandemic, REIT dividend policy, REIT equity and debt offerings

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The COVID-19 pandemic was an unprecedented market disruption that had significant global economic consequences. In the face of uncertainty, the U.S. and virtually all other markets around the world halted economic activity and governments found innovative ways to support individuals, families, and companies during the time of crisis. The crisis crippled all corners of the market and forced a generalized shutdown. The U.S. REIT sector was not an exemption, the industry experienced a significant temporary shock to revenue and to the supply of capital which is crucial for operations and growth. In this paper, we examine the impact of the COVID-19 pandemic crisis on REIT dividend policy and capital raising. For our analyses, we employ accounting and dividend data from S&P Global Market Intelligence (Formerly SNL Financial), and debt and equity offerings from the National Association of Real Estate Investment Trusts (NAREIT). We seek to determine the severity of the COVID-19 pandemic crisis on the halt or partial disruption in REIT dividend payments and uncover the ways REIT managers coped with the short-term market shocks. In addition, we will determine whether the capital markets provided REITs with capital during these uncertain times.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT



# THE ROLE OF ACTIVE PORTFOLIO MANAGEMENT AND SECTOR SELECTION IN SHARPE RATIO OPTIMAL PORTFOLIOS IN THE 21ST CENTURY

Wilhelm Breuer, Johannes Kroog

**KEYWORDS:** listed real estate, portfolio selection, CAPM, active portfolio management

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The paper compares the optimal portfolio constellations of listed real estate companies (LRE) with a pure market weighting over a time horizon from 2008 to 2023. The companies represented were selected according to market capitalization and geographical criteria. The ten largest companies from each of the regions North America, the eurozone, Asia-Pacific and the UK were compiled in rolling five-year time frames according to the Sharpe ratio-optimized allocation. In a second step, the selected companies were structured according to their asset classes Retail, Residential, Office, Industrial, Diversified and Specialty and analyzed using the same method. It can be seen that active portfolio management generally has a better risk-return profile than simply market-weighted portfolios. The risk component in particular can be significantly reduced. In comparison, the eurozone achieves the best risk-adjusted performance. Optimization can increase the Sharpe ratio here by an average of +25.5%. In a comparison by asset class, companies with a residential focus stand out with the highest Sharpe ratio. By optimizing the portfolio constellation, the Sharpe ratio can be increased by an average of 42.3%.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT



# THE FINANCIAL STRUCTURE OF REAL ESTATE COMPANIES IN M & A S

Massimo Mariani, Paola Amoruso, Antonia Brandonisio, Daniele Arcidiacono

**KEYWORDS:** M&A, financial structure, real estate, market

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The study aims to investigate the role of firms' financial structure as a determinants of M&A transactions for real estate companies. The paper analyses how M&A transactions are influenced by particular aspects related to the choice of a specific financial structure, thus verifying leverage effects and the forms of financing. An interesting consideration could be made regarding the type of debt, i.e. whether it concerns bank debt or other forms of structured financing to develop M&A operations. Other noteworthy considerations are related to the volatility of the reference market, the characteristics of particular assets and specific macroeconomic conditions, which have unavoidable repercussions within the business environment. Ultimately, the paper can provide an in-depth perspective on optimizing the financial structure, thus enabling real estate companies to maximize benefits from M&A transactions. The present study could be particularly interesting in order to understand financial dynamics of real estate sector, offering practical insights for the stakeholders involved in extraordinary finance transactions.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT



## RISK-ADJUSTED PERFORMANCE OF GERMAN OPEN-ENDED FUNDS AND LISTED REAL ESTATE AND THE ROLE OF REPORTING STANDARDS

Wilhelm Breuer, Julius König

**KEYWORDS:** Listed Real Estate (LRE), Open-ended Funds, Reporting standards, Sharpe Ratio

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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The paper compares the risk-adjusted performance of German open-ended funds and listed real estate companies (LRE) using the Sharpe ratio concept in the short, medium and long term. The results show that both outperform depending on the term and that the different reporting standards of the two vehicles play an important role in explaining the outperformance.

**THEME D:**  
**REAL ESTATE  
FINANCE  
AND  
INVESTMENT**



## GEOPOLITICAL RISK AND THE DYNAMICS OF REITS RETURNS

Alain Coen, Aurelie Desfleurs


**KEYWORDS:** REITs, Asset Pricing, Geopolitical Risks, GMM

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The aim of this study is to analyze the relative importance of geopolitical risk (GPR), as introduced by Caldara and Iacoviello (2022), on the dynamics of U.S. REITs returns. Using an extended conditional version of Merton (1973)'s capital asset pricing model, we highlight the role played by GPR and its two components, geopolitical acts (GPA) and geopolitical threats (GPT), on the expected returns of securitized real estate. Our robust results, report the level and the significance of the geopolitical risk metrics on the decomposition of REITs returns grouped into different portfolios ( built from CRSP/Ziman series). We shed light on the link between the characteristics of REITs and the relative importance of geopolitical risk during the last decades.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT



## **PUBLIC AND PRIVATE REAL ESTATE IN A PORTFOLIO IN CRISIS AND NON-CRISIS PERIODS**

Martin Hoesli, Jackline Kraiouchkina, Richard Malle

**KEYWORDS:** REITs, mixed-asset portfolio, private real estate, crisis

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## **THEME D: REAL ESTATE FINANCE AND INVESTMENT**

Although public and private real estate have common economic drivers, the response of their returns to crises often differs in time and in magnitude. Whereas the listed real estate market tends to react quickly and sharply to a shock, the impacts are usually more muted and are lagged for the direct market. Against this background, limited research has investigated whether it is beneficial to combine listed real estate and direct investments in a mixed-asset portfolio and what the optimal allocation to real estate should be during crisis and non-crisis periods. Using U.K. and U.S. monthly data from 2006 to 2023, this research seeks to dig deeper into the benefits of combining public and private real estate in a mixed-asset portfolio in periods of market turmoil and in periods of stability. For each country, we also aim to explore the composition of the real estate bucket by considering the main property sectors. In this context, the paper should inform U.K. and U.S. investors about the breakdown between public and private real estate and about how the allocations vary across sectors. Specifically, we aim to answer the following research questions. Can the combination of public and private real estate generate superior risk-adjusted performance in a mixed-asset portfolio and do the benefits change with market conditions? How does the allocation to public and private real estate in a mixed-asset portfolio change in crisis versus non-crisis periods? What is the composition of the real estate bucket across sectors in crisis versus non-crisis periods? Are there differences in portfolio compositions for U.K. versus U.S. investors and how can these be explained? The period under investigation is of interest as it includes three significant crises: the global financial crisis and its aftermath leading to the European sovereign debt crisis, the COVID-19 pandemic, and the Ukraine conflict and subsequent periods of rising interest rates.



## PORTFOLIO SALES: PRICE PREMIUM OR PRICE DISCOUNT?

Farley Ishaak, Peng Liu, Egbert Hardeman, Hilde Remoy

**KEYWORDS:** portfolio sales, transaction price, commercial real estate

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In commercial real estate, it is common to trade entire portfolios of real estate instead of single objects one by one. A portfolio refers to a set of real estate objects and, unlike the residential real estate market, the commercial real estate market is characterized by these constructions. Trading portfolios can be efficient as it requires one agreement instead of many. It is, however, unknown whether trading portfolios is also financially beneficial. A better understanding of this market behavior enables better monitoring of financial stability as the share of portfolio sales fluctuates over time. The aim of this study is to determine whether trading real estate portfolios involves a premium or discount in the transaction price. We used Dutch Land Registry Office data to identify portfolio transactions and examine the relationship between real estate portfolios and transaction prices with a hedonic regression. We find that real estate portfolios are most often traded with a price discount. Many portfolio sales in a certain period, therefore, indicate a “buyer’s” market and a price-lowering effect.

## THEME D: REAL ESTATE FINANCE AND INVESTMENT





# **BANK - AFFILIATION AND INFORMATION LEAKAGE AROUND EARNINGS ANNOUNCEMENT: EVIDENCE FROM TURKISH REITS**

Murat Tinic, Zeynep Önder


**KEYWORDS:** Real Estate Investment Trusts, bank affiliation, information leakage, secondary market quality

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## **THEME D: REAL ESTATE FINANCE AND INVESTMENT**

This paper examines whether the bank-affiliated brokerage houses actively use the private information they possess about their affiliated publicly traded real estate investment trusts (REITs) around earnings announcements in Borsa Istanbul (BIST) between 2005 and 2015. The legal framework surrounding Turkish Real Estate Investment Trusts makes it particularly interesting to investigate the secondary market implications of the information asymmetry between majority and minority shareholders within BIST. We propose bank affiliation as a potential mechanism for disseminating private information about the official quarterly earnings announcements for the first time in the literature by assigning exogenous classifications across different investor types at high frequency. Our results indicate a substantial informed trading activity passing through bank-affiliated brokerage houses around earnings announcements, especially with the increase in earnings (when the announcement carries good news). Through intraday panel regressions, we also document that private information attributed to trades submitted through affiliated brokerage houses significantly enhances market quality by increasing future liquidity and reducing future volatility levels, whereas private information percolated through unaffiliated brokerage houses demand liquidity and increases volatility, reducing overall market quality.



## **DISTRESSED DEBT IN US COMMERCIAL REAL ESTATE MARKETS: ARE US LENDERS POSITIONED TO HANDLE THE FALLOUT FROM OFFICE?**

Bernhard Funk


**KEYWORDS:** real estate finance, banks US real estate markets, CMBS

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DOI: [10.15396/eres2024-218](#)

## **THEME D: REAL ESTATE FINANCE AND INVESTMENT**

US commercial real estate markets have shown very low transaction activity in 2023. The begin of year 2024 has not brought significant change to this trend. 2024 will show an increase in commercial real estate debt volumes coming due. Following lower transaction activity, loan extensions and loan modifications are in demand from property owners. At the same time higher interest rates have prompted developers struggling to secure suitable funding from lenders. As property cash flow fundamentals deteriorate especially in parts of the office sector, distressed debt volumes have increased. So have delinquency rates, including delinquencies for CMBS. During the Great Recession financial turmoil originating in the CMBS markets has triggered widespread banking failures. This paper looks at the current state of US markets for commercial real estate finance. It covers three fundamental questions: How do US lenders react to current changes in commercial real estate market fundamentals? How do US supervisory authorities react to current market distress? What are the medium-term expectations for the changes in the supply side of markets for commercial real estate finance?



## **GOLD MARKET VOLATILITY AND REITS' RETURNS DURING TRANQUIL AND TURBULENT EPISODES**

Kola Akinsomi, Afees Salisu, Ametefe Frank, Hammed Yinka


**KEYWORDS:** real estate investment, gold, volatility, financial crisis

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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We analyze the predictability of REITs returns based on gold market volatility for 11 sectors and five regions. Our findings show higher gains during volatile gold market conditions, but results vary in tranquil and turbulent periods. We observe sector-specific investment behavior in the REITs market during the pre-GFC, but the post-GFC and COVID periods show otherwise. REITs offer a safe haven ability for gold, but their hedging power is sector-specific. For sensitivity analysis, stock market volatility is used in lieu of gold market volatility, and the outcome provides the expected counterfactual evidence with the REITs market. Our study has numerous policy implications for global financial market stakeholders.

## **THEME D: REAL ESTATE FINANCE AND INVESTMENT**



## UNDERSTANDING FACTORS AFFECTING PRICES OF NEW CONDOMINIUMS ALONG MRT ORANGE LINE IN BANGKOK, THAILAND


Rungsee Benjaanunphong, Pornaht Pongprasert

**KEYWORDS:** Central Business District (CBD), MRT Orange Line, Eastern Bangkok suburbs, condominium

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## THEME D: REAL ESTATE FINANCE AND INVESTMENT

This research aims to analyze the factors affecting the price of condominium projects along the Mass Rapid Transit (MRT) Orange Line, an electric train that is expected to start operation in 2025. It is the main Heavy Rail line connecting Eastern Bangkok suburbs with the city's new Central Business District (New CBD). To provide more opportunities for land development, the city plan of Bangkok has also changed along the Orange Line, especially Ramkhamhaeng Road. The price of land will rise as a result. Researchers are interested about how the price of the condominium will change if additional factors are taken into consideration, such as the project's proximity to the MRT station, the main road, the expressway entrance and exit points, private facilities, and other factors related to the operator's reliability and the expense of the common area. To construct the project and set the price in line with the actual circumstances, this research outcome aims to provide real estate developers with an understanding of the factors that determine the pricing of condominiums along MRT Orange. Buyers of condominiums can use the proper price information to inform their selections. When making investing decisions, investors of stocks in real estate companies could consider this information into consideration and this data can be used as an outline by the Revenue Department to collect land taxes. In this research was used to analyze data from 28 condominium projects along Orange Line with a project life of no more than five years, covering areas close to the new CBD to the Eastern Bangkok suburbs, such as Min Buri. There are a total of 17 factors used in running regression under 3 groups: locational, physical and neighborhood characteristics. In result, it is found that 3 factors that affect the price are: floors, distance from train station and distance from department store.



# ASSESSING THE FORECAST PERFORMANCE OF MACHINE LEARNING ALGORITHMS AND ECONOMETRIC MODELS IN REAL ESTATE

Sotiris Tsolacos, Tatiana Franus

**KEYWORDS:** property pricing, machine learning, econometric models, forecasting assessment

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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## THEME D: REAL ESTATE FINANCE AND INVESTMENT

In this paper we study the performance of a range of methodologies to forecast real estate prices. We compare the forecast accuracy of econometric and time series models to machine learning algorithms. The target series is the yield impact a metric which is based on changes in yields (cap rates) and a prime determinant of capital value or price changes (appreciation returns). We focus on the main sectors – offices, retail and industrials – in the UK and we perform the analysis with monthly data taken from MSCI. Using monthly MSCI data results in a sample that begins in 1987. The econometric and time series models include ARMA, ARMAX, stepwise and Lasso regressions. Machine learning methods include random forest, XGBoost, and support vector machines. We use a large set of economic, financial and survey data to predict movements in yield impact. We assess the forecast performance of the selected methodologies over different time horizons, one, three, six, and twelve months. The forecast evaluation follows conventional forecast evaluation metrics. This includes basic measures such as the mean error, mean absolute error and RMSE and more sophisticated measures such as Diebold-Mariano tests. We are particularly interested in forecasting gains arising from the combination of forecasts from different methods. The results have significant practical value. The forecast assessment can pick up directional changes and be used for price discovery. Real estate data in the private market are produced with a lag (even monthly data) and early information about changes in prices are valuable to real estate investors and lenders. The study aims to identify the methods or the combination of methods with the best predictive ability and focus investor attention to these methods.



# IMPLICATIONS OF BREXIT ON INTERNATIONAL CAPITAL FLOWS INTO THE LONDON OFFICE MARKET

Martin Haran, Michael McCord, Olawumi Fadeyi

**KEYWORDS:** capital flows into real estate, London offices, Brexit, international property investment trends

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## THEME D: REAL ESTATE FINANCE AND INVESTMENT

The London office market is a primary destination for international real estate capital and a key global city and financial center for international real estate investment. However, the increase in global uncertainties in recent years due to political events and economic and inflationary challenges highlights the need for more insights into the behavior of international real estate capital flows. The purpose of this study is to evaluate the influence of the global and domestic environment on international real estate investment activities within the London office market over the period 20016–2023, concentrating on the separation of the UK from Europe due to the Brexit referendum, which seemingly have influenced investment flow patterns in and out of London. We employ an auto-regressive distributed lag approach using quarterly MSCI cross-border investment transactions within the central London office market for the period 2016-2023. We measure both long-run and short-run co-integrating effects and causality relative to Long-term interest rates, real effective exchange rates, total returns and yields from the London office market, GDP, Stock Market Capitalization, the VIX index and Global Liquidity.



## MOTIVATIONS BEHIND SHARING IN HOUSING: A SELF- DETERMINATION THEORY

Fabian Lachenmayer, Martin Christian Höcker, Andreas Pfnür

**KEYWORDS:** shared city, housing, self-determination theory, sharing economy

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DOI: [10.15396/eres2024-045](https://doi.org/10.15396/eres2024-045)

The need for sustainable transformation affects all areas of the economy and society. The housing situation of private households is also subject to this transformation process, with the result that housing and location preferences as well as qualitative and quantitative housing needs are changing. In recent years, the sharing economy has established itself as a new sustainable form of consumption. The wisdom 'You are what you own' has been replaced by 'You are what you can use and share'. As the ultimate place for sharing, cities play a key role in the development and spread of this phenomenon. The concept of 'shared cities', which can be applied in various areas such as spaces, mobility, objects and food, can thus make an important contribution to the efficient use of resources, the sharing of living space, energy use and conscious consumption in housing. However, little is known about the various motivations why people participate in sharing in housing. By using the Self-Determination Theory (SDT), this study aims to investigate the reasons why consumers participate in shared cities. According to this theory, motivation can be driven by intrinsic and by extrinsic values. For this purpose, survey data from n = 1,005 German private households are analyzed using multiple linear regression. The results emphasize the importance of intrinsic and in particular extrinsic motivation for the intention to participate in sharing in housing. The study provides important implications for theory and management practice in order to realize sharing in housing in the future.

## THEME E: HOUSING



## HIGHLY SKILLED IMMIGRANTS AND LOCAL HOUSING PRICES: EVIDENCE FROM THE H-1B VISA LOTTERY

Eli Beracha, Wintoki Babajide, Kim Emily, Xi Yaoyi

**KEYWORDS:** real estate return, housing appreciation, Housing, H-1B visa program


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This study explores the extent to which highly skilled immigrants affect local housing prices by exploiting exogenous inflow of highly skilled immigrants to an area through the H-1B visa lottery program. Our results suggest that an influx of highly skilled and high-income immigrants increases the demand for housing. Specifically, our findings show that greater inflow of highly skilled immigrants leads to higher local housing price appreciation. This positive relationship between the influx of highly skilled immigrants and housing price appreciation is stronger in areas with faster overall population growth and in areas with inelastic land supply. However, additional findings show that the inflow of highly skilled workers does not significantly affect local rent prices.

## THEME E: HOUSING





# THE NUMBER OF REAL ESTATE COMPANIES IN GERMANY AND FEATURES OF THEIR BUSINESS ACTIVITIES - AN EMPIRICAL PROJECT

Stephan Kippes

**KEYWORDS:** brokerage, number of real estate companies in Germany, German real estate market, residential real estate

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## THEME E: HOUSING

In Germany there is not much information available on the number of real estate companies. Property companies in Germany need a permit before they start doing business. In this respect, it should be possible to determine the number of companies selling or letting properties. Since this approval is not returned, even if the real estate company is no longer in business, the number of permits is not meaningful. In addition, there is a lack of information on how many of these companies are only occasional brokers and how many of these companies can be assumed to be fully established brokerage firms. Therefore, the empirical paper analyzes the number of real estate companies, and important features of their business activities based on the IMV database. It also examines how the number of brokerage firms has changed over time considering the respective real estate sales on the German real estate market. The IMV program is an efficient research tool for residential market analysis, the program collects nearly all property ads in Germany, which are published in real estate portals, newspapers, and weeklies, and stores them in the IMV data base. Over 700,000 real estate offers are evaluated nationwide every day from hundreds of print media and the Internet.



# A POTENTIAL OF INCLUSIONARY HOUSING AS AN AFFORDABLE HOUSING SUPPLY INSTRUMENT IN POLAND

Magdalena Załęczna, Agata Antczak-Stepniak, Katarzyna Olbinska

**KEYWORDS:** inclusionary housing, developer, Poland, local government

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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## THEME E: HOUSING

Developers have become the leading housing providers in Poland; in recent years, their share in the primary housing market has increased from 34% in 2015 to 60% in 2022. Demand is high and is mainly of an investment nature. At the same time, many households, especially in large cities, cannot meet their housing needs independently and expect support from local authorities (in 2022, there were almost 143,000 households). Municipalities cannot fulfill their obligations, their resources are shrinking due to privatization and technical wear and tear, and they do not build new resources independently (in 2022, they only made 600 apartments). Cooperation with social rental housing actors also results in a small pool of apartments. The authors investigated whether an inclusionary housing solution would be accepted and implemented in Polish conditions. The IH model's implementation consists of planning policy tools due to the importance of planning for the location design and number of new housing units, the size of affordable housing supply, and the applicability of the Value Capturing mechanism (de Kam, Needham & Buitelaar 2014). The IH allows for separating affordable flats in commercial housing projects and allocating them to households meeting specific criteria. The research conducted by the authors was multidimensional and used various methods; the first stage was in 2020, and the revision of results was prepared in 2024. The authors used the desk study to identify different IH models and their effects in practice. Then, to determine the potential of using IH in Poland, the authors identified and analyzed national legal bases enabling the implementation of solutions similar to IH in practice, and they examined the degree of their use. This concerned solutions to the acts commonly called 'premises for land,' starter apartments, and Lex developer. The next stage of the research was qualitative, and it aimed to indicate the degree of interest in IH on the part of local authorities in Polish cities and developers. The methods used allowed the authors to make conclusions.



# PRICE CO-MOVEMENT ACROSS LOCAL HOUSING MARKETS IN THE UNITED KINGDOM

Michael White, Joanne Loh

**KEYWORDS:** price diffusion, contagion, DCC-GARCH, local housing markets

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DOI: [10.15396/eres2024-084](https://doi.org/10.15396/eres2024-084)

A significant body of research has examined regional house prices in the UK, testing for example for long run relationships (MacDonald and Taylor, 1993; Muellbauer and Murphy, 1994; Cook, 1995; Meen and Andrew, 1998), convergence (Drake, 1995; Cook, 2012; Abbott and De Vita, 2013), diffusion and volatility (Stevenson, 2004; Ferrari and Rae, 2011), as well as policy effects (Hilber and Vermeulen, 2016; Choudhry, 2020). In this research we focus on house price co-movement given the significant changes in house prices in the UK and examine the degree of synchronicity, spillovers, and volatility in price movements. Furthermore, we examine these co-movements at local authority (or municipality) level. The analysis draws upon a rich dataset provided by ONS HPSSAs, which offers detailed and granular information on house prices across small geographic areas. We apply dynamic conditional correlation generalized autoregressive conditional heteroscedasticity (DCC-GARCH) models across urban areas over contiguous local authorities. This method has been adopted by DeFusco et al. (2013) for US metro area housing markets, by Zimmer (2014) for four US cities, as well as Miles (2016) for UK regions. Our disaggregated data set is quarterly covering the period 1995q4 to 2023q1 allowing analysis of years of, sometimes, rapid, house price appreciation as well as periods of price depreciation and whether these different economic circumstances change the relationship between house prices in and between different local authority areas.

## THEME E: HOUSING



# HOUSE PRICE BUBBLES AND SYSTEMIC EVENTS OVER THE LAST SIX CENTURIES

Alona Shmygel, Martin Hoesli

**KEYWORDS:** house price bubble, systemic event, financial crisis, Sweden

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How many house price bubbles have there been over the last six centuries? And how have house prices responded to different types of systemic events? These two questions are addressed using house price data for Stockholm, Sweden, for the period 1420 to 2021. To answer the first question, we construct two measures to detect house price overvaluation, namely the price-to-income ratio and a fundamental price level for house prices, which is gauged against actual house prices. The second question is answered using local linear projections, with which we test the response of house prices to different types of systemic events, such as epidemics, wars, and financial crises. We check the lag with which house prices react and how long the responses last for different types of systemic events. Additionally, we investigate how the link between house prices and systemic events has changed over time. We find that bubble periods are evenly distributed over time. The price-to-income ratio appears to be sensitive to financial crises, which mostly happened during the 20th century. The influence of other types of systemic events is less straightforward and is time-varying.

## THEME E: HOUSING



# SPATIAL ANALYSIS OF CHINESE CITY-LEVEL HOUSING PRICES IN RESPONSE TO MACROECONOMIC CHANGES

Zhenyu Su, Paloma Taltavull de La Paz


**KEYWORDS:** housing prices, macroeconomic indicators, spatial analysis, China

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DOI: [10.15396/eres2024-108](https://doi.org/10.15396/eres2024-108)

This research aims to conduct a spatial analysis of Chinese city-level housing prices in response to macroeconomic fluctuations. By employing advanced spatial analysis techniques, we will examine how macroeconomic indicators, such as GDP growth, inflation, interest rates, and employment levels, correlate with spatial patterns of housing prices across different cities in China. Through the utilization of geospatial data and econometric modeling, we seek to identify spatial clusters, hotspots, and cold spots of housing price changes in relation to macroeconomic shifts. Additionally, the study will explore the spatial heterogeneity of the housing market responses to macroeconomic changes, shedding light on regional disparities and variations in housing price dynamics. The findings of this research will provide valuable insights into the spatial relationships between macroeconomic conditions and housing prices in Chinese cities, offering implications for policymakers, real estate developers, and investors seeking to understand the nuanced dynamics of the housing market in response to macroeconomic shifts.

**THEME E:  
HOUSING**



## PREFERENCES AND DEMANDS FOR MULTI-HABITATION: EVIDENCE FROM A QUESTIONNAIRE SURVEY IN KOREA

Jun Hyung Kim


**KEYWORDS:** multi-habitation, housing demand, housing preference, housing consumption

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DOI: [10.15396/eres2024-109](https://doi.org/10.15396/eres2024-109)

In Korea, the concept of 'one house for one household' has been the principal pillar of the national housing policy framework for decades. Owning two or more houses has been regulated to guarantee housing affordability. However, it has recently faced challenges due to the depression of the regional housing market. Combined with the increasing trend of telecommuting after COVID-19, it has driven new trends, 'multi-habitation'. Yet, there are not abundant analyses about the preferences or demands for multi-habitation. Based on a questionnaire survey, this paper figures out the feasibility of multi-habitation policy or projects.

**THEME E:  
HOUSING**



# A DURATION ANALYSIS OF HOUSING CONSTRUCTION TIMES EVIDENCE ON THE ROLE OF OPTION VALUES, PUBLIC INVOLVEMENT AND STALLED SITES

Jan Rouwendal, Lars Brugman

**KEYWORDS:** housing construction, land use planning, housing supply, stalled sites

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DOI: [10.15396/eres2024-128](https://doi.org/10.15396/eres2024-128)

This paper investigates the duration of housing construction projects in the Netherlands. We utilize comprehensive data from the Dutch Land Registry for the period 2013-2022 to investigate the importance of municipal land ownership, building plot price changes, construction costs, development inside areas that are already built-up and competition. The construction process covers the time between issuance of building permits and completion of the project, which can be split in a preparation and construction phase. We find that municipal involvement in projects speeds them up significantly, while increasing building plot prices and especially construction costs have a delaying effect. Construction inside already built-up areas fastens the preparation and slows down actual construction, with an significant net delaying effect on the total duration. Competition decreases the time needed for construction. Our results lend support to real option theory and indicate differences in the objections of private firms and local authorities.

## THEME E: HOUSING



# CAUSES AND EFFECTS OF SPATIAL DIFFERENTIATION OF PRICES IN A POLYCENTRIC METROPOLITAN HOUSING MARKETS

Adam Polko, Wiktoria Jedrusik, Radoslaw Cyran

**KEYWORDS:** housing markets, metropolitan regions, spatial economics

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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## THEME E: HOUSING

The past three years have witnessed a dynamic surge in prices and rents within Poland's housing markets. The primary macroeconomic drivers behind this escalation are primarily attributed to high inflation, the influx of refugees from war-stricken Ukraine, and government initiatives that include subsidies for housing loans. These factors collectively contribute to an augmented demand in both primary and secondary housing markets, surpassing the current supply. The prevailing trend in the housing market is the dominance of investors viewing housing as a financial asset. In contrast, households perceiving housing as a consumer good face a discernible disadvantage in the current market dynamics. The dynamics within housing markets, inherently confined to local spatial contexts, exhibit non-uniformity. This heterogeneity is particularly pronounced in polycentric metropolises, where substantial variations in housing prices between neighboring cities are prevalent. The primary objective of this research article is to elucidate the causes and effects of spatial disparities in prices within a polycentric metropolitan housing market. Employing transaction prices as exemplified over the past three years within housing markets of the Upper Silesian Metropolitan Region, the article seeks to address the following research questions: Do housing prices in central areas experience a more rapid escalation compared to those in the periphery? In instances of swift growth in housing prices, do discrepancies between prices in diverse cities intensify? What distinguishing characteristics define areas witnessing the most substantial price hikes, and conversely, those exhibiting minimal increases or even a decline in prices? The search for the reasons for the variation of housing prices in the metropolitan housing market will allow us to better understand the principles of the functioning of housing markets that are located in the immediate vicinity and differ due to the polycentricity of the metropolis. The interest of researchers and practitioners is usually focused on housing markets in the largest cities (in Poland, such as Warsaw, Krakow, Wroclaw, or Katowice) and neglects the analysis of price formation in medium and small cities located in metropolitan areas. Due to their immediate vicinity, transport connectivity, proximity to labor markets, medium and small cities often become an alternative for households unable to buy apartments in the center of the metropolis. Spatial analysis of housing prices will allow the final section of the research paper to make recommendations for households to purchase housing in diverse metropolitan housing markets.





## EUROPEAN HOUSING PRICES AND SALES STATISTICS - DATA SIGNALING THE SEQUENCE OF THE DOWNTURN

Peter Parlasca

**KEYWORDS:** house prices, data analysis, house sales statistics, real estate statistics

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## THEME E: HOUSING

The upswing of the housing markets started in Europe around 2014 even without being hampered by the Covid crisis. However, from summer 2022, signals for the end of the house price bubbles could be seen in many European countries due to Ukraine war related effects supply shortages, increasing inflation and raising interest rates. The down turn affected first Denmark and Germany. In the third quarter 2023 already 10 countries showed house price levels below the previous year. New statistics at the European level and the availability of house sales figures not only in indices for numbers and volume but in physical numbers and the turnover in national currency allows better analysis in particular an earlier detection of downturns and upswings. The development of house prices differed widely between European countries and will be put into perspective with the development of economic activity within Europe. In contrast to the economic developments, housing markets in a small number of European countries did not yet reach the pre-crisis level until 2023 although the upswing of the housing markets started in Europe around 2014. On the other hand, in a significant number of European countries house prices doubled between 2008 and 2023. The data on quarterly house sales (indices of number of transactions and volume) now complemented by additional information seem to be a promising data source to develop projections of the housing market in many European countries.



## RESIDENTIAL MORTGAGE AFFORDABILITY: EVIDENCE FROM POLAND

Konrad Zelazowski, Alina Jędrzejczak, Anna Miklaszewska,  
Katarzyna Olbńska, Dorota Pekasiewicz, Magdalena Załączna

**KEYWORDS:** housing finance, mortgage market, mortgage affordability,  
Polish housing market

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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## THEME E: HOUSING

The mortgage market in majority of developed countries is the foundation of an effective housing finance system. For many households, an available mortgage loan is the only option to achieve housing independence, and it also enables more effective adjustment of the scope and quality of housing services to their needs and expectations. The developed mortgage market also favors increased transaction activity in the housing market, which is particularly important in improving its efficiency and optimal allocation of capital. In the long term, a stable inflow of credit capital stimulates construction investment and has a positive impact on the housing stock. The Polish banking sector has been witnessing the dynamic growth of mortgage market for many years. Despite this, we are still not able to fully answer the basic questions: How many Poles can afford a housing loan? How sensitive is the demand for mortgages to changes in interest rates, real estate prices or the financial capabilities of potential borrowers? The aim of the paper is to measure the affordability of mortgage loans for Poles, taking into account their financial situation and economic reality at the end of 2022. Using CSO microdata, we estimated the percentage of households that, due to their financial constraints, would not be able to take out a mortgage loan to purchase an average-sized dwelling.



## RENT GOUGING IN GERMANY? AN ANALYSIS OF ASKING RENTS AND PUBLIC RENT INDICES

Lars Jagemann, Steffen Sebastian, Laurenz Wörner


**KEYWORDS:** rent control, rent development, asking rents, German housing market

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This study investigates the developments of asking rents and public rent indices in a sample of selected German cities. As the rent indices compiled by local authorities serve as regulatory bases for rent controls in Germany, the analysis aims at quantifying the gap between rent prices offered by landlords and price ceilings determined by local rent indices. Using data manually drawn from rent index reports and a nationwide asking rent database, we identify a growing gap, both in absolute and relative terms: while asking rents have risen sharply, official rent indices have been more reserved due in parts to their methodology. This gap appears to be more pronounced in dense cities, while the gap shrinks in more scarcely populated cities. We find the results to be significant over time. Our results suggest that the current regime of rent price indices is ineffective, stressing the need for future reforms.

**THEME E:  
HOUSING**



## COMPARING THE GENTRIFICATION RATES BETWEEN METRO SERVED AND NON-METRO SERVED MAJOR HOUSING ESTATES: A CASE STUDY OF HONG KONG


Ka Man Leung, Lennon Hung Tat Choy

**KEYWORDS:** gentrification, metro accessibility, difference-in-differences approach, major housing estates

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This study examines if metro served major housing estates in Hong Kong gentrify faster than non-metro served ones. If so, in what distance does this effect last? Data of the latest population censuses conducted in 2016 and 2021 are employed in the analyses. Controlling the changes in population characteristics, the results show that major housing estates with metro served within 250m gentrified faster than non-metro served ones (in terms of all three gentrification indicators). The effects lessened when larger sized buffers are employed. Meanwhile, the effects of new stations are also revealed through the analyses. These results provide a fuller picture of how gentrification happens in rental housing with different metro accessibility, which are important references for academic research and policy implementations.

**THEME E:  
HOUSING**



## THE NRAS CLIFFHANGER: STAKEHOLDER INSIGHTS INTO REBUILDING THE BROKEN AUSTRALIAN AFFORDABLE HOUSING SYSTEM

Lynne Armitage, Johari H.N. Amar

**KEYWORDS:** affordable housing, Australian private rental sector, NRAS, PaCWIPi

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## THEME E: HOUSING

Over the last few decades, there has been an increasing awareness that Australian housing policies are failing to meet the needs of low- and middle-income households. This study addresses persistent challenges households face in the private rental market, exacerbated by the pandemic, soaring rents and termination of National Rental Affordability Scheme (NRAS). This study examines the efficacy of ongoing policy debates of market-based schemes and identifies strategic and tactical opportunities for housing stakeholders. This empirical research, including 31 interviews with key informants from public, private and community sectors, reveals substantial influence of ‘set and forget’ by partisan politics on the oversight available to policymakers in such programs. The findings highlight five key mistakes and five lessons learned, emphasizing the pressing need to reassess current policies and strategies to tackle the deepening housing affordability crisis. The research also offers a benchmark test for all affordable housing policies, namely ‘personal and collective will in policy implementation’ – PaCWIPi – applicable for all housing policy processes.



# ESTIMATION AND DETERMINANTS OF HOUSING SUPPLY ELASTICITY IN TURKEY

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**KEYWORDS:** housing supply, undevelopable land, price elasticity, emerging economies

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We estimate the price elasticity of housing supply and then provide empirical evidence on the determinants of the estimated elasticities at the province level in Turkey for the 2008Q1–2017Q4 period. The price elasticity of housing supply is a measure that provides information on how housing supply responds to price increases, and it plays a crucial role in urban development. The motivation for studying housing supply elasticity in Turkey stems from several reasons. First, over the last two decades, the construction industry has been the booster of the growth of the Turkish economy, and legal reforms support the rise of the sector by lifting regulatory restrictions on property development. Second, housing affordability has become one of the hot topics in Turkey due to rising house prices and an inflationary environment. We contribute to the housing studies literature by estimating housing supply elasticity and determining the factors that explain the elasticities in an emerging economy. The studies on housing supply elasticities agree that barriers to residential construction in the form of land availability or regulations are the main causes of low supply elasticity. Our results suggest that Turkish provinces have relatively low housing supply elasticity, and in line with the literature, geographical constraints seem to be associated with lower elasticities. We also provide evidence that demographic characteristics and local regulatory conditions matter in this environment.

## THEME E: HOUSING



# LEAD INDICATORS OF RESIDENTIAL MARKET PRICE CHANGES : AN EMPIRICAL STUDY

Louise Brown

**KEYWORDS:** bidding, tom, open market transactions, house price cycles

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**Purpose:** This paper empirically demonstrates that lag time to first bid (LT) and amount of first bid (DBid1) for open market property transactions are indicators to predict house price volatility. LT is advocated as an alternative measure to time on the market (TOM) and provides early signaling to vendor and agent of SP-LP.

**Methodology:** The dataset contains 3124 detailed transaction histories for properties sold in Belfast between 2002-2009 characterizing a period of rapid price growth (2005-2007) followed by a period of sharp decline (2008-2009). The dataset facilitates the investigation of housing market dynamics through examining trends of actual bidding histories using regression modelling. The effects of vendor and bidder behavior in a rising and a falling market on sales price relative to list price are analyzed.

**Findings:** Results from regression analysis indicate LT as a statistically significant variable for predicting SP-LP offering a similar  $r^2$  to TOM model, combining DBid1 increases  $r^2$ . LT provides an early indicator of market perception and conveys market intelligence that can inform price expectations and probability of sale. Furthermore, survival analysis demonstrates LT is a useful predictor of the probability of a sale achieving  $SP > LP$ .

**Originality:** The dataset includes detailed transaction histories for residential property covering phases of a house price cycle including new variables of LT and DBid1 to enhance our understanding of the sales process through the use of microvariables which capture purchaser behavior.

**THEME E:  
HOUSING**



# THE REVEALED PREFERENCES IN THE WARSAW RESIDENTIAL HOUSING MARKET

Justyna Tanaś

**KEYWORDS:** housing market, revealed vs. stated preferences, buyers' preferences


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This article aims to determine buyers' revealed preferences in the secondary housing market in Warsaw. The study was conducted based on data on transactions of real estate premises made on the secondary market in Warsaw in 2016-2020. These data were supplemented with the information contained in land and mortgage registers (section II - ownership), in the real estate cadaster, and using Google Street View. After a tidying-up exercise, a database of over 35,000 residential property transactions was created. The vast majority of buyers' preferences in the residential market in Poland conducted in recent years have been studies of local markets, usually in the largest cities. Most of the time, surveys of declared preferences were conducted using a survey questionnaire, usually targeted surveys that did not meet the sample's representativeness. The unique database built this way allows the preferences of different buyers (e.g., young people, seniors, singles, married couples, etc.) to be identified in a previously impossible way due to the lack of such databases.

**THEME E:  
HOUSING**





# WHAT DETERMINES DYNAMICS OF HOUSE PRICES IN ADVANCED ECONOMIES? EVIDENCE FROM EMPIRICAL RESEARCH LITERATURE

Sviatlana Engerstam

**KEYWORDS:** fundamental determinants, advanced economies, house price dynamics

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Despite the extensive international interest in house price dynamics and the growing body of research in this area, until now it was not that evident what is the size of the fundamental factors potential impact on house price dynamics over the long run. This study provides an overview of empirical studies on the fundamental determinants of house prices in advanced economies at the aggregated level. The synthesis includes 67 selected journal articles published in 58 top-tier housing, urban and real estate journals during the last five decades (1973-2023) and represents a summary of the developments in the field of housing economics related to house price dynamics. The results of the study suggest that most of the research on house price determinants employed quantitative methodology with a wide variety of econometric techniques. The study defines fundamental determinants of house prices over the long run, classifies them in relation to the size of their elasticities and emphasizes the differences between them. In addition, the study describes the role of data sources as well as quality and modelling techniques, and discusses the impact of inflation, momentum, mean reversion and housing market efficiency.

**THEME E:  
HOUSING**



## VARIETIES OF HOUSING INEQUALITY PATTERNS IN EUROPE

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**KEYWORDS:** housing inequality, housing wealth, housing regimes, varieties of residential capitalism

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**Purpose:** To jointly analyse different approaches to housing inequality in search of similarity patterns across various coexisting housing regimes in Europe.

**Research hypothesis:** Each variety of residential capitalism (i.e. housing regime) exhibits its own pattern of housing inequalities.

**Research method:** Using microdata from the newest Household Finance and Consumption Survey (HFCS) wave 2021 (for Poland, data from the wave 2017 was used), we calculated various measures of housing inequality for 20 EU member states. We consider housing space inequality and the size of multiple homeownership, as well as gross and net housing wealth inequality, both for the whole population and for homeowners only. Additionally, we have added Eurostat data on housing cost overburden and housing over- and undercrowding rates. On this data set we performed k-means cluster analysis to search for patterns of similarity between the analysed countries.

**Main findings:** The calculations showed that the k-means cluster composition almost perfectly overlapped with the classifications of housing regimes in Europe. In other words, we have identified that each variety of residential capitalism exhibits its own distinct housing inequality patterns. In statist countries such as Germany, Austria, the Netherlands, and France, there are high housing wealth inequalities but much lower inequalities in housing space and costs. In turn, corporatist countries such as Belgium, Ireland, and Finland exhibit medium wealth inequalities but high housing space and cost inequalities. Mediterranean member states, also denoted as countries with a commodified familial model of residential capitalism, have developed the largest class of homeowners, where, on average, 18% of households own two or more residential estates. This increases housing wealth inequalities, especially when considering mortgage debt, but has no effect on space inequalities which is one of the lowest among all analysed countries. Finally, Central and Eastern European countries, also called super-ownership states, which exhibit a non-commodified familial model of residential capitalism, have the lowest housing wealth inequalities, with 72% of households owning just one residential property, which they occupy, but they have very high space inequalities, with almost a quarter of the population living in overcrowded dwellings and medium to large housing cost inequalities. These results indicate that each housing regime requires a unique housing policy approach to mitigate future housing inequalities.

## THEME E: HOUSING



# THE SHORT- AND LONG-RUN IMPACT OF COVID-19 ON NEIGHBOURHOOD RESIDENTIAL TURNOVER AND SPATIAL SORTING IN LONDON, UK

Yi Wu, Kwan Ok Lee, Souneil Park

**KEYWORDS:** residential turnover, neighbourhood quality, COVID-19, Big Data

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## THEME E: HOUSING

Existing evidence on residential migration has focused on patterns of leaving high-density central cities and moving into peri-urban areas after COVID-19. However, the discussion on variations in these patterns between neighbourhoods within the central city has been largely neglected. We investigate whether the role of neighbourhood quality to residential turnover has changed and how this quality affects the destination neighbourhood choices of movers over different COVID-19 phases. In doing so, we use the monthly information of inter-neighbourhood migration from more than 11.61 million mobile phone users in UK (25% market share) including more than 224.265 million pairs of movers between April 2019 and October 2022 in UK, which is linked to the Index of Multiple Deprivation (IMD) of 4,835 neighbourhoods in London. We first report a significant increase in out-migration from London neighbourhoods to commuting belt areas or even further after COVID-19. Next, we demonstrate that more deprived neighbourhoods in London experienced a higher turnover by losing their residents to non-London and other London neighbourhoods after the COVID-19 outbreak. This trend was strongest during COVID-19 but continued even when the COVID-19 faded out. Finally, we find a stronger sorting pattern by the quality of origin neighbourhoods especially after the new normal started. Movers from more deprived London neighbourhoods show a lower probability of upward mobility to both London and non-London destinations, relative to pre-COVID-19 periods. These findings on within-city variations in residential turnover and spatial sorting have important implications for residents' wellbeing and potential spatial segregation.



## GOVERNMENT-INITIATED URBAN DEVELOPMENT AND LAND FINANCING

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**KEYWORDS:** land development, land readjustment, land finance

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## THEME E: HOUSING

Land readjustment has been widely employed in Taiwan to facilitate an orderly urban development with little financial burdens to the city. Although landowners participating in land readjustment are required to contribute part of their land holdings to the city, this project area will normally be up-zoned. In consequence, the smaller parcels that remain with landowners are typically valued substantially higher than the original larger parcels. Contributed portions of land are used as sites of public infrastructures and also sold by auction to pay for the constructions of infrastructures. In contrast, in a similar development area where land readjustment is not used, both sites of infrastructure and construction will be paid for by public budget. Land readjustment therefore acts not only as a development instrument but also a fiscal one. In practice, in a booming housing market, the government is often left with a substantial amount of financial surplus when land readjustment projects are completed. The financial surplus will be deposited in a special fund which can be paid to a wide variety of public uses. The operation of this fund is overseen by a special committee and city councillors. The scrutiny of fund operation is however not as tight as regular city budgeting. In consequence, this fund is often criticized to have become a mayor's private coffer. This research looks into the official budgeting and spending records of Taipei city, the capital of Taiwan, with the attempt to understanding how the fund has been spent over time. It is hoped through this analysis to explore whether the above observation has lured the city to exploit land readjustment as a supplementary financial source and even to deliberately over-develop the city with this scheme.



# SHORTCOMINGS OF CONDOMINIUM: SPECIAL CASE OF UKRAINE AND GENERAL INFERENCE ABOUT PROSPECTIVE PROPERTY MODEL

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**KEYWORDS:** real property, housing, condominium, company

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## THEME E: HOUSING

The paper presents the conclusions from the authors' search of the problems of multi-apartment building maintenance carried out by inefficient owners in Ukraine and other post-socialist countries after privatization. In the introduction the authors presented a comprehensive historical analysis of the housing sector of Ukraine and identified housing stock degradation trends. Then they analyzed experts' visions of the ways of further housing provision of citizens focusing on the property relations. Especial attention was drawn to the necessity of harmonizing the housing policy with the model of the welfare state which must be clearly defined taking into account the unity of two components in the concept of housing: the vital needs of a person, on the one hand, and the value of real estate as assets of the owner, on the other hand. The author's methodology of the housing value and cost analysis used several modern economic concepts: imputed rent, life cycle costing, and sustainability. The subject of research was deepened by applying theoretical provisions about legal and economic ownership in relation to residential real estate, in particular, objects of joint ownership. The models of joint ownership of housing in different countries were classified in detail, and the specifics and shortcomings of the formation of the Ukrainian condominium model were clearly shown against this background. Then, multidirectional factors in housing ownership model were theoretically discovered. It was shown, on the one hand, the economic feasibility of joint home ownership, and, on the other hand, the complication of the management system when splitting: a single real estate object into a land plot, buildings, structures and apartments; a single owner into numerous co-owners of common property; a bundle of property rights into individual rights of subjects regarding various objects of residential real estate. In this way, the inevitability of problems in condominiums was theoretically justified. As a practical illustration of attempts to solve these problems, on the examples of different countries, the varieties of the classic dualistic condominium model were shown. Particular attention was paid to the uncertainty of physical objects of individual ownership and their value, which creates numerous problematic situations in management. It was shown that the high and unclearly defined cost of maintaining real estate in a condominium leads to the need for significant indirect state participation in the maintenance of private housing in apartment buildings, which contradicts to the principles of market economy. The inferences were made that, in contrast to the dualistic model of the condominium, the most developed countries returned to the concept of a single real estate object in the form of a unitary model admitting the economic nature of the processes of housing maintenance and operation. Thus, the conclusion about the optimal organizational form of joint home ownership - a housing company - was made. In the specific conditions of Ukraine (poor condition of buildings, insolvency of residents, mass destructions caused by the war, absence of convenient investment mechanism for restoration), the necessity of transforming the real

property of inefficient owners in condominiums into corporate rights in a housing company with the possibility of attracting external investors to finance the renovation was substantiated. For this purpose, the principles of state regulation and statutory self-management of housing companies, which will be created based on the best practices of the latest corporate management, were proposed. As a generalization of the advantages of housing companies as a form of ownership and management of real property, the prospects for the use of digital technologies and tokenization in property partial transactions and in the management of housing stock were shown.



## PANDEMIC-INDUCED CHANGES ON RESIDENTIAL PRICES IN MAJOR FRENCH CITIES

Martin Regnaud, Marie Breuille, Julie Le Gallo

**KEYWORDS:** housing market, real estate platforms data, structural breaks, Covid-2019

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This study provides a comprehensive analysis of the evolution of bid-rent functions for housing prices and rents in 30 major French attraction areas during a period marked by the COVID-19 pandemic. We exploit 3.3M property transfers (DV3F) and 740'000 rental listings posted on SeLoger's portal to quantify the shifts. We observe a flattening of the bid-rent curve in the wake of the pandemic, especially for large areas of more than 200,000 inhabitants and for sold properties (apartments or houses). Stronger flattening of the bid-rent curve for sold properties is observed for a higher share of employees, more densely populated areas, and lower purchasing power. By contrast, the pandemic had little effect on bid-rent function slopes for rents.

## THEME E: HOUSING



## “DESIGNER HUTS” IN ALLOTMENT GARDENS – A NEW PHENOMENON – A CASE OF WARSAW, POLAND

Grazyna Wiejak-Roy, Rafal Mazur

**KEYWORDS:** allotment garden, family garden, designer hut

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Allotment gardens are widespread across Europe. Their gardeners maintain green oases in otherwise heavily built-up areas by cultivating urban land and caring for the green space. Thus, they generate positive externalities by privately managing public green spaces. Over the last few years, the popularity of allotment gardens has increased as an alternative to travel and a recreational place. This research looks into new phenomena in the design of allotment gardens and buildings to serve the evolving requirements of allotment gardeners. Using Warsaw as a case study of the largest and most dynamic allotment garden market in Poland, based on detailed landscape surveys and exploratory walks we identified new types of modern allotment garden designs, namely a new phenomenon of “designer huts”. We then in phenomenological interviews with the architects of these buildings unpacked the design process, outcomes and future design directions to ensure that future buildings are designed in harmony with the surroundings, respect for the natural environment, and support addressing urban environmental challenges. We expect that our observations will inform designers and policymakers in developing long-term strategies to effectively support this type of urban green space.

**THEME F:  
URBAN  
AND  
REGIONAL  
ANALYSIS**





## MANAGEMENT OF URBAN GREENERY

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**KEYWORDS:** urban greenery, spatial management, greenery management

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Green space management is part of taking care of the environment at the municipal level. Green space management can be viewed as an investment in ecosystem services, defined as society's benefits from ecosystems. The services offered by green spaces include providing raw materials (a provisioning service), influencing the microclimate (a regulating service), increasing biodiversity (a supporting service) or influencing human health and mental condition (a cultural and social service) [Millennium Ecosystem Assessment, MEA, 2005]. Caring for the state of greenery is therefore not only a matter of nature conservation but concerns a broader dimension. The purpose of the study is to carry out a diagnosis of the advancement of the process of greenery management in municipalities as an element of spatial management. Data will be obtained from polish publicly available sources, such as the local data bank (BDL).

## THEME F: URBAN AND REGIONAL ANALYSIS



# HOMEOWNERSHIP IN SHRINKING CITIES: AN ANALYSIS IN THE BALTIC SEA REGION

Can Orhan

**KEYWORDS:** owner-occupation, shrinkage, Baltic Sea Region

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## THEME F: URBAN AND REGIONAL ANALYSIS

Trends of demographic change, outmigration and deindustrialization create challenges associated with population and/or industrial decline affecting not only rural areas but also cities. Among their counterparts in the world, shrinking cities in the Baltic Sea Region are some of the most dramatically affected and transformed ones regarding the shifts in volume and density in their physical and social entities. At the same time, shrinkage is interlinked with economic, social, and institutional aspects in the Baltic Sea Region and, is associated with a complex process joining trends of population decline, alterations in the volume of economic activities over time and, shifts in the quantity and quality of material stocks. According to the existing literature (Bernt et al., 2017; Couch & Cocks, 2013; Gao et al., 2023), housing, as a component of the material stock, is a particular challenge and contains some spatial anomalies in the context of shrinkage in the Baltic Sea Region cities. Indeed, housing, with its different physical, economic and social forms, is not only a problem in the shrinking process but may also represent an opportunity for different groups. Abandoned and vacant housing stock transforms city landscapes while economic and population decline may reduce housing values. These trends may shape the function and accessibility of housing as a financial tool but also create an unstable environment in tenure structures. This complexity creates ambiguity in the value of housing in the context of shrinkage, where it may be perceived either as an affordable or a worthless investment. This ambiguity may hold consequences for ownership structure in shrinking cities and specifically for the role of owner-occupation, as the dominant tenure pattern in the region (Kohl, 2017). Hence, this research aims to investigate the relationship between urban shrinkage and homeownership structures in the Baltic Sea Region. Different spatial and institutional formations produce different dynamics. Therefore, this research considers shrinkage as a multidimensional process and aims to disentangle the economic and demographic perspectives of shrinkage. By doing so, it aims to quantify the extent of economic and demographic decline through the lens of the Baltic Sea Region cities and to investigate the consequences for owner-occupied housing patterns. Furthermore, the countries in the Baltic Sea Region are institutionally composed of different tenure and shrinking patterns. This research, thus, expects to reveal distinct tenure responses to the shrinkage process among the case areas. Using data from the European Population and Housing Census for the years, a regression-based analysis of the role of socio-economic and demographic factors in the form of the urban shrinkage process is carried out to explain the relationship between shrinkage and the owner-occupied housing sector, as well as distinguish the changes of owner-occupied housing in shrinking urban and rural areas.



# SMART CITY FOSTERING INNOVATION: EVIDENCE FROM CHINA'S LISTED ENTERPRISES

Masaki Mori, Hua Fan, Chen Zheng

**KEYWORDS:** smart city, innovation, Chinese corporations

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## THEME F: URBAN AND REGIONAL ANALYSIS

This paper primarily explores the impact and mechanisms of smart city policies on innovation output in China's listed enterprises. Using a sample of A-share listed companies in 246 cities from 2004 to 2019, we employ the Staggered Difference-in-Differences (DID) method to analyze the influence of smart city policies on corporate innovation. Simultaneously, we also analyze the impact mechanisms of smart city policies on corporate innovation activities from the perspectives of industry competition, agglomeration of smart city development-related industries, internet development, and enterprise digital transformation. The study reveals that smart city policies effectively promote innovation output in China's listed companies. From the perspective of industrial development, smart city policies have substantially stimulated cities' lower competitive enterprises to innovate, and promoted innovations through agglomeration of industries which are closely related to smart city development. From the perspective of technological development, smart city policies enhance the innovation capabilities of enterprises through the application of the Internet and information technology. Through digital transformation, enterprises can optimize department structures, reduce costs, broaden marketing channels, and improve operational efficiency, leading to further innovations. The study also finds that smart city policies significantly promote innovation output in state-owned, large, and mature enterprises. However, the impact on innovation in non-state-owned, small and medium-sized enterprises is not pronounced and may even hinder innovation. Additionally, the influence of smart city policies on corporate innovation exhibits regional imbalances, with innovative effects being significant in economically advanced first-tier cities, as well as third, fourth and fifth-tier cities. The innovation effect in medium-developed second-tier cities is not significant. These findings indicate potential design flaws and implementation constraints in smart city policies, suggesting a failure to adequately consider the actual needs and challenges of small to medium-sized enterprises and medium-developed cities, leading to unequal resource distribution.



## STRATEGIES FOR ALLEVIATING HOUSING SHORTAGES: EVALUATING THE FISCAL EFFECTS AND PROFITABILITY OF RESIDENTIAL LAND DEVELOPMENT


Julius Range, Albert Erasmus Grafe

**KEYWORDS:** urban development, tax revenues, land consumption, spatial regression

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Economic profitability of land development is a major driver for land consumption but is prone to increasing political scrutiny and environmental concerns. Our paper aims to quantify the income tax effects of increases in residential areas in Germany. We estimate the effect based on a detailed synchronized panel database for German counties. Applying a spatial regression approach, we address the heterogeneity of regions as well as neighboring and spill-over effects. Our findings suggest that an increase in residential areas has a significant positive effect on income tax revenue. We relate these estimates to average costs for green- and brownfield development. Our research sheds new light on the interplay between revenues and costs in residential land development.

## THEME F: URBAN AND REGIONAL ANALYSIS



# CIRCULAR ECONOMY IN ESG STRATEGIES OF REAL ESTATE AND CONSTRUCTION SECTOR ENTITIES. DIRECTIONS OF IMPLEMENTATION AND UNTAPPED POTENTIAL

Beata Wieteska-Rosiak

**KEYWORDS:** sustainable real estate, sustainability reporting, circular practices, climate change

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## THEME F: URBAN AND REGIONAL ANALYSIS

The paper examined the approach to shaping the circular economy (CE) in the ESG strategies of real estate and construction sector entities in response to climate change. The theoretical perspective indicates models and possibilities of applying the circular solutions in construction investments. The aim of the article is to identify the directions of implementation of circular economy principles by entities in the real estate and construction sector. Based on the analysis of the ESG strategies of entities from the real estate and construction sector (WIG real estate and construction index), this study leads to the conclusion that entities are becoming more and more active in implementing solutions from the circular economy, which is an opportunity to spread good practices to all real estate market stakeholders. The circular activities specified in the analyzed strategic documents differ in terms of type and scope of implementation. On the one hand, there is a positive direction in the implementation of circular principles and, on the other hand, there is still untapped potential for the development of the circular economy in real estate and construction. Unlocking the sustainable and circular potential requires stimulating the development of financial, economic, legal and social conditions by public, social and private sector.



# URBAN LIFE CYCLES: DYNAMICS OF DECLINE AND GROWTH IN COMMERCIAL DISTRICTS

Jeongseob Kim

**KEYWORDS:** shrinking cities, decline, urban life cycle, city life cycle

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City undergoes life cycles such as development, growth, and decline. Cities experiencing decline occur due to changes in population and industrial structures, and these declining cities may have different physical characteristics and usage patterns compared to growing cities. Specifically, the central areas of cities, often referred to as downtown or main street, concentrate various facilities as the focal point for employment, commercial activities, and urban administration. However, as a city enters the decline phase, vacant storefronts increase, new construction activities decrease, and pedestrian traffic on the streets declines. Such vitality declines hinder the influx of new businesses and contribute to the continued decline of the city. In this context, this study aims to compare and analyze the characteristics of entrepreneurs in growing and declining cities to derive insights for the management and revitalization of declining cities. Targeting cities in Korea with a population of over 100,000, the study distinguishes the life cycles of cities based on changes in population and employment over the past 20 years. It establishes variables for the physical environment and service characteristics of commercial districts in each city and statistically analyzes how different characteristics manifest based on the city's life cycle. Finally, the study classifies cities based on their life cycle and commercial district characteristics, proposing development strategies for each type of city.

## THEME F: URBAN AND REGIONAL ANALYSIS



# HOME OR AWAY: EXPLORING THE INFLUENCE OF HOUSING CHALLENGES ON MIGRANTS' RETURN INTENTION

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**KEYWORDS:** rural migrants, housing affordability, return intention, IV probit

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## THEME F: URBAN AND REGIONAL ANALYSIS

The discussion on the return intentions of migrants and its influencing factors has been widely discussed. Existing research indicates that factors such as economic status, household registration status, identity recognition, and urban integration can largely influence the willingness of rural migrants to return home. Additionally, with the development of the digital economy, engaging in entrepreneurship has also to some extent encouraged rural migrants to go back home. Considering the rapid increase in housing prices in China over the past decade, issues related to housing affordability have undoubtedly become factors prompting rural migrants' return intention. Considering rural migrants are more disadvantaged in receiving housing assistance in residing cities, housing difficulties, especially housing affordability issues are therefore further accelerating their willingness to return home. However, many existing studies on housing affordability focus on the nation as a whole, with little attention on disadvantaged groups such as rural migrants. Therefore, this paper integrates the issues of housing difficulties with the return intentions of rural migrants, exploring how housing difficulties have impacted their willingness to return home using China Migrants Dynamic Survey (CMDS) 2017 data. Two variables were constructed to measure housing difficulties: subjective and objective housing difficulties. Subjective housing difficulties were determined through survey questions asking whether migrants experience housing difficulties. Housing affordability ratio is adopted to evaluate the subjective housing difficulties encountered by migrants. We used the macro house prices data on the residing cities and the micro household income included in the survey to calculate the house price to income ratio. Based on the international threshold, the housing price-to-income ratio higher than 3 is considered to have objective housing difficulties. We investigated the impact of subjective and objective housing difficulties on rural migrants' return intention. Using a probit and IV Probit model, our research evidenced a negative relationship between subjective housing difficulties and return intention. Self-reporting housing difficulties didn't really increase the likelihood of returning home, because this variable was often influenced by individual risk preferences. While it is evidenced that objective housing difficulties have positive impact on return intention. Specifically, the higher the house price to income ratio, the higher likelihood of returning home. Heterogeneity analysis shows that the relationship between objective and subjective housing difficulties and the return intention of migrants varies across different levels of economic development in residing cities, educational achievement, and age group.



# IS SUSTAINABLE DEVELOPMENT ENOUGH FOR OUR CITIES?

Anna Wojewnik-Filipkowska

**KEYWORDS:** sustainable development, smart city, resilience


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## THEME F: URBAN AND REGIONAL ANALYSIS

Measuring development is challenging. Stiglitz, Fitoussi and Durand point out (Beyond GDP. Measuring What Counts for Economic and Social Performance, OECD, Paris 2019) that new measures are needed to help protect people from possible shocks, and restore a sense of security and trust in anti-crisis policies. It is also necessary to change the way we think about what is a component of well-being. The subject of the research is the city as an organization, the phenomenon which is a home for almost 60% of the population. The work is based on the following assumptions: 1. Organizations can be thought of as a system, which means that the connections between the components of the system must be taken into account when making changes to the organization. 2. All organizations operate under the influence of the environment, therefore problems related to functioning and development must be considered taking into account the relationship with the economic, social, political, and natural environment. 3. The condition for the survival and development of an organization is the ability to learn and adapt to the anticipated internal and external changes determining the operating conditions. Cities can be analyzed and described using the concepts of Sustainable City, Smart City, and Resilient City. The main objective of this paper is to develop and present the 'Fundamental Power of the City' index – a tool for strategic diagnosis and monitoring of city development, where the fundamental power of the city is a synthesis of the concept of a sustainable, intelligent, and resilient city. Research methods include literature analysis and synthesis, and design method.





# REAL ESTATE SELL-RESELL WITHIN MINUTES? ANALYSIS OF SHORT-TERM TRANSACTIONS IN AUSTRIA

Julia Angerer, Wolfgang Brunauer

**KEYWORDS:** sell-resell analysis, short-term trades, Austrian real estate market, transaction data analysis

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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## THEME F: URBAN AND REGIONAL ANALYSIS

This paper presents an analysis of short-term real estate trades in Austria, focusing on speculation with real estate prices and the involvement of intermediary companies. The study examines the location, timeframe, and companies participating in transactions occurring within short time spans, ranging from same-day transactions to those spanning several days or weeks. Sell-resell activities are analyzed using a comprehensive dataset of transactions in the time frame from 2019 up to 2024. Additionally, it investigates the financial gains facilitated by intermediary firms, considering characteristics such as company age. The analysis extends to exploring potential patterns in dedications and other relevant metrics for presenting results. At the geospatial level, the frequency of such cases can be aggregated to provide broader insights. The paper points out the value and highlights the potential of the combined and enriched data sources we are using at Data Science Service GmbH. Suggestions for practical applications, in exploration tools to identify affected properties, are also discussed. Furthermore, potential benefits for clients, and financial regulatory bodies, are considered. However, the paper acknowledges potential limitations stemming from unidentified shares, and discrepancies due to temporal mismatch. Despite these challenges, the study underscores the overall robustness of the dataset while emphasizing the importance of careful interpretation.



## UNPACKING HOUSING MARKET CONNECTEDNESS

Yu-Lieh Huang, Dean Katselas, Pin-Te Lin


**KEYWORDS:** housing market connectedness, common risk, idiosyncratic risk

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This paper proposes and tests a different approach to investigating regional connectedness in the UK housing market. Drawing upon the notion that returns may be decomposed into components to reward homeowners for assuming common (market wide) risk, and a residual, which is compensation for idiosyncratic risk, we argue that the latter is particularly relevant when trying to understand regional connectedness. Using the dynamic network methodology with the raw return data, we firstly show that the South East has the greatest influence on regional market integrations, consistent with prior empirical research. Next, we filter the series for a common risk factor, resulting in regional return series which are unrelated to the national housing market. Doing so reveals London to be the most influential region in the country, consistent with intuition and prior theory.

## THEME F: URBAN AND REGIONAL ANALYSIS



## EMPLOYEE PREFERENCES FOR OFFICE BUILDINGS' ADAPTIVE CONTROL UNDER MULTI-MODEL DISCOMFORT SITUATIONS

Han Li, Rianne Appel-Meulenbroek, Theo Arentze, Hoes Pieter-Jan


**KEYWORDS:** occupant behavior, indoor environmental quality, sustainable buildings, building energy efficiency

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## THEME G: SUSTAINABLE REAL ESTATE

Buildings account for 30% of global energy consumption. Although applying energy efficiency programs or energy saving campaigns has helped to conserve energy use in offices, the consumption figures are still increasing. It might be that the scarcely studied user behavioral factors are partly at fault for this. Hence, this study will explore occupants' energy-related behavior under multi-model indoor discomfort situations, particularly focusing on office environments. A modified discrete choice experiment design is used to reveal the preference of occupants for adjusting four types of building comfort control system (i.e., windows, blinds, lighting, and thermostat). In addition, these occupants' choice preferences for four types of personal comfort adaptation measures are included (i.e., adjust clothing, have cold/hot beverages, use of personal heater and fan.). The choices are made under randomly assigned context scenarios based on attributes including weather, task, location, the preceding indoor environmental quality situation, and general attributes like demographics and current building control features. The data collected from the discrete choice experiment is used to build a predictive model that estimates the likelihood of occupants choosing a specific building control system under multi-model discomfort situations. The model offers guidance to building stakeholders in decision-making processes regarding the development and management of building energy transition/conservation strategies. Additionally, it will promote building consumption related researchers in creating more holistic building simulations models in the pursuit of more holistic sustainable building practices for future application.



## WHY STATE OF THE ART GEOTHERMAL PILES WERE NOT ACTIVATED FOR 14 YEARS BY ASSET MANAGERS- THE NEED OF TECHNICALLY HIGHER EDUCATED ASSET MANAGEMENT STAFF- A CRITICAL APPRAISAL

Hermann Lebherz, Annelie Stumpp

**KEYWORDS:** geothermal power plant, the need of technically higher educated asset management, digital web monitoring of plants, controlling of asset management companies

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## THEME G: SUSTAINABLE REAL ESTATE

At the ERES conference in Milano 2010 we delivered a paper on state of the art geothermal piles for a shopping center with offices. 14 years later, in the process of a due diligence report, our company was informed that the geo- thermal heating and cooling plant was in excellent condition and the technical documentation was excellent. But we got asked: „why got the geothermal plant never at work?“ A very puzzling question. The asset managers have rather used electrical energy to cool down or heat a 60 million asset and spent hundred thousands of Euros, rather than starting and monitoring the cooling and heating with the geothermal plant. The system of geothermal modelling is that you have to monitor the amount of heat you are extracting in the winter period through several 40 m deep concrete piles with integrated pipes of circulating liquid. In the summer period one has to monitor the amount of warm energy which is pumped in the piles with tubes which are heating-up the surrounding soil. So a balance has to be calculated between winter heat extraction and a summer cooling extraction over a year period. For this calculations a computer program monitors all the heating and cooling energy, but it has to be operated by university trained engineers, which have to be trained on the job as well. WLS is assuming that the competition for the job, was awarded to the lowest bid, to an asset management company which employed standard craft men with no knowledge how to handle such a system. A way forward is not to have isolated plants run by individual staff, but to have all plants to be integrated by a internet connection to a monitoring and controlling center which is staffed with adequately educated and adequately paid university engineering staff, to run and monitor the plants energy efficient. Other clients of WLS introduced now a system by controlling all asset management company duties of their assets on a 2 year cycle.



## OCCUPIERS' ESG IN COMMERCIAL REAL ESTATE

Nan Liu, Norman Hutchison, Yuanyuan Zhao, Bowen Yan

**KEYWORDS:** ESG, occupiers, office market

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## THEME G: SUSTAINABLE REAL ESTATE

There is a gap in the existing environment, social and governance (ESG) literature in the real estate sector, where occupier characteristics with respect to ESG are overlooked. The paper investigates the relationship between the characteristics of occupiers of commercial real estate and their choice over sustainable labelled buildings, evaluates the bargaining power of tenants with different ESG agendas; and examines the potential impacts of regulation on minimum energy performance and the Covid pandemic on the relationships between occupiers' characteristics, choice of building and rent determination. This project focuses on the London office and use lease transactions from CoStar ([www.CoStar.co.uk](http://www.CoStar.co.uk)) and occupiers' ESG scores from Refinitiv ([www.refinitiv.com](http://www.refinitiv.com)) from 2002 to 2022. Our empirical results show that publicly listed tenants, who are more likely to disclose their Corporate Social Responsibility (CSR) policies and therefore more likely to be ESG-conscious, are more likely to occupy a sustainable labelled (such as BREEAM certified) space. Tenants with stronger emphasis on governance (i.e., higher G pillar scores) are also more likely to choose a BREEAM certified office space. Our hedonic modelling results confirm a BREEAM related rental premium of around 9% on average in the London office market. However, this sustainable label related premium, is lower among listed firms. The introduction of minimum energy performance regulation seems to have increased listed firms bargaining power in rent negotiation due to the increased supply of more sustainable buildings. Listed firms' bargaining power also is shown to be stronger during Covid period, as the demand for office spaces significantly reduced. Tenants' overall ESG scores do not appear to affect effective rent they pay in the hedonic estimation, while separate scores on the 'Social' and 'Governance' pillars do seem to affect effective rent during the Covid period. This paper differs from previous ESG studies in real estate by providing further insights into occupier's demand and covenant strength that are related to their ESG agenda, and thereby contributes to the sustainability and the 'net zero' debate by providing further insights from the occupiers' perspective. It sheds light on landlord-tenant relationships and the changing occupier role in the context of ESG. The quantitative analysis and results will have direct implications to real estate investors, real estate managers, developers, occupiers, and policy makers who influence the supply and demand of commercial spaces.



# GREEN OR NOT: DISENTANGLE THE VALUE DETERMINANTS AND EXTERNALITIES OF GREEN BUILDING

Yue Zhang

**KEYWORDS:** green building, sustainability, urban externalities, commercial real estate

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## THEME G: SUSTAINABLE REAL ESTATE

The global call for reducing greenhouse gas emissions has highlighted the importance of sustainable transitions in buildings as an effective means to optimize energy, waste, and other resources utilization. However, balancing environmental impact and green retrofit costs still need to be justified carefully. Though various studies have identified price and rental premiums for green buildings (GB), there is a lack of research delving into the dynamics behind the supply of green buildings. This research aims to investigate the underlying mechanisms and peer effects on green building supply. Thus, the research questions are as follows: (1) What value determinants contribute to green building premia? (2) How does the entry of a green building affect the possibility of nearby buildings turning into green? By using a sample of 59079 office property transactions spanning the period of 2013 to 2022 in Hong Kong, we found that certified office properties command a rental premium of approximately 9.8% compared to non-certified properties. The sample consisted of transactions involving green buildings certified by HKBEAM, BEAM-Plus, and LEED, which accounted for 15% of the total sample. To understand the mechanisms and externalities of GB, we constructed a hedonic model-based rental index. We compared the responsiveness and volatility between GB and non-GB. The provisional results showed that the rental level of certified office properties is more responsive and volatile than non-certified properties and varies across different areas. In the next phase, we plan to use local Moran's I and Getis-Ord  $G_i^*$  statistic, which measure the local spatial autocorrelation and hot spots of green buildings. Then by employing Google's geocoding and distance matrix APIs, we will define neighborhoods flexibly, e.g. we can classify buildings located within k-meter walking distance from a green building as peers. A difference-in-difference method will be used to detect the externalities, where a dummy variable was introduced measuring whether there is an entry of newly certified green buildings into an area within 100 meters of property  $i$  over a one-year window before time  $t$  (100 meters and 1 year here are arbitrary and subject to robustness checks). Confirming a positive coefficient for this variable would support the hypothesis of urban externalities. This study aims to enhance our understanding of the market mechanism of commercial property and the decision-making of stakeholders. It provides empirical evidence regarding green commercial real estate while offering valuable insights for investors and tenants who are concerned about climate change and energy uncertainty.



## DEMAND MODELING FOR LOW CARBON INVESTMENTS OF THE REAL ESTATE SECTOR IN POST-DISASTER SETTLEMENTS

Kerem Yavuz Arslanli, Ayse Buket Onem, Cemre Ozipek, Maide Donmez, Belinay Hira Guney, Maral Tascilar

**KEYWORDS:** low carbon, energy demand modelling, post-disaster settlements

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The research focuses on creating an estimation tool designed to automatically evaluate both environmental and economic benefits arising from low-carbon investments in the real estate sector, with a particular emphasis on large building stocks. The tool offers a swift and dependable assessment of energy consumption related to heating, hot water, cooling, and electricity in buildings, considering specific features like building geometry and orientation. Assessing a building's energy demand involves comparing the existing state (pre-retrofit) and the proposed design (post-retrofit). The annual energy savings and net monetary gains achieved over the entire investment cost will be attributed to the renovation investment after a predefined period. This tool is poised to streamline the evaluation process for the impact of low-carbon initiatives in real estate, providing valuable insights into the potential environmental and economic advantages of such investments. Ultimately, it aims to facilitate informed decision-making for stakeholders involved in large-scale building renovations, contributing to a more sustainable and economically viable real estate sector. This Project was supported by the Istanbul Technical University Scientific Research Projects Coordination Unit. Project Number:SCAP-2023-44476.

## THEME G: SUSTAINABLE REAL ESTATE



# ASSESSING THE IMPACT OF VOLUNTARY CERTIFICATION ON SUSTAINABLE DEVELOPMENT IN THE REAL ESTATE INDUSTRY

Kilian Arthur Jean Wolf Enders

**KEYWORDS:** voluntary certification, governance & regulation, sustainability, environmental impact assessment


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This research examines the role of voluntary certification, especially concerning the sustainable and governmental aspects for the real estate industry. The underlying paper delves into the implication and effectiveness of voluntary certification as a tool to promote ESG-conformity practices in real estate. By applying a systematic literature review on current academic papers, fragmented opinions regarding a certificate's effectiveness can be perceived. The author identifies several key trends and controversial opinions regarding voluntary certification while examining its impact on investment decisions, market values, and regulatory landscapes. The findings indicate a complex interplay between economic-driven incentives, governmental regulation, and standards set within voluntary certification. This study contributes to understanding the dynamics between sustainable development and sustainable ambitions of and for the real estate industry.

## THEME G: SUSTAINABLE REAL ESTATE





# ENERGY EFFICIENCY IMPROVEMENTS AND PROPERTY VALUES: A HEDONIC ANALYSIS OF MARKET INCENTIVES IN ENGLAND AND WALES

Norbert Pfeifer, Robert Hill, Miriam Steurer

**KEYWORDS:** energy performance certificate, energy efficiency improvements, housing market

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## THEME G: SUSTAINABLE REAL ESTATE

Increasing the energy efficiency of housing needs to be a key part of strategies to reach Net Zero carbon emissions by 2050. In this paper we measure the market incentives of owners to improve the energy efficiency of residential properties and how these incentives differ by location and property type. By linking sales records for England and Wales with their Energy Performance Certificates (EPCs), we create a merged micro-level dataset providing transaction price, physical and locational characteristics, energy performance, recommended energy efficiency improvements, and associated costs at the level of individual properties. We also construct a proxy for plot size using the exact geographic location and distances to neighboring properties. We then estimate a hedonic model to predict the property price increases if all EPC recommendations were implemented. Our results reveal significant differences in market incentives across regions and property types. On average, we find that 84.4% of the costs of EPC-recommended energy efficiency improvements are capitalized in property prices for flats, as compared with 59.4% for semis/terraces and 59.3% for detached houses, although significant differences exist across regions. Subsidies targeted to regions and property types where market incentives are weakest could help reduce the cost of reaching Net Zero.



## EMISSIONS IN THE REAL ESTATE SECTOR ARE FALLING BUT NOT FAST ENOUGH

Daniel Piazzolo

**KEYWORDS:** climate change, emissions reductions, buildings

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Greenhouse gas emissions in the EU have fallen by around 31 per cent by 2022 compared to 1990 levels – covering all relevant sectors like the real estate industry but also including international aviation. The rate of reduction has increased recently, but it is still not enough to achieve the EU targets. According to the EU commission, emissions will probably fall by around 51 per cent by 2030 - which is below the target set out by the “Green Deal” of 55 per cent. The European Environment Agency (EEA) is also cautious. In December 2023, the EEA stated that reaching this target was uncertain<sup>1</sup>. Many actors in the real estate sector have committed themselves to ambitious goals of achieving considerable greenhouse gas emissions reductions or even climate neutrality. Greenhouse gas emissions should therefore fall as far as possible with the remaining emissions in areas such as cement production being offset thanks to forests and other landscape sinks as well as technical solutions. However, it becomes increasingly clear to the participants in the real estate sector, that these greenhouse gas emissions reductions are very costly. Emissions in the real estate sector are falling but not fast enough. Ever since the EU adopted its climate target for the year 2030, it has been clear that the international community's climate policy ambitions especially including the real estate sector will not be achieved unless more carbon dioxide is removed from the atmosphere.

## THEME G: SUSTAINABLE REAL ESTATE

# ESG FACTORS FROM THE PERSPECTIVE OF REAL ESTATE FUNDS IN POLAND

Jolanta Panas, Gabriel Główska, Anna Grygiel-Tomaszewska

**KEYWORDS:** ESG, sustainable assessment, real estate, Poland

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## THEME G: SUSTAINABLE REAL ESTATE

**Purpose** – The purpose of this study was to analyze how ESG criteria are implementing in allocation decision-making processes assets by real estate investment funds in Poland.


**Design/methodology/approach** – As part of the research project entitled Quality of management of ESG aspects and resilient to crises. Enterprises - financial institutions - local government, planned for 2022-2024 at the Collegium of Business Administration at the SGH Warsaw School of Economics, the focus was on how ESG factors are understood by various economic entities from both the private and public sectors. The researched entities were represented by companies listed on the Warsaw Stock Exchange, financial institutions, in particular, investment funds focused on investing in securities and funds investing in real estate, and local government units. The interdisciplinary research team was divided into research groups depending on the type of entity being the subject of the research. Empirical research was conducted in November / December 2022 in the form of focus group interviews divided into the entities under study. The following section presents detailed conclusions from focus group interviews conducted among selected real estate funds. To the research group in the context of real estate funds, consisted of representatives, among others: asset managers of real estate funds who decide on the selection of real estate for investment portfolios, risk managers, managers responsible for creating products and managers responsible for compliance.

**Findings** – The multi-faceted nature and complexity of the ESG issue is reflected in the broad impact of the issue of sustainable development on the functioning of the entire economy, on the functioning of the real estate sector due to the resource-intensity and emission-intensity of buildings. The results of the above-described research among real estate funds indicate that nowadays ESG factors constitute a key challenge for real estate portfolio managers.

**Research limitations/implications** – Currently, the most important contribution to drawing attention to the need to apply the ESG concept are EU cascading regulations regarding the activities of individual groups of entities. The examined entities face numerous challenges, including: such as: the need to learn and understand changes in regulations and requirements of key stakeholder groups in the field of non-financial aspects of management, awareness of opportunities for sustainable transformation in the context of ESG or developing appropriate competences to use them. **Practical implications** – From the conducted research, it can be clearly stated that real estate fund managers are striving to create a standardized assessment of real estate sustainability because the expected future value of investment portfolios depends on the degree of their sustainability.

**Originality/value** – The research has tracked how ESG criteria are implementing in allocation decision-making processes assets by real estate investment funds in Poland. The real estate funds participating in the described study are in the initial phase of ESG transformation, at the same time, the people representing them are highly aware of the importance of ESG issues for the entities they represent. In the near future, further identification of criteria should be expected to assess

the potential benefits resulting from compliance with ESG requirements by entities from the real estate sector as well as closely related sectors.



# PERFORMANCE EVALUATION OF SOCIAL AND ECOLOGICAL ENVIRONMENTAL DIVERSITY CHARACTERISTICS ON THE REAL ESTATE MARKET: A DYNAMIC NETWORK DATA ENVELOPMENT ANALYSIS

Tony Shun-Te You, Tai-Hsi Wu, Yu-An Yang


**KEYWORDS:** social-ecological system, sustainable development, ESG in real estate, human and environment coupled

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## THEME G: SUSTAINABLE REAL ESTATE

The analytical model of the social-ecological system structure is designed to explore spatial environmental performance from a holistic, complex, dynamic, network-oriented, and nonlinear perspective. In this research, we employ the Social-Ecological System (SES) framework proposed by Ostrom (2009) and McGinnis and Ostrom (2014) to construct a model capturing the characteristics of Taiwan's real estate market in relation to social and ecological spatial diversity. Utilizing Dynamic Network Data Envelopment Analysis (DNDEA), we conduct performance measurements for the SES model. This framework encompasses various real estate market features, including resource systems, ecological and environmental indicators, government governance, and characteristics of real estate market sectors. The study observes dynamic interactions over multiple years. By incorporating assessments of indicators such as social, industrial, energy, ecological, pollution, and healthcare, central and local governments can optimize relevant policies based on comprehensive social and ecological characteristics in addressing the real estate market. This research is funded by the Ministry of Science and Technology: 111-2410-H-305 -055 -MY2.



## DO WORDS MATCH DEEDS? EXPLORING THE LINK BETWEEN ESG DISCOURSE AND PERFORMANCE OF REAL ESTATE COMPANIES

Siqi Huang, Anupam Nanda, Eero Valtonen

**KEYWORDS:** ESG discourse, real estate sustainability

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Research on ESG issues in real estate has indicated a complex link between sustainable real estate and financial success. A particular challenge in exploring the link comes from the lack of robust measures of various aspects of real estate sustainability, partly due to the limited availability of granular data. Presently, the assessment of firm-level real estate sustainability mainly uses ESG or CSR ratings from rating agencies, which rely heavily on self-disclosed ESG data from real estate companies. These third-party ESG/CSR ratings come with several limitations, including overlooking the potential impact of disclosure language patterns and sentiment bias on ESG ratings. In this study, we focus on the words around ESG actions and promises from official disclosures and credible news sources and offer a comprehensive evaluation of real estate companies' sustainability performance. We focus on 65 US REITs over a 15-year time period. Our preliminary analysis, based on computational linguistic techniques, highlights various salient features of what companies disclose in the public domain.

## THEME G: SUSTAINABLE REAL ESTATE



## THE HIGHER THE BETTER: CLIMATE CHANGE AND HOUSE PRICES IN SWISS SKI RESORTS 2001 - 2020

Floris Blok, Franz Fuerst

**KEYWORDS:** climate change, housing, tourism, regional analysis

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## THEME G: SUSTAINABLE REAL ESTATE

The way in which climate change impacts land and property values has drawn considerable attention of economists over the recent years as the impacts of climate change are starting to be felt. Agricultural land and residential property at risk of flooding have received most attention. This paper looks at the case of altitude and (reduced) snowfall and winter sports in the European Alps, a region uniquely dependent on the right climatic conditions for its economic survival. We hypothesize that skiers and house-buyers switch from lower-lying, less snow-secure resorts to high-altitude areas with more reliable snowfall. Employing a panel comprising 303 Swiss municipalities across 45 different ski resorts, our study spans from 2001 to 2020. We regress changes in mean house prices at the municipal level over the 19-year period on altitude, temperature and (change in) snow cover duration. The channels through which climate might affect house prices indirectly (income, employment, visitor numbers) are also examined. We find that higher altitudes and lower temperatures are associated with increased house price appreciation over the 2001-2020 period for ski resorts but not for the control group of municipalities not located near a (major) ski resort. No such relationship is found for average snow cover duration or changes in snow cover. Possible explanations for these findings are discussed.



## PRICE IMPACT OF CLIMATE RISK ON COMMERCIAL REAL ESTATE

Abdullah Yavas, Lu Fang, Lingxiao Li, David Scofield

**KEYWORDS:** hurricane, commercial, valuation


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## THEME G: SUSTAINABLE REAL ESTATE

We study how hurricane-related climate risk affects the commercial real estate (CRE) market using hurricane Sandy as an example. We introduce an ex-post climate risk measurement for CRE assets by supplementing a sample of CRE transactions in the New York Metropolitan Area before and post Sandy with a dataset containing detailed assessments of the severity of the storm-related damage and flooding. Among the four major types of CRE assets including offices, retail stores, warehouses, and apartments, we only document a significant and negative price impact by Sandy to offices, whereas no significant effect on the value of other CRE types. Specifically, we find robust evidence that unaffected office assets surrounded by severely damaged properties within proximity experienced a significant price penalty for four years following the storm. Meanwhile, we did not find any significant price impact on unaffected office assets with moderately damaged properties or flooded properties nearby. Additionally, it seems that the documented price penalty to unaffected office assets located in most severely damaged neighborhoods is mainly driven by a decline in building occupancy. We attribute the differential impact of Sandy on office and other CRE to the increase in remote work for office employees triggered by Sandy. We also note that the absence of any impact of Sandy on other CRE, including apartments, compared to significant and negative impact on single family homes reported in earlier studies (Fang et al. 2023) is an indication of more rational expectations and pricing in the commercial space.





## **PUBLIC-PRIVATE ACTORS' NETWORKS IN HEALTHY URBAN DEVELOPMENT AND INVESTMENT DECISION- MAKING**

Nalumino Akakandelwa, Kathy Pain

**KEYWORDS:** healthy urban production, actor social interaction, systems approach, transparent disclosure

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## **THEME G: SUSTAINABLE REAL ESTATE**

Improving social wellbeing has become a real estate commercial priority. Social value is increasingly considered an attribute of investment risk-return and decision-making in global capital flows into investment assets that influence health and wellbeing. Urban production and reproduction of the urban environment is a social and cultural process shaped and regulated by practices and the 'collective action' of a complex assemblage of private and public social actors. Within the assemblage of social actors, are significantly knowledgeable real estate professionals, influential agents and public service providers with interests in healthy urban production. However, little is known about competing constructs of health benefits between public and private stakeholders upstream and downstream in urban production which influence investment appraisal and decision-making. We review using systems approach the complexity of social actors' interactions in pursuit of the (re)production of healthier urban environments. The sample is drawn from real estate service providers, investment companies and public authorities associated with mixed-use schemes in Bristol and Manchester city case studies. The results inform better understanding of how investors' perceptions of inward firm benefit from and outward contribution to community quality of life are embedded in investment appraisal models and decision-making. The findings could contribute to improved transparency in the disclosure of health information in investment appraisals and decisions for the benefit of both private and public stakeholders.



# QUANTIFYING THE STRANDING RISK OF ASSETS – A SEMIPARAMETRIC REGIONAL APPROACH FOR RENTS AND PRICES

Anna Knoppik, Marcelo Del Cajias, Wolfgang Schäfers

**KEYWORDS:** residential real estate, energy performance certificates, machine learning, generalized additive model

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## THEME G: SUSTAINABLE REAL ESTATE

Retrofit measures are critical for achieving policy-driven goals to reduce Carbon dioxide (CO<sub>2</sub>) emissions. Although the benefits of retrofitting are widely recognized, there has been limited research on how these interventions affect the pricing of assets, particularly regarding regional determinants. Predicated on the assumption that retrofits are compulsory for apartments with inadequate energy efficiency to align with regulations, an understanding of the pricing mechanism is essential. This paper therefore uses a semi-parametric model to examine the influence of energy-efficient refurbishments on the rent-to-price ratio, expressed as net initial yield, in the residential sector in Germany and explores the role of spatial variables that affect the pricing of assets. In addition, a fuzzy K-means cluster analysis is used to identify groups of assets that more likely to benefit from a retrofit. The results show that apartments in rural areas have larger rent and price deviations, which is reflected in the rent-to-price ratio. Furthermore, the analysis reveals that the yield premium from retrofitting fluctuates based on regional conditions and applicable regulations. These findings are crucial for effectively quantifying ESG measures and underline the importance of various determinants for investment decisions.



# THE ECONOMIC VALUE OF SUSTAINABILITY: ENERGY PERFORMANCE AND HOUSING MARKET

Ezio Micelli, Giulia Giliberto, Eleonora Righetto, Greta Tafuri


**KEYWORDS:** built environment, energy transition, real estate market, hedonic prices

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## THEME G: SUSTAINABLE REAL ESTATE

The international commitment to the energy transition of the housing stock is essential to meet the global challenges of decarbonization and reduce CO<sub>2</sub> emissions. The building sector is responsible for 40% of fossil fuel consumption and 30% of CO<sub>2</sub> emissions, making energy performance upgrades urgent. Recent research highlights the impact of energy performance on property value, revealing inequalities related to energy efficiency. The research investigates whether highly efficient homes present a premium price over less efficient ones and whether this premium differs according to the city's size and vibrancy of the housing market. The study focuses on six Italian cities, three metropolitans (Milan, Turin, and Florence) and three medium-sized (Padua, Mestre, and Bergamo), analyzing over 2,935 ask prices. The methodology employs the Hedonic Price Model to estimate the premium price related to different energy performance levels. The results show a market segmentation according to energy efficiency, with premium prices converging in medium-sized and metropolitan cities. The average gap between high-efficiency properties (class A) and low-efficiency properties (class G) is about 30% for medium-sized cities, narrowing to 14% between class D and class G properties. For metropolitan cities, the average gap between high-efficiency properties (class A) and low-efficiency properties (class G) is about 15%, decreasing to 6% between class D properties compared to class G properties. The findings highlight a higher depreciation in properties in less active medium-sized cities compared to those in more dynamic metropolitan areas. Metropolitan cities seem to be less affected by their position in the EPC ranking, while the energy transition shows more significant effects in medium-sized cities. This implies a possible additional difficulty for struggling territories, accentuating social and economic inequalities.



# ENVIRONMENTAL, SOCIAL, AND GOVERNANCE IN REAL ESTATE FROM 1994 TO 2023: SYSTEMATIC LITERATURE REVIEW AND BIBLIOMETRIC ANALYSIS

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**KEYWORDS:** real estate, ESG, sustainability, financial performance

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## THEME G: SUSTAINABLE REAL ESTATE

**Purpose** - This paper aims to systematically analyze research on Environmental, Social, and Governance (ESG) practices and financial performance in the real estate sector, an area that has not yet been fully explored. The study focuses on evaluating how ESG factors affect financial and non-financial outcomes in real estate, considering the sector's unique dynamics and inherent complexities.

**Design/Methodology/Approach** - The study utilized a systematic literature review guided by the PRISMA framework, ensuring a comprehensive and transparent analysis.

**Findings** - The findings reveal a spectrum of associations between ESG practices and financial performance within the real estate sector, ranging from positive correlations to no significant impact, and occasionally, inverse effects. This variation in outcomes underscores the multifaceted nature of ESG impacts and the complex dynamics of the sector. We observed an increased interest in ESG after 2018. Geographically, the research is concentrated in developed markets, with a significant portion of studies emerging from North America and Europe. We also observed a notable variation in methodological approaches suggesting the need for a unified ESG framework, which could help to reconcile divergent interpretations of ESG's financial implications. Key unanswered questions that emerged from our analysis include: How do ESG practices influence the asset value in varying market conditions? What are the long-term financial impacts of ESG integration on real estate portfolios? How does investor demand for ESG compliance translate into real estate development and management practices?

**Originality/Value** - The patterns and identifying pivotal researchers and topics, this review provides valuable insights into the sector's trajectory towards a more integrated ESG approach and suggests promising directions for future research.



# RETHINKING ENERGY EFFICIENCY IN GERMAN REAL ESTATE: TOWARDS SUSTAINABLE AND ECONOMICALLY VIABLE CLIMATE ACTION

Nikolas Müller

**KEYWORDS:** Zero Emission Building (ZEB), Energy Performance of Buildings Directive (EPBD), social impact of energy and climate policies, energy efficiency first

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## THEME G: SUSTAINABLE REAL ESTATE

Germany's building sector, crucial for climate protection, exhibits a considerable energy-saving potential. However, this potential remains largely untapped due to the stagnant renovation rate of about 1%, leading to significant delays in energy retrofitting and failure in meeting energy and greenhouse gas reduction targets. This study examines alternative Zero Emission Building (ZEB) standards in terms of cost-effectiveness, macroeconomic efficiency, and their potential in reducing greenhouse gases. The focus is on GdW's real estate portfolio, which comprises 30% of Germany's rental apartments, mostly occupied by low to middle-income households. This demographic accentuates the social impact of energy and climate policies. The findings highlight the inefficacy of current renovation strategies, which blend economic and climate objectives, in realizing the sector's potential. These strategies lead to suboptimal energy savings and reduced affordability for tenants. The research proposes a shift to a ZEB standard defined as low-temperature capable, offering a more cost-effective and feasible alternative to the current 'Efficiency House 55' standard, potentially boosting the achievement of climate goals. A considerable investment discrepancy is noted, with the 'Efficiency House 55' standard necessitating significantly higher funds, raising concerns about the financial feasibility, particularly for socially focused housing corporations. The paper advocates for a balanced approach, merging sufficient energy efficiency with the expansion of renewable energies. This strategy is presented as economically viable and socially fairer, urging a paradigm shift in Germany's building energy and climate policy. The recommended approach better aligns with the EU's 'energy efficiency first' principle and promises greater sustainability and economic soundness.



## ENERGY EFFICIENCY, HOME IMPROVEMENTS, AND THE ACCUMULATION OF WEALTH

Martijn Dröes, Yasmine Van der Straten


**KEYWORDS:** energy efficiency, home improvements, wealth

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This paper shows that lower-income households are less likely to do energy efficiency enhancing home improvements. At the same time, higher-income households sort themselves into homes that are already more energy efficient to begin with. Over a 10-year horizon, the combined effect of energy savings accumulate to 12% of median net wealth, with ex ante sorting explaining 65% of this effect. If all households, regardless of income, had the same high energy-efficient home and the same rate of home improvement, the Gini coefficient on net wealth would be 1.7 percent lower over a 10-year period. These results show that households become green to varying degrees and that this has a fundamental impact on the accumulation and distribution of wealth.

## THEME G: SUSTAINABLE REAL ESTATE



# COMPARATIVE STUDY OF EUROPEAN AND NORTH AMERICAN INSTITUTIONAL FRAMEWORKS CONCERNING THE FIGHT AGAINST CLIMATE CHANGE AND THE BIODIVERSITY PROTECTION

Sylla Maldini, Andree De Serres

**KEYWORDS:** sustainable real estate, regulatory frameworks, governance & ESG, disclosure

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## THEME G: SUSTAINABLE REAL ESTATE

This study is based on the analysis of the evolution of institutional and regulatory frameworks of four territorial jurisdictions concerning the fight against climate change and biodiversity protection in the real estate sector: European Union, United-Kingdom, United States, and Canada. When it comes to the fight against climate change, obligations for new construction and major renovations are growing. It is possible to observe the inclusion of an approach considering the life cycle of buildings, the monitoring of construction waste, or even the use of less polluting materials and energy consumptions limits with ultra-efficient buildings or even energy production. Existing buildings for their part are not left out, since they will still constitute a large majority of the real estate stock of the legal frameworks studied. Although the room for maneuver is less, the obligations mainly focus on the energy performance dimensions and requirements increasingly target owners by penalizing them in the event of non-compliance with the consumption thresholds per m<sup>2</sup> or ft<sup>2</sup> that have been imposed. These sanctions may result in the impossibility of renting non-compliant spaces. All these elements are accompanied by tax incentives or assistance to stimulate the achievement of these thresholds. The biodiversity protection is less established than the fight against climate change, because the government concerns about their ecosystemic impacts have emerged more recently. Nevertheless, considerable dynamism exists to frame this theme. In fact, certain frameworks are already requiring for new constructions such as the need to consider as a priority the realization of dense developments on brownfields sites in urban areas in order to limit sprawl, integrate natural elements within the building to ensure that real estate development does not result in a loss of biodiversity or the obligation to prioritize the in-depth renovation of a building before destroying it to build a new one and justifying why, if applicable. Existing buildings are not left out since obligations relating to greening rates are already effective in some jurisdictions and are on the shelf for others. Finally, in terms of data disclosure, most regulatory frameworks have obligations relating to organizations trading on public stock markets. However, some of them have obligations aiming at private organizations. For the moment the thresholds (of turnover, number of employees and number of assets under management) target large organizations, but these thresholds will fall year after year to include more companies. Jurisdictions which have not yet established obligations in this regard are working on similar requirements. These requirements or draft laws are based on benchmarks such as the TCFD, the ISSB or even EFRAG. All these elements in terms of existing or currently developing obligations complicate the development and ownership of real estate assets. It

is a sector in which it becomes necessary to collaborate with partners of choice and to develop knowledge and know-how internally to manage existing stock in order to limit the holding of non-compliant properties (by transferring them or undertaking upgrading work). Monitoring and analyzing the regulatory framework is also essential to anticipate the obligations that could arise and ensure that the long-term value of the assets is preserved as well as the value creation model, because the maintenance or retrofit works on the assets as well as the collection of quality data that can be disclosed generates significant costs.





# ASSESSMENT OF THE IMPACT OF A PUBLIC TRANSPORTATION INFRASTRUCTURE ON THE CHANGE OVER TIME IN GREENHOUSE GAS EMISSIONS OF A CITY: CASE STUDY OF THE VANCOUVER SKYTRAIN'S CANADA LINE

Cynthia Aubert, Charles Séguin, Andree De Serres

**KEYWORDS:** greenhouse gas emissions, public transportation infrastructure, sustainable mobility, sustainable city

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## THEME G: SUSTAINABLE REAL ESTATE

The transportation industry is a vector of important change to meet the challenges of sustainability and resilience of our societies. It is the second largest GHG emitter in Canada, accounting for nearly 28% of the country's total emissions. Among these emissions, 57% were attributable to the travel of Canadians in 2021, of which 30% are linked solely to the use of private cars. To limit their circulation, the development of public transit infrastructure is an effective way. However, such infrastructure has indirect effects on GHG emissions due to its interdependence with the urban planning and its socio-economic characteristics. This research paper aims to evaluate the impact of the commissioning of a public transit infrastructure on the evolution of a city's GHG emissions over time. The case of the Vancouver SkyTrain's Canada Line was analyzed. The methodology used to carry out this study is a synthetic control. This is one of the contributions of this research to the existing literature, whose studies generally only assess the direct effects of a transportation infrastructure from the emissions avoided by the modal shift of passengers. The data analyzed was collected from the open databases of Canadian cities and Statistics Canada. These include GHG emissions in CO2 equivalent, GDP, gasoline and fuel tax revenues, construction investments, number of inhabitants and their transportation habits in the cities in the control group. The results show that the introduction of the Canada Line resulted in an increase of approximately 8.6% in Vancouver's GHG emissions in 2011. This increase could be explained by the redevelopment of neighborhoods around infrastructure stations to the detriment of their gentrification, accentuating urban sprawl. For an investment in a sustainable means of transport to effectively reduce GHG emissions in the long term, more emphasis should be placed on the interactions between transport, urban development (to be built or renovated) and the socio-economic characteristics of neighborhoods. Studies with more spatial precision would provide a better understanding of the interweaving of social, economic, and environmental changes generated by transportation infrastructure and affecting a city's GHG emissions.



# WHY URBAN COMMONS MATTERS? COLLECTIVE ACTION IN SHARED RESIDENTIAL AREAS IN CITIES

Adam Polko

**KEYWORDS:** urban commons, commoning, residential area

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## THEME G: SUSTAINABLE REAL ESTATE

Urban commons emerge through collective actions by urban communities utilizing shared resources to collaboratively create and share various goods, both material and immaterial (Foster 2013; Polko et al. 2021). Establishing and sustaining commons involves three essential components: shared resources, a community, and a set of rules (social protocol), rendering it a complex phenomenon (Bollier 2014; Harvey 2012). This underscores a unique connection between the community and resources, reflected in the need to safeguard resources and an awareness of their value (Bollier 2014; Bollier, Helfrich (eds.) 2015). Numerous instances of urban commons exist, ranging from community gardens, community land trusts (CLTs), and repair cafes to friends' park groups, among others (Feinberg et al. 2021). In urban settings, residents in neighborhoods are increasingly forming communities to enhance the quality of their neighborhoods or protect places from threats, such as preventing the appropriation of a park by developers. These residents are adopting commoning practices that extend beyond market and state mechanisms to manage shared urban spaces. This research article aims to deepen the understanding of how the process of urban commoning impacts the management of shared spaces in urban residential areas, with a focus on improving quality. The article addresses key research questions: Why and when do residents initiate the commoning process in residential areas? Does the structure, size, and spatial layout of a housing development influence the creation of urban commons? What types of urban commons are produced, and do they enhance housing quality and impact housing prices? Scientific studies have been conducted in various Polish cities, and the research results aim to provide a comprehensive understanding of the interactions among residents of housing estates. Additionally, the findings will offer recommendations on principles for managing shared spaces within housing estates, including squares, parks, backyards, parking lots, etc.



## ESG RATING FOR REAL ESTATE PORTFOLIOS

Martin Schnauss, Laura Archer-Svoboda


**KEYWORDS:** sustainability, rating, energy efficiency

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The imperative for energy efficiency in real estate investments has been amplified by growing environmental awareness and economic factors. The escalation of energy costs has led to a critical re-evaluation of energy efficiency and the need for property upgrades, particularly in Switzerland. Here, a significant portion of residential real estate is managed by real estate funds, pension funds, and other financial institutions, which are under increasing pressure from investors and regulators to improve the environmental sustainability of their portfolios. In addition, newly enacted regulations imposing rent caps on properties that have not undergone energy-efficient renovations pose a risk to future rental income streams. This context underscores the critical need for improved methods of measurement and accountability. Our presentation addresses the formulation of modern, transparent and data-centric strategies for valuing Swiss real estate assets, with a focus on energy efficiency, combating obsolescence and projecting future market values. Our research highlights ways to assess and manage changing environmental and regulatory requirements.

## THEME G: SUSTAINABLE REAL ESTATE



## TEMPORARY USES OF VACANT REAL ESTATE: THE AGENCY OF NON-PROFIT ENTITIES BETWEEN INSTRUMENTATION AND EXPERIMENTATION

Chiara Mazzearella, Hilde Remoy

**KEYWORDS:** temporary uses, vacant real estate, value creation, non-profit entities

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## THEME G: SUSTAINABLE REAL ESTATE

This study delves into the significance of temporary uses initiated by non-profit entities in vacant real estate assets, with a particular focus on the diverse benefits arising from community management. Certain non-profit entities serve as intermediaries between urban communities and property owners, facilitating the temporary utilization of real estate. Through these initiatives, a variety of activities are activated, thereby enhancing community engagement, social cohesion, and local initiatives. However, traditional valuation methods often fail to fully capture the values derived from such endeavors, which encompass social, cultural, and environmental dimensions. To address this gap, the research employs a methodology that blends qualitative assessments with quantitative analyses to comprehensively evaluate the value of experimental temporary uses. By integrating qualitative assessments such as community impact evaluations and stakeholder engagement with quantitative metrics like economic impact analysis, a more holistic understanding of the multidimensional value of these temporary uses is attained. The beneficiaries of these values are diverse, spanning various sectors including the local community, residents, businesses, and policymakers. Community-driven initiatives significantly contribute to social cohesion, cultural enrichment, and environmental sustainability, thereby enhancing the overall quality of life in the neighborhood. Businesses may experience benefits such as increased foot traffic and heightened consumer engagement resulting from community activities. Policymakers and urban planners can leverage insights from this study to inform decision-making processes, urban development strategies, and policies that acknowledge the pivotal role of temporary communities in creating value from vacant spaces and revitalizing neighborhoods. Through the integration of diverse perspectives and valuation techniques, this study aims to explore the multiple outcomes of community-managed temporary uses in vacant real estate. Understanding and quantifying the multidimensional values generated by non-profit-led initiatives can inform policy decisions, urban planning strategies, and real estate development practices to recognize the agency of temporary communities in creating value from vacancies and enhancing the neighborhood.



## SUSTAINABLE COMMUNITIES AND REAL ESTATE VALUE: A REVIEW

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Andrea

**KEYWORDS:** sustainable communities, global climate, valuation, real  
estate

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Several works have investigated sustainable communities globally. Turner-Skoff and Nicole Cavender (2019) examine the role of trees and their role for people and the planet. Their study shows that trees are essential for healthy communities and people, and they benefit and can help cities meet 15 of the 17 United Nations sustainable development goals. Schweizer-Ries (2008) examines the role of energy sustainability and the environmental and psychological aspects of the change in energy supply and demand. The paper examines energy-sustainable communities and examines a case study as an example of a community in Germany. Duxbury and Jeannotte (2011) discuss the role of culture and sustainable communities and its benefits to people who live in these communities. Therefore, this literature review attempts to fill the gap in the literature on sustainable communities, which are still quite unpopular globally, by examining the best practices in sustainable communities by examining past literature, exploring and having a clearer understanding of how it impacts real estate value.

## THEME G: SUSTAINABLE REAL ESTATE



# THE ECONOMIC VALUE OF END OF TRIP FACILITIES FOR CYCLIST COMMUTER IN AN OFFICE BUILDING

Qiulin Ke

**KEYWORDS:** cycle to work; bike storage; shower room; rent of office building

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## THEME G: SUSTAINABLE REAL ESTATE

The benefits of cycling as a sustainable transportation mode are widely recognized. In recent years, the concept of commuting by bike has gained considerable attention. Cycling to work brings a multiple benefits for individuals, employers and the environment from improving physical health, wellbeing, productivity and public health to reducing carbon emissions. Governments in many countries have implemented a variety of policy measures, intervention and initiatives to increase the cycling level. Some cities and town encouraged workplaces to provide bike-friendly amenities such as secure bike parking/storage, showers, and changing rooms (called end of trip facilities) to accommodate cyclists and motivate more employees to embrace sustainable transportation options. At the same time, such amenities are identified to influence cycling behavior and deter the people from cycling to work. Given the desirability for these amenities, the number of the office building with bike storage and share room is small; their economic value is unknown. In this paper, we investigate whether presence of cycling to work supportive facilities could add value to office buildings. This study uses office buildings across the England at the end of 2021, we examine with hedonic technique: 1. Whether the office buildings with bike storage and/or shower facility could secure rent premium; 2. Whether the existence of rent premium for bike storage and/or shower varies in location and across regions in England and independently from the premium for BREEM certificate.



# THE DIFFUSION OF CERTIFIED GREEN BUILDINGS IN EUROPE

Gunther Maier, Katarzyna Reyman, Michal Gluszak


**KEYWORDS:** green buildings, diffusion, Europe

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Real estate is one of the key sectors when it comes to the development toward sustainability. National and international policy as well as the market request buildings to be sustainable. The complexity of buildings and their durability make it difficult, however, to determine their degree of sustainability as well as to demonstrate it to potential buyers. Green building certification schemas were developed as instruments to measure sustainability of buildings and as instruments for third party verification of building quality in this realm. In this paper we want to investigate the diffusion process of certified green buildings in Europe. We will look at the diffusion over space and over time for the most important international certification schemas. We will try to identify leaders and laggards in the process at the levels of countries, regions, and cities. Since this is exploratory work, we will try to derive hypotheses about the reasons for certain observable patterns. These should serve as the basis for future more detailed research.

**THEME G:**  
**SUSTAINABLE**  
**REAL ESTATE**



## PROMOTING CIRCULAR BUILDING ADAPTABILITY IN AN ADAPTIVE REUSE PROJECT: AN ACTION- AND DESIGN RESEARCH-ORIENTED EXPERIMENTATION

Mohammad Hamida, Greco Angela, Hilde Remoy, Vincent Gruis,  
Brian van Laar


**KEYWORDS:** adaptive reuse, adaptability, action research, circular economy

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## THEME G: SUSTAINABLE REAL ESTATE

The practical implementation of circular- and adaptable-related strategies in building transformation projects becomes an indispensable action for a resource-efficient and future-proof redevelopment of the built environment. In this regards, using the developed framework for circular building adaptability in adaptive reuse (CBA-AR) by Hamida et al. (2023) in practice seems to be a promising action. However, the CBA-AR framework has not been tested in real world settings, in which knowledge about its usability and effectiveness is immature. Thus, this study aims to test and reflect on the usability and effectiveness of the CBA-AR framework as a guiding tool for practitioners aiming at promoting circularity and adaptability in building transformation projects. An action research- and design research-oriented approach is followed, using a series of exploration- and design-oriented workshops as a primary research method. The experimentation is being carried out on a vacant office building in Rotterdam, the Netherlands. This study directly connects theory and practice by testing and reflecting on the usability and effectiveness of a conceptual framework in the real world. This research contributes to the relevant body of knowledge to CBA in adaptive reuse by bridging the gap among theoretical, empirical and participatory research observations through testing and reflecting of the applicability and effectiveness of a guiding framework in the real world. Scholars can reflect on the lessons learned from this study in developing decision-making tools for circular adaptive reuse.





## **FUTURE OPPORTUNITIES THROUGH CONVERSION FROM RETAIL TO MIXED-USE PROPERTIES - ANALYSIS OF CASE STUDIES AND DEVELOPMENT OF A 4-PHASE MODEL FOR SUCCESSFUL TRANSFORMATION**

Dieter Rebitzer, Maximilian Nothhelfer, Franka Lange

**KEYWORDS:** retail property, property development, sustainability, urban development

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## **THEME G: SUSTAINABLE REAL ESTATE**

The transformation process of retail property requires expertise in retail, property, and construction law. Three research questions are posed using the case study method: 1) How did the rise and fall of large retail properties and the resulting numerous vacancies in prominent locations come about? 2) How have former retail properties been re-utilized in the past? 3) What should a structured process for value-retaining re-utilization look like? The study analyses the success factors based on twelve case studies of successful reuse concepts. The results are used to formulate and test a four-phase model for successful re-utilization concepts, which is then presented using a specific practical example. This involves an iterative consolidation of all the analyzed information into the final concept. The model has been tried and tested in practice and is internationally transferable. The study is aimed at owners and investors as well as cities, business development organizations, city marketing, and similar interest groups that are affected by retail closures.



## NAVIGATING UNCERTAINTY: EXPLORING BLACK SWAN EVENTS AND THEIR POSSIBLE IMPACTS ON THE REAL ESTATE MARKET ENVIRONMENT

Saija Toivonen


**KEYWORDS:** resilience, futures studies, risk management, black swans

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## THEME G: SUSTAINABLE REAL ESTATE

Real estate market actors are navigating in an increasingly challenging market environment where volatility of changes, interconnected drivers and ambiguity of impacts are typical characteristics. As one crisis after another has followed, the traditional probability-based and narrow scoped risk management has been found to be inadequate to cope with the constantly changing landscape of possible risks. Therefore, there is an urgent need to recognize not only the most probable future threats born in the real estate market environment itself but also shed light on the underlying and creeping drivers originating from the different domains of society that can cause crises and lead to a variety of negative impacts on real estate, space and land use. The aim of this study is to increase the understanding of the black swan type of events and their impacts on the real estate market environment. Black swans possess low probability, but their impacts are considered highly significant when realized. Our focus is on the identification of both direct and indirect impacts. We employ a futures-oriented research approach to reveal the possible black swans of the future and utilize the futures wheel method to analyze their impacts in multidisciplinary workshops, together with experts representing academia and practice. The findings of this study contribute to understanding what the low probability events are that hold the potential for significant impacts in the real estate market environment. Our findings serve as a starting point for developing more holistic risk management and resilience building in the field of real estate.



# UNDERSTANDING ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG) FACTORS IN THE SMART HOME INNOVATION-DECISION PROCESS: A SYSTEMATIC LITERATURE REVIEW

Jennifer Schäfer

**KEYWORDS:** smart home technologies, ESG, innovation-decision process, literature review

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**THEME H:  
NEW  
TECHNOLOGY  
AND DATA  
IN REAL  
ESTATE**

This systematic literature review examines the role of environmental, social, and governance (ESG) factors within the smart home innovation-decision process. Due to the potential for smart home technologies (SHTs) to foster sustainability, which is a superordination of ESG, such analysis is critical. Within the smart home context, no article combines all three ESG components in one body of research. The literature also does not distinctly connect ESG aspects with the innovation-decision process. Understanding this potential connection could help to increase the adoption of SHTs. By applying an open coding process, this literature review integrates ESG factors into the five stages of the innovation-decision process. Findings from this framework extension suggest that, environmentally, the literature covers ecological facets, energy efficiency, and sustainability. Socially, acceptability, psychology, socialization, sociodemographic implications, societies, and networks are significant. While governance factors address board characteristics and business models, further research is necessary. Moreover, future research should differentiate between the investor and the end-consumer perspective while enhancing insights on all three ESG components.



# ISTOKEN: THE DIGITAL REVOLUTION OF FRACTIONAL OWNERSHIP & REAL ESTATE TOKENIZATION MODEL IN TURKEY

Göksu Sabuncuoğlu, Kerem Yavuz Arslanli

**KEYWORDS:** Tokenization, DLT, Smart contract, STO

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## THEME H: NEW TECHNOLOGY AND DATA IN REAL ESTATE

Real estate access has become increasingly challenging due to high property costs and financial difficulties in Turkey especially major cities like Istanbul. These limitations have restricted the opportunity for individual and small-scale investors to participate in large real estate projects. However, solutions such as fractional ownership concepts and real estate investment funds have emerged to overcome these challenges and democratize real estate investments. Fractional ownership divides large properties into smaller shares, offering investors the advantage of acquiring these properties at a lower cost. This model enables individuals and small-scale investors to own real estate assets with smaller amounts of capital. Another effective method that has gained prominence alongside these solutions is real estate tokenization. Real estate tokenization involves converting properties into digital assets, allowing investors to become property owners with more minor, fragmented shares. This facilitates participation in real estate projects with smaller amounts of capital, and investors can hold property ownership through digital tokens. Tokenization manages these transactions transparently and reliably, providing a faster and more cost-effective investment process. To democratize real estate access in Turkey, various financial tools, combined with solutions brought by the digital revolution, offer investors a broader and more effective range of investment opportunities. As a result, the real estate sector becomes more accessible and diversified, leading to healthier growth for individual investors and the industry. In this research, existing fractional ownership practices in Turkey are examined, and solutions for the challenges of regulating tokenization are proposed by referencing various applications of real estate investment funds. A new model of real estate tokenization, named 'ISToken' (Istanbul Token), is introduced, offering technological, legal, and financial solutions to make the real estate sector more accessible and liquid.



# JOINT MULTI-TASK MODELING OF MULTIPLE ATTRIBUTES FOR THE ENRICHMENT OF REAL ESTATE DATA

Miroslav Despotovic, Stumpe Eric, Matthias Zeppelzauer, Roberto Labadie-Tamayo

**KEYWORDS:** Multi-Task Machine Learning, Automated Valuation Models, Data Enrichment

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## THEME H: NEW TECHNOLOGY AND DATA IN REAL ESTATE

In recent years, there has been an increasing focus on addressing the problem of feature extraction and/or imputation of missing real estate data for training Automated Valuation Models (AVM), where Multi-Task Learning can be used as a convenient solution. Multi-task learning aims to learn multiple different tasks simultaneously while maximizing performance on certain or all the tasks. By learning several tasks in parallel, the information learned for one task can be used to better generalize for another task. The related information from other tasks thereby serves as a domain-specific inductive bias. This inductive bias is the prerequisite for the classifier's or regressor's ability to generalize. Thereby, a more general representation should be learned that takes relationships between the different tasks into account and that enables transferring knowledge learned for one task to another (shared concepts). As a result, on task can build upon the information learned for another task. To cope with the feature extraction and missing information in the data we leverage the framework of multi-task learning. Thereby, we aim at exploiting mutual information between similar real estate attributes for more accurate prediction of the extracted features. We aim at stacking and connecting task-specific layers on top of the multimodal representation. We jointly fine-tune the individual models with the information available as ground truth and connect the individual predictors to enable the sharing of concepts between real estate attributes. The main challenge is the different nature of the attributes that shall be modeled. Some attributes may be categorical (e.g. type of floor), others binary (e.g. balcony vs. no balcony) and others continuous (e.g. living area). Thus, different target functions must be optimized that require for different cost and regularization functions. This makes the learning task more difficult than typical multi-label learning tasks where all target functions are of the same type. The results show improved robustness of prediction by jointly modeling multiple attributes (including real estate properties' unstructured description text, images, numerical and categorical meta data) via multi-task learning, i.e. by leveraging information learned for one attribute to predict another one. We were able to achieve a particularly good prediction accuracy rate for external building characteristics such as year of construction, building condition and even heating demand. As real estate related attributes can be related (e.g. building condition is very likely to correlate with heating demand or building size is very likely to correlate with the number of floors) the joint modeling of multiple attributes in a multi-task fashion is a promising direction. We believe that the present study provides new insights into the use of alternative data and state-of-the-art analysis techniques for real estate analysis and provides a promising basis for further research in this area.



# A DATA-DRIVEN APPROACH TO REAL ESTATE PRICE ESTIMATION: THE CASE STUDY SLOVAKIA

Julius Golej, Andrej Adamuscin, Miroslav Pánik

**KEYWORDS:** Automated Value Model, Big Data, real estate market, real estate prices

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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Automated value model (AVM) is a computerized statistically based software that collects and uses Big Data in the real estate sector. It uses property information such as comparable and historical sales, property characteristics, price trends, and any other information relevant to the property in its algorithm. The effectiveness of using AVM depends on the amount and especially the quality of the data used because only high-quality data can be considered reliable and representative. At the same time, it should be added that machine data collection and evaluation in the field of real estate would never be as accurate as manual valuation, where the appraiser can, based on his knowledge and experience, take into account factors that are not taken into account and documented in the collected data, through a physical inspection. Even if an appraiser uses certain specific methods to determine the price of a property, the appraiser's subjectivity factor always enters the valuation process, which can create a certain deviation in human-generated sales prices compared to the price generated by the software. The following contribution is devoted to the issue of creating an AVM model for evaluating real estate sales prices. The authors collaborated on the creation of such a model for practice in Slovak conditions, the main goal of which was to increase the efficiency and productivity of work in the field of real estate valuation.

## THEME H: NEW TECHNOLOGY AND DATA IN REAL ESTATE



## CAN GOOGLE TRENDS DATA PREDICT HOUSING MARKET TRENDS?

Mirosław Bełej, Agnieszka Szczepańska

**KEYWORDS:** Google trends, housing, real estate, forecasting

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DOI: [10.15396/eres2024-044](https://doi.org/10.15396/eres2024-044)

The main idea of this work is that the dynamics of the housing market is derived from the society's behavior and the data obtained from Google Trends, allows monitoring the activity of the information society in terms of interest in housing. Obtaining and analyzing data on the dynamics of internet searches for specific words related to the housing market can provide a basis for forecasting housing price dynamics. An increase in searches can suggest a future increase in prices and a decrease a stagnation or slump. The study used a vector autoregressive model (VAR) together with causality analysis in the Granger sense. The method developed allows more accurate forecasting of housing prices than traditional methods using only macroeconomic data.

## THEME H: NEW TECHNOLOGY AND DATA IN REAL ESTATE



## INFORMATION DISCLOSURE VS. INFORMATION LEARNING VIA GOOGLE SEARCH

Damian Damianov, Xiangdong Wang, Cheng Yan

**KEYWORDS:** Google search, information transmission, mortgage default risk

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)  
DOI: [10.15396/eres2024-056](#)

We decompose the Google Trends Search Volume Index into naïve and sophisticated searches and examine their impacts on mortgage default, respectively. Using U.S. data from 2006 to 2018, we find that the sophisticated search activity has a positive and robust relationship with the change in the percentage of mortgages in 90+ days of delinquency. However, foreclosure starts are positively related to naïve search activity in the short term, but negatively related to sophisticated search activity in the long term. Borrowers are more likely learn from sophisticated online searches than from naïve online searches, and they can use the information to avoid foreclosure starts and keep their houses. The relationship between Google search activity and mortgage default outcomes are significantly stronger in states that experienced substantial house price drops in the recent year. Our findings are robust to a battery of alternative settings.

## THEME H: NEW TECHNOLOGY AND DATA IN REAL ESTATE





# GEODEMOGRAPHIC SEGMENTATION FOR SITE SELECTION: A BAYESIAN APPROACH IN COMMERCIAL REAL ESTATE

Gözde Karahan, Kerem Yavuz Arslanli

**KEYWORDS:** geodemographic segmentation, site selection, GIS

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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Site selection studies in urban planning have traditionally relied on subjective judgments, often made by a limited team, leading to decisions that may need more objectivity. This research addresses the need for a more systematic and objective method for choosing locations, particularly in cases involving large geographies and numerous properties and/or branches. The study introduces a novel approach to site selection by proposing a geodemographic segmentation method. Leveraging Geographic Information Systems (GIS), this method divides wider geographies into segments, facilitating more informed decision-making in location selection. By reducing the reliance on subjective judgments, the proposed method aims to enhance the efficiency of decision support systems, allowing for the utilization of accumulated experience in a more structured manner. Central to the research is the development of a generalizable socioeconomic segmentation method tailored for the location selection of commercial real estate with a significant number of branches. The study employs Bayesian approaches to analyze demographic data, searching for a robust foundation for decision-making processes. The anticipated outcomes of this research include the generation of geodemographic segments through GIS and establishing a generalizable socioeconomic segmentation method. These segments will serve as the study's results and be integrated into location selection models, contributing to more effective decision support systems.



# FORECAST OF RESIDENTIAL REAL ESTATE PRICES IN SLOVAKIA USING OF NEURAL NETWORKS

Miroslav Pánik, Andrej Adamuscin

**KEYWORDS:** residential real estate prices, forecasting, neural networks, artificial intelligence

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## THEME H: NEW TECHNOLOGY AND DATA IN REAL ESTATE

The current turbulent development in the real estate market, not only in Slovakia but throughout Europe, is caused by several crises that have a global impact and partially resemble the situation in the market 15 years ago. One factor that negatively affects the real estate market in Slovakia is the lack of residential real estate. In the long term, the demand for housing significantly exceeds the supply of apartments. The article analyzes the prices of real estate intended for housing in Slovakia. It defines economic, demographic and social factors that have a significant impact on the development of real estate prices. The methodology of statistical data collection differs considerably in the developed countries of the EU. Národná banka Slovenska has been publishing quarterly data on real estate prices since 2005. Development modeling is possible, for example, using correlation and regression analysis, which is well known. In the presented article, the forecast of housing prices will be realized with the help of artificial intelligence - neural networks.



## REAL ESTATE TOKENS: EVALUATING LONG-TERM RELATIONSHIPS WITH OTHER MAIN TYPES OF ASSETS

Seyedeh Fatemeh Mottaghi, Bertram Steininger

**KEYWORDS:** real estate tokens, blockchain, cointegration, VECM

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Based on real estate token data, we investigate the long-term relationships between real estate tokens, other real estate investment vehicles, and asset classes (i.e. equities, bonds). Employing not only the conventional cointegration method but also a sophisticated analysis employing COINtensity VECM, specifically tailored for examining complex and dynamic relationships within financial markets. Our findings show the quantitative dynamics of how this novel investment vehicle interfaces with established assets. This research strives to offer fresh perspectives into the transforming investment landscape of traditional assets coexisting with tokenized real estate assets, emphasizing the potential impact and role of real estate tokens in the evolving financial environment.

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## ASSESSING THE VALUE IEQ CREATES IN THE REAL ESTATE SECTOR – PROPERTY OWNERS AND OFFICE TENANTS' PERSPECTIVES FROM FINLAND

Helena Mantere, Juha Franssila

**KEYWORDS:** indoor environmental quality, value creation, office environment, willingness to pay

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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## THEME H: NEW TECHNOLOGY AND DATA IN REAL ESTATE

Interest in indoor environmental quality (IEQ) has increased within Finland's real estate sector, gaining more attention from both property owners and tenants. IEQ-related technologies can improve the quality of indoor environments, but also enable monitoring of IEQ and even occupancy. These solutions can enhance employee well-being, but also reduce costs for tenants and property owners, and support their sustainability goals. But despite the growing interest and the recognized benefits, adoption of IEQ technologies has been rather slow in the real estate industry. The purpose of the research is to examine whether and how real estate owners and tenants perceive value in IEQ in office environments, in post-pandemic context. The research focuses on identifying and evaluating the key IEQ attributes that create value for the tenants. Additionally, the research aims to assess owners and tenants' willingness to pay (WTP) for improved IEQ and IEQ technologies. The research utilizes a mixed-method approach, employing both interviews and a questionnaire to achieve a comprehensive understanding. As a result, a framework is created for evaluating the value generated by IEQ. With the framework, for instance office tenants' needs can be assessed and met more effectively.



# CHALLENGES AND DRIVERS OF DIGITALIZATION IN THE REAL ESTATE SECTOR IN FINLAND

Jukka Puhto, Osku Torro

**KEYWORDS:** digitalization, real estate business

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The aim of the study was to identify the drivers and challenges of digitalization in the real estate sector among different actors. The research methodology has been based on interviews. The organizations interviewed consisted of property owner organizations from both the residential and commercial sectors, as well as property management companies. The key drivers of digitalization were identified as growing customer demands, increasing competition and efficiency targets. Key challenges were an old property stock, where data is challenging to access, siloed systems and lack of open interfaces, low maturity of data management.

## **THEME H: NEW TECHNOLOGY AND DATA IN REAL ESTATE**



## MEASURING INTER- ORGANIZATIONAL KNOWLEDGE EXCHANGE BETWEEN FIRMS

Jasmine Bacani, Chiara Pelosi, Monique Arkesteijn, Alexandra Den Heijer


**KEYWORDS:** inter-organization, measurement, knowledge exchange, universities

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The escalating significance of knowledge exchange in diverse industries is owed to its potential to enhance business performance. Although numerous theoretical frameworks have been applied to understand and measure knowledge exchange within and between firms, a notable gap remains in measuring inter-organizational knowledge exchange among horizontally-linked firms in the same sector. This research endeavors to fill this gap by proposing a comprehensive survey grounded in theory and practice for assessing knowledge exchange among 14 universities in the Netherlands. Drawing from inputs from campus managers and established theory-based evaluation methods, four key elements were identified: organizational context, enablers and disablers, processes, and outcome expectations. This synthesis aims to offer insights into how knowledge exchange dynamics can be gauged between firms. By gaining insights into the intricacies of inter-organizational knowledge exchange through the survey developed in this study, organizations would be able to adopt more informed strategies, fostering collaborative environments and ultimately optimizing the efficiency of knowledge exchange processes between organizations in the same sector.



# LIVING ON THE HIGHWAY: ADDRESSING GERMANY'S HGV PARKING CRISIS THROUGH MACHINE LEARNING SATELLITE IMAGE ANALYSIS

Julius Range, Benedikt Gloria, Albert Erasmus Grafe


**KEYWORDS:** machine learning, specialized real estate, satellite image analysis, transportation

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DOI: [10.15396/eres2024-164](https://doi.org/10.15396/eres2024-164)

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The rapid increasing demand for freight transport has precipitated a critical need for expanded infrastructure, particularly in Germany, where a significant crisis in Heavy Goods Vehicle (HGV) parking facilities is emerging. Our study aims to determine the optimum supply of HGV parking lots required to mitigate this problem. Utilizing state-of-the-art object detection techniques in satellite imagery, we conduct a comprehensive analysis to assess the current availability of HGV parking spaces. Our machine learning-based approach enables an accurate and large-scale evaluation, revealing a considerable undersupply of HGV parking lots across Germany. These findings underscore the severity of the infrastructure deficit in the context of increasing freight transport demands. In a next step, we conduct a location analysis to determine regions, which are impacted acutely. Our results therefore deliver valuable insights to specialized real-estate developers seeking to cater to the demand and profit from this deficit. Based on the results, we develop industry and policy recommendations aimed at addressing this shortfall.



# UNVEILING SWITZERLAND'S AND POLAND'S RESIDENTIAL MARKETS WITH BOOSTED TREES AND SHAP

Nicola Stalder, Michael Mayer, Martin Hoesli, Steven Bourassa

**KEYWORDS:** Automated Valuation Models, residential real estate, Shapley Additive Explanations (SHAP), boosted trees

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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What factors impact residential rents, and how? We use a large dataset of offered rents and of explanatory variables for Switzerland to provide insights concerning the dynamics of the country's residential real estate landscape. Rents are modeled by boosted trees (LightGBM) and analyzed with typical tools from explainable AI. We then focus on an innovative application of SHAP (SHapley Additive exPlanations) values to assess the combined location effect of all geographic variables. Thanks to their additivity, the SHAP values of all geographic variables can be summed up and visualized as heatmaps providing full transparency on local and regional rent levels. We further highlight the impact of considering interaction constraints to bring additional structure to the results and achieving a high interpretability of the model. The methods used for the Swiss market are then applied to a dataset of rents and prices for the largest cities in Poland, including the city of Gdansk.

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## THE ROLE OF AMENITIES IN STRATEGIC ASSET SELECTION

Anett Wins, Marcelo Del Cajias, Rebecca Restle


**KEYWORDS:** Amenities Magnet Score (AMS), AI, GAM, residential rental pricing

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

DOI: [10.15396/eres2024-191](https://doi.org/10.15396/eres2024-191)

Using artificial intelligence (AI) algorithms, modern location analysis evaluates attractiveness almost in real time. In this paper we explore the relationship between amenities and residential asking rents in several large European cities. The study introduces the Amenities Magnet Score (AMS) differentiated by seven basic living needs as crucial metric for assessing and evaluating the attractiveness of urban locations. Research results emphasize the critical role of amenities and their impact on residential rental prices: It highlights that the AMS directly correlates with rental prices in European cities, with higher AMS associated with rental premiums. Different types of amenities affect rental prices variably, and there are threshold effects where rental premiums stabilize or sharply increase as the AMS reaches certain thresholds, highlighting the nuanced relationship between amenities and rental values. Findings offer valuable insights for real estate investors seeking to understand and navigate the dynamics of urban rental markets and developing strategies for asset allocation that capitalize on the demand for amenities.

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# BLOCKCHAIN AND SMART CITIES FOR INCLUSIVE AND SUSTAINABLE COMMUNITIES: A BIBLIOMETRIC AND SYSTEMATIC LITERATURE REVIEW

Andrea Delle Foglie, Massimo Biasin

**KEYWORDS:** smart cities, Distributed Ledger Technologies, real estate, sustainable urban environment

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## THEME H: NEW TECHNOLOGY AND DATA IN REAL ESTATE

Smart Cities are urban areas that leverage technological solutions to enhance the management and efficiency of traditional networks for the benefit of their residents and businesses. This paper presents a systematic literature review based on the SPAR-4-SLR protocol, aimed at analyzing the literature and the progress in Smart Cities research. It specifically focuses on the impact of blockchain technology on the urban environment and its potential to contribute to the development of inclusive and sustainable communities, including financial systems with similar characteristics to serve these societies. The findings reveal a lack of research on practical applications of Distributed Ledger Technologies (DLTs) and blockchain in developing the financial ecosystem of Smart Cities. To address this gap, a future research agenda is proposed, highlighting several research questions that could be useful for academics and practitioners interested in exploring the development of Smart Cities' financial systems. It also highlights the potential of blockchain technology for the real estate market, which is a crucial component of urban organization in smart city constructions. Blockchain can provide a secure and transparent land registry system that reduces fraud, streamlines property transactions, and enhances land management. Therefore, research is needed to develop blockchain-based solutions for land registration, title verification, and property taxation in smart city governance.



# ARE HEDONIC MODELS REALLY QUALITY-ADJUSTED? THE ROLE OF APARTMENT QUALITY IN HEDONIC MODELS OF HOUSING RENTAL MARKET

Michal Hebdzynski


**KEYWORDS:** rental market, hedonic methods, quality signaling, price index

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## THEME H: NEW TECHNOLOGY AND DATA IN REAL ESTATE

In micro-level data concerning the housing market, the apartment quality may be signaled via textual statements or the attached descriptions/photos. It may be done using hard information related to the easier-to-measure structural characteristics or soft information related to the apartment condition and design - soft quality. This paper checks whether the choice of the approach to handling the issue of soft quality of apartments influences the properties of hedonic models and the course of hedonic rent indices. The study shows that hedonic models that account for soft quality have better statistical properties than those without soft-quality-related variables. Among them, the models that include the information on quality extracted from descriptions of apartments prove to be the best. Still, considerable differences in the indicated course of hedonic rent indices have not been detected. However, the paper concludes that utilizing information on apartments' soft quality may be crucial to understanding the market adjustment process to economic shocks. It has been proven that the price reaction of the rental market in Poznań (Poland) to the COVID-19 pandemic and the shock related with the Russian aggression on Ukraine has been diversified in the quality-related market segments.



# THE INCIDENCE OF MATHS ANXIETY IN REAL ESTATE EDUCATION AND THE IMPACT OF MAGMA AS A PEDAGOGICAL STRATEGY

Louise Brown, Alan Brown

**KEYWORDS:** maths anxiety, innovative teaching, risk literacy, growth mindset

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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## THEME I: REAL ESTATE EDUCATION

Background: It has been reported that 35% of UK adults feel anxious when doing maths (KPMG 2023). Maths anxiety has been defined as “feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations.” (Richardson and Suinn 1972). The majority of research into maths anxiety has been in the context of mathematics teaching and there is a limited research base of evidence from an applied mathematical context such as real estate which involves statistics and valuation as core components. Interventions that reduce maths anxiety have the potential to both improve retention and also to enhance equality, diversity and inclusion (EDI) in real estate education. Samuel et al. (2023) indicate that MAGMA (mindfulness and growth mindset approach) is an effective approach to reducing maths anxiety. Post pandemic incidences of anxiety amongst the student population have increased, Basheti (2023) reported 46% of students surveyed were experiencing abnormal levels of anxiety due to the pandemic measures.

Methodology: The project will use validated instruments : the Berlin Numeracy scale (a psychometric test) to determine statistical numeracy and risk literacy; the UK Maths Anxiety scale (MAS-UK) and the three item Growth Mindset scale to produce a baseline for the cohort of students. The MAGMA intervention approach (Samuel et al., 2023) which focusses on mindfulness and growth mindset will be implemented at the beginning of each session and encouraged as part of directed study. At end of the semester the UK Maths Anxiety instrument will be rerun and a short questionnaire on the perceived effectiveness of interventions over the period of the module delivery. Attendance figures will also be used as a proxy for level of interest and engagement and compared with other modules in that semester. Attrition and failure rates will also be monitored. Data will be collected from January to April 2024.

The research questions are : At what level does maths anxiety exist amongst students in applied mathematical subjects? Are there correlations between maths anxiety and numeracy/gender/previous qualifications? To what extent do MAGMA strategies alleviate maths anxiety? Can this approach be applied in other real estate modules? The paper will present findings from the initial research project.



# QUARTO, R, GITHUB AND FRIENDS: A NEW FRAMEWORK FOR REPRODUCIBLE ARTICLES AND REPORTS

Gunther Maier


**KEYWORDS:** quarto, reproducibility, digital, publishing

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In this paper I discuss a new framework of open source software for writing articles, reports, research notes, webpages, blogs, and many more. The framework is centered around Quarto, a program that integrates formatted text and data analysis in R, Python, or other software and can output a wide range of formats. As compared to traditional solutions, the framework offers major advantages in terms of reproducibility as well as the streamlining of workflows. Because of the many output options, the framework can serve traditional, 'print'-oriented publication processes where one needs to submit a Word-, LaTeX- or PDF-document. At the same time, however, the framework supports HTML-based, web-oriented publication processes and even integrates the respective publication workflow. In this realm, the framework allows for interactivity and embedding of multimedia elements, thus strongly utilizing the advantages of digital media. The paper will give an overview of the framework and discuss some potential applications in real estate research and real estate industry.

**THEME I:  
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# LIFELONG LEARNING IN REAL ESTATE EDUCATION: THE CASE OF THE MASTER CITY DEVELOPER CURRICULUM RENEWAL

Erwin Heurkens

**KEYWORDS:** lifelong learning, professional education, curriculum renewal, urban development

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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## THEME I: REAL ESTATE EDUCATION

Real estate practice is subject to constant changes due to related economic, societal and environmental transitions, such as circular economy, sustainable mobility and renewable energy, that need to be taken into account when shaping the built environment. As a result, there is a growing need among public and private real estate professionals to understand the wickedness of the challenges ahead, and to develop leadership skills and appropriate courses of action to realize resilient urban real estate projects. For professional organizations and individual practitioners it increasingly becomes evident that lifelong learning is an much needed investment and effective strategy to obtain state-of-the-art knowledge and to create transdisciplinary learning experiences enabling them to adapt to the changing circumstances and to create positive societal impact. Real estate educators increasingly will face the challenge to accommodate life learning needs and extend the traditional bachelor and master course with a variety of courses aimed at educating professionals. This paper addresses the substantive and didactic principles applied in the curriculum renewal of a Dutch post-master program Master City Developer (MCD), aimed at educating planning and real estate practitioners for the challenging job ahead. This two-year professional education program is organized by Erasmus University Rotterdam and Delft University of Technology with the aim to educate practitioners to strategically lead urban development projects. The current 20th course has seen a substantial curriculum change as part of an externally financed renewal project. The renewed course structure is based on ten consecutive modules, focusing on economy, transitions, governance, investment and finance, strategy and design, transformation, law, international development, research methods, and thesis. A major content shift involves the introduction of the urban transitions module, focusing on understanding spatial-economic implications of the mobility and energy transition within various scenarios. Moreover two new modules are added. The urban transformation module support students to understand, create and apply integrative strategies to complex inner-city transformation projects. The urban law module deepens the student's knowledge on contemporary spatial legislation and contractual law methods that assist them to effectively collaborate on planning and realizing urban projects. Besides the substantive change, various didactic principles and learning methods are introduced resonating with the latest academic insights on lifelong professional education: blended-learning, case-based learning, student-centered learning. Blended-learning involves purposely linking the weekly interactive face-to-face meetings with student flexible self-study preparations via diverse online learning materials including theme-based videos, self-assessment, and peer-to-peer assignments. Case-based learning evolves around studying one critical urban development case per module from specific theoretical perspectives, aimed at enhancing the student's ability to critically compare practices in order to

construct and apply management concepts and strategies for their own job. Student-centered learning factors in the growing need among professionals for relevant personal leadership skills, which is given shape by a personal development trajectory aimed at individual and collective reflective learning at the intersection of study and practice.



# ATTRACTIVENESS OF TERRITORIES: THE INTERNATIONAL REAL ESTATE CHALLENGE

Marzia Morena, Tommaso Truppi, Alberto Celani

**KEYWORDS:** real estate, attractiveness, territories, challenge

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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Real estate is a strategic framework for value creation in the territory; it is the infrastructure which generates innovation, employment, real value, social value and economies of scale in welfare services. In this scenario, Politecnico di Milano – Dip. ABC wants to be a leader and a promoter of innovation and change in real estate and does so through the consolidation of a structured network of synergies among universities, students, professors, operators, institutions, market demand, private and social private sector, by creating the REAL ESTATE CENTER.

## THEME I: REAL ESTATE EDUCATION





# ARTIFICIAL INTELLIGENCE WILL LEAD TO A RETHINKING IN REAL ESTATE EDUCATION

Bob Martens

**KEYWORDS:** information technology, knowledge exchange, text generation, performance assessment

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## THEME I: REAL ESTATE EDUCATION

The progressive integration of Artificial Intelligence (AI) in various areas of our lives raises a variety of questions and has considerable potential for polarization. The tension ranges from possibly exaggerated fears to unfulfillable hopes. Developments in the field of AI will certainly not leave real estate education unscathed. There is no doubt that text generation processes (using 'prompt' as an instruction/specification) are turning some areas of performance assessment within the framework of (academic) education upside down. This makes it considerably more difficult to determine whether certain learning skills have actually been acquired. No extensive or lengthy training is required to generate detailed 'answers' to any question using AI instruments. However, it is important to bear in mind that there is often a significant delay in keeping the knowledge base up to date. However, even in this environment, forecasting into the future would only be able to depict a supposed trend by means of extrapolation, as future developments have yet to take place. So far, even 'real estate bubbles' could not be predicted precisely. What other implications could there be for education? Final theses, where an exposé has to be prepared first, are particularly tricky. The automated generation of an overview-like presentation using AI is not rocket science. It would probably hardly be noticeable that it was not created by humans. Subsequently, it would also be possible to write individual chapters in a similar way. However, it would still be necessary to do the literature research yourself to a certain extent. Or would it even be worth considering simply adopting the discussion of the research situation from a similar work? After all, tools for checking the probability that AI components are present in a textual representation are also on the rise. However, it is important to bear in mind that text components can also be falsely identified as AI-generated due to an existing range of fluctuation.



## QUALIFYING FUTURE PROFESSIONALS; ASSURING COMPETENCE IN A CHANGING REGULATORY LANDSCAPE

Ian Jeal


**KEYWORDS:** competence, regulation, assessment, education

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

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The evolution of the surveying profession, and changes to skills and competencies requires new assessment approaches. This is just one finding from a two-year project reviewing assessments of professional of competence and regulatory requirements for Chartered Surveyors, led by the RICS Education and Qualifications policy team. The research and consultation exercise collected data from over 2,000 members and non-members of the Institution through an online survey, open and closed roundtables, and individual interviews. The final report will recommend substantive changes to professional qualification routes, including changes to undergraduate and postgraduate degree programs.

## THEME I: REAL ESTATE EDUCATION



# WHAT DETERMINES LOCAL HOUSING AFFORDABILITY? A DECOMPOSITION ANALYSIS OF RESIDUAL INCOME DISTRIBUTIONS IN GERMANY 2002 - 2018


Marco Schmandt

**KEYWORDS:** housing affordability, housing expenditures, residual income, RIF-decomposition

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## THEME Z: PHD SESSION

Using detailed survey data from the German micro census, I analyze changes in the distributions of housing affordability for renters in three local housing markets (Berlin, Cologne, Ruhr area). Despite (strong) real increases in rents, housing affordability, measured as the income net of housing expenditures (residual income), increased between 2002 and 2018 along the entire distributions in two of the three markets. I document that at the same time the socio-demographic (education, age, household size) and housing market compositions (locational quality, living space per person, mobility) changed in all housing markets and propose that these compositional changes could contribute to the observed increases of residual incomes. To assess the impact of compositional changes on local housing affordability, I apply a decomposition method based on recentered influence function regressions (Firpo, Fortin & Lemieux 2018) to decompose changes in residual incomes along the local affordability distributions into a part that can be attributed to compositional changes and a residual that must be attributed to changes in preferences and implicit prices. I show that at the local level and along the whole distributions, a major part of the increases of residual incomes is explained by changes in the composition of socio-demographic characteristics.



# ON THE PATH TO SUSTAINABLE CONSTRUCTION: EXPLORING ECONOMIC PROFILES IN THE EUROPEAN CONTEXT THROUGH ONE-STOP SHOP AND TURNKEY CONTRACT BUSINESS MODELS

Edda Donati


**KEYWORDS:** Turnkey contract business model, one-stop shop business model, economic profiles, sustainable business model

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## THEME Z: PHD SESSION

This study will analyze two of the most important sustainable business models in the construction sector, namely the One-stop shop and the Turnkey contract. The aim is to identify the elements which characterize each model, as well as their similar economic profiles. Since the early 1990s, the growing environmental awareness and the several directives issued by the European Union have led the different states to promote subsidies, tax rebates and sustainable business models aimed at reducing emissions and promoting sustainability in the construction sector. The One-stop shop model, which was developed following Directive 2018/844/EU, consists of a physical or virtual reference point where owners can access all the necessary information and services in order for their service providers to carry out the renovation projects. The Turnkey contract, on the other hand, is characterized by a contract whereby a single contractor warrants and provides all the premises, structures, tools, materials and operating personnel necessary for the completion and commissioning of the project. The main difference between the two models lies in the objective: while the One-stop shop focuses on improving the efficiency of existing properties, the Turnkey contract is instead intended for the construction of new buildings. The research is carried out in three phases, which entail: i) the collection of European case studies on the improvement of efficiency or new construction of real estate through these business models; ii) an exploratory analysis using Multiple Correspondence Analysis (MCA) in order to identify associations between variables in the dataset related to both the applied business model and the improved/constructed real estate; iii) a cluster analysis using the k-modes algorithm in order to define the economic profiles associated with the One-stop shop and Turnkey contract models. The research, therefore, aims to describe in detail two of the most used sustainable business models in the construction sector, as well as to illustrate how their application depends not only on energy-related factors, but also on economic and social factors that are characteristic of each European country.



# THE HOME BUYING AND SELLING PROCESS IN ENGLAND: WILL MANDATING MATERIAL INFORMATION UPFRONT REDUCE TRANSACTION TIMES AND FAILURE RATES?

Helen Price, Danielle Sanderson, Peter McLennan

**KEYWORDS:** residential property, real estate, failed transactions, completion times

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## THEME Z: PHD SESSION

The sale of residential real estate plays a significant role in the UK economy. In 2020 the economy benefitted on average by around £9,559 per transaction. An average of 1.25m transactions contributes nearly £12bn to GDP. 44% is directly attributed to the process, the largest proportion 33% arising from estate agent and conveyancing fees. 56% is generated after the sale of the property, from renovations, and household goods. Home buying and selling in England is widely acknowledged to be notoriously stressful. Consequently, since 1997, reform of the process has been high on various Governments' agendas, without success. In 1998 it took on average 77 days to exchange contracts (offer to completion) and 28% of transactions failed. In 2022, despite advances in technology, it took even longer, 132 days to exchange and 38% of transactions failed. The 2018 resurgence has three main objectives: to improve customer service; speed up transactions; and reduce the number of transaction failures. Utilizing previous Government research, this research investigates whether mandating information upfront will improve the process. The inclusion of a property condition report and reservation agreements will also be evaluated. Comparisons with other countries where the same shortcomings are not apparent will also be made. This research will use a mixed methodology to canvass the opinions of key actors and engage with consumers to record and comment on their journey through the process. The research will seek to demonstrate that the process and the dynamics of buying and selling are integrated. Buyers and sellers typically change homes simultaneously, so a "chain" is a characteristic of this "process." It is important to evaluate the complete process and the associated dynamics when implementing changes. This research will develop a conceptual framework of the housing purchase decision-making process for the English system and focus on the psychological factors impacting mandating information. The research also explores the impact of the latter on listing price, lender's valuation and sold price, as the time to complete as opposed to time on the market. This presentation will focus on the process, the causes of delay, and the theoretical framework.



# SOLAR POTENTIAL AND FINANCIAL PERFORMANCE OF REITS

Ben Höhn, Sven Bienert, Yannick Schmidt

**KEYWORDS:** net zero, decarbonization, transition risk, scoring model

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We introduce a comprehensive scoring model designed for both listed and non-listed companies within the real estate sector, offering a systematic approach to evaluate and benchmark their progress in achieving Net Zero commitments. The guide encompasses five distinct implementation categories, namely Targets, Strategies, Organizational Structure, Operational Measures, and Tracking/Monitoring/Reporting. These categories are identified through a prior qualitative study, which involves an extensive examination of Net Zero strategies and expert interviews. Utilizing these identified measures, we have developed a framework and executed an extensive survey involving ESG professionals in the industry representative of companies exceeding \$1,000 billion in AuM. The goal is to establish a ranking system for these measures, ultimately leading to the creation of a robust scoring system to assess holistic strategies. The implemented scoring system contributes to this initiative in three significant ways. Firstly, it streamlines the process for companies seeking to commit to net-zero carbon emissions by providing a structured evaluation framework. Secondly, it aids in pinpointing potential gaps in green actions within the strategies of these companies. Lastly, it enhances the transparency surrounding the quality of net-zero commitments, thereby mitigating the risk of (unintentional) greenwashing practices.

## THEME Z: PHD SESSION



# REAL-GPT: EFFICIENTLY TAILORING LLMs FOR INFORMED DECISION-MAKING IN THE REAL ESTATE INDUSTRY

Benedikt Gloria, Sven Bienert, Johannes Melsbach, Detlef Schoder

**KEYWORDS:** digitalization, LLMs, NLP, real estate

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In recent times, large language models (LLMs) such as ChatGPT and LLaMA have gained significant attention. These models demonstrate remarkable capability in solving complex tasks, drawing knowledge primarily from a generalized database rather than niche subject areas. Consequently, there has been a growing demand for domain-specific LLMs tailored to social and natural sciences, such as BioGPT or BloombergGPT. In this study, we present our own domain-specific LLM focused on real estate, based on the parameter-efficient finetuning technique known as Low-rank adaptation (LoRA) applied to the Mistral 7B model. To create a comprehensive finetuning dataset, we compiled a curated 21k self-instruction dataset sourced from 670 scientific papers, market research, scholarly articles and real estate books. To assess the efficacy of Real-GPT, we devised a set of ca. 5,000 multiple-choice questions to gauge the real estate knowledge of the models. Despite its notably compact size, our model outperforms other cutting-edge models. Consequently, our developed model not only showcases superior performance but also illustrates its capacity to facilitate investment decisions, interpret current market data, and potentially simplify property valuation processes. This development showcases the potential of LLMs to revolutionize the field of real estate analysis and decision-making.

**THEME Z:  
PHD SESSION**



## ASSESSING CLIMATE RISK QUANTIFICATION TOOLS - MERE FULFILLMENT OF DUTY OR ACTUALLY BENEFICIAL?

Hannah Salzberger, Ben Höhn, Sven Bienert

**KEYWORDS:** physical climate risk, quantification tools, fiduciary duty, fictive pan-European-portfolio

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## THEME Z: PHD SESSION

The real estate sector is confronted by escalating physical climate risks due to more frequent and severe extreme weather events from ongoing climate change. These risks impact habitability, energy consumption, and maintenance costs, with regulatory pressures threatening asset valuation. Real estate assets that do not address climate risks and fail to adapt to the changing market demands towards sustainable and resilient properties may experience reduced attractiveness and competitiveness. While climate risks have evolved into a pivotal consideration in transaction due diligence and regulatory compliance, the existing tools for risk quantification frequently encounter criticism for their perceived lack of transparency and comparability, stemming from divergent results. In response to the challenges regarding quantifying physical climate risk this research evaluates current methods of quantifying physical climate risks in real estate, considering criteria such as database quality, quantification methodology, transparency, actuality, scope, and geographical suitability. The study employs a two-step approach, initially gathering qualitative data through extensive literature reviews and interviews with tool providers. In the subsequent phase, a quantitative analysis is undertaken using identified tools to assess the physical risk within a predetermined fictive pan-European real estate portfolio, containing approximately 360 assets. By synthesizing tool outcomes with qualitative insights, the research delves into hazards' predictability, country-specific differences, and evaluations of tool classes. Leveraging Ordinary Least Squares (OLS) regressions, the study further endeavors to categorize hazard contributions to predicted total asset loss, providing nuanced and comprehensive insights crucial for risk assessment in real estate decision-making. Overall, the study aims to make several contributions to the field, including an overview of available tools used by market participants, criteria for assessing climate risk tools (with a focus on the real estate industry), and identification of the strengths and weaknesses of different approaches. It is also determined whether an 'all-in-one' tool is efficient enough or whether a more reliable but time-consuming result is achieved by using specialized tools. Finally, it also provides guidance for financial decision-making.





# SPATIAL RESILIENCE IN HEALTHCARE: EXAMINING THE NEXUS BETWEEN MEDICAL RESOURCE DIVERSITY AND REAL ESTATE PATTERNS

Yu-An Yang, Tony Shun-Te You

**KEYWORDS:** medical resource accessibility, real estate market, hierarchical healthcare facilities, population structure

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## THEME Z: PHD SESSION

Resilience, defined as the ability of a system or community to rapidly adapt, recover, and maintain functionality in the face of stress, disasters, or changes, holds paramount significance in the healthcare domain. This study explores the application of resilience concepts to fortify the healthcare system's capacity to address diverse challenges and crises. The research focuses on the intricate interplay among medical resource diversity, population distribution, and real estate dynamics, delving into the spatial patterns of healthcare configurations. Medical resource diversity, encompassing various healthcare institutions and specialties, plays a crucial role in meeting diverse healthcare needs. Often considered an indicator of urban development, medical resources are reflected in the capitalization of real estate. Employing an integrative methodology involving multi-stage spatial data mining and a two-stage floating catchment area approach, this research evaluates the current spatial proximity of overall medical resources in vertical healthcare supply and medical specialties. The study, based on distinct population structures, assesses developmental disparities and current distributions of medical resources across regions, ensuring rational resource allocation. To provide a comprehensive understanding, the study emphasizes the impact of healthcare configurations on real estate dynamics. It employs multi-scale geographically weighted regression analysis to examine how medical resource diversity, spatial distribution, and proximity influence real estate prices in nearby communities. The discussion underscores the intricate relationships between healthcare configurations and real estate dynamics, providing valuable insights for optimizing resource allocation, enhancing community well-being, and understanding the broader capitalization implications. This research is funded by the Ministry of Science and Technology 111-2410-H-305 -055 -MY2.



## **BREAKING DOWN THE REIT MARKET: IS SOCIAL MEDIA CAPABLE OF PREDICTING A REITS' PERFORMANCE?**

Sophia Bodensteiner, Lukas Lautenschlaeger, Wolfgang Schäfers

**KEYWORDS:** Twitter, REITs, sentiment analysis, machine learning

Citation Links: [EndNote Tagged](#) - [RIS](#) - [EndNote XML](#)

DOI: [10.15396/eres2024-090](https://doi.org/10.15396/eres2024-090)

Twitter is established as a major platform for sharing information and opinions online. This research explores the impact of the sentiment expressed on Twitter on the indirect U.S. real estate market, particularly focusing on financial metrics such as returns and volatility. It analyzes how Twitter sentiment correlates with the overall indirect market and additionally focuses on the corporate level, investigating if general findings are also applicable on an individual company basis. Given by the nature of Twitter messages, comprehensive natural language processing is applied to clean and identify relevant posts and to provide the foundation for extracting the sentiment. The complex linguistic features of the given informal language are handled by using three different approaches for classification including traditional and advanced machine-learning methods. Preliminary results suggest that social media sentiment holds predictive value for both market trends and corporate-level changes. Moreover, they indicate towards changing dynamics in the impact of market sentiment on performance metrics during a crisis, exemplified by the 2020 COVID-19 pandemic. This research additionally highlights the effectiveness of classical dictionary-based approaches for sentiment analysis but also shows the capabilities of more sophisticated classifiers.

## **THEME Z: PHD SESSION**



## NEW WORK PATTERNS AND HOUSING LOCATION CHOICES

Xiaodan Liu, Anupam Nanda, Sotirios Thanos

**KEYWORDS:** work from home, housing location choice, new sorting, England

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Distance and commuting costs are well established as key determinants of location choice for a place of work and a place of residence. Technological changes in recent decades have greatly affected these factors. Triggered by the COVID-19 pandemic, there is now widespread adoption of various forms of flexible working, work-from-home (WFH), and hybrid working, and those are expected to continue to shape working patterns. As workers are increasingly able to choose residence locations farther away from the place they work, it raises a significant question: how are urban markets affected by the introduction of new ways of working? In this study, a spatial equilibrium model is employed with data from all regions of England to analyze changes in the distribution of population and income and their impacts on real estate markets, considering household heterogeneity and local amenity diversity. We also analyze the implications of this new sorting and look at the possibility of the inequality gap widening due to varying levels of access to new work patterns. This research has substantial implications for policymaking and investment decisions.

**THEME Z:**

**PHD SESSION**



# EXPLORING THE SECONDARY MARKET OF REAL ESTATE TOKEN - AN EMPIRICAL ANALYSIS

Heiko Leonhard, Ralf Laschinger, Wolfgang Schäfers

**KEYWORDS:** real estate token, tokenization, digital assets, secondary market

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The tokenization of real-world assets is one of the fastest growing innovations in blockchain technology within the financial landscape. It is poised to redefine the current paradigm in how we fund, trade, and manage assets. Its disruptive potential is particularly significant for traditionally illiquid assets, such as real estate. One of the main promises of tokenization is the improvement of accessibility, liquidity, and tradability. Therefore, a functioning and lively secondary market is a necessary requirement. We observed 342 real estate tokens in the USA traded between 2021 and 2023 across various marketplaces. Based on 2,429,220 blockchain transactions, we analyze the market structure of real estate tokens and the dynamics of liquidity, tradability, and their determinants. Our study is the first comprehensive empirical investigation into secondary market activities and liquidity for real estate token. This research provides guidance for real estate token investors, business actors, and regulatory entities on the practical functioning and the maturity of the nascent secondary markets for real estate tokens.

## THEME Z: PHD SESSION



# DYNAMICS OF REIT RETURNS AND VOLATILITY: ANALYZING TIME-VARYING DRIVERS USING AN EXPLAINABLE MACHINE LEARNING APPROACH

Hendrik Jenett, Maximilian Nagl, Cathrine Nagl, S. McKay Price,  
Wolfgang Schäfers


**KEYWORDS:** REIT return, volatility, machine learning, neural network

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In the current context of heightened market tensions driven by rising interest rates, there is vital interest for both researchers and practitioners to understand the dynamics of Real Estate Investment Trust (REIT) returns and their accompanying uncertainties. To address this concern, we examine the drivers of REIT returns and volatility in a time-varying framework, spanning the modern REIT era (1991 to 2022). Our study is the first to simultaneously forecast both REIT returns and their associated volatility using an artificial neural network. We contribute to the literature by opening the black-box character of neural networks, enabling the identification of individual feature impacts on predictions and their evolution over time. The key focus revolves around understanding how the influence of accounting and macroeconomic variables changes during periods of financial crises compared to non-crisis periods. The results showcase superior predictive capabilities of the neural network compared to conventional regression models. We shed light on the intricate interplay of diverse variables influencing the performance of REITs. Our findings hold implications for investors, policymakers and researchers navigating the complex landscape of real estate investments in a dynamically evolving market environment.

**THEME Z:**  
**PHD SESSION**



# TRANSFORMING AGED EDUCATION BUILDINGS THROUGH CIRCULAR RENOVATION: FROM A MULTIFACETED CASE STUDY ANALYSIS IN THE NETHERLANDS

Fujing Ma, Torsten Schröder, Juliette Bekkering

**KEYWORDS:** circular economy, circular design, zero-energy renovation, architectural transformation

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## THEME Z: PHD SESSION

Background: In the building industry, the concept of the circular economy is gaining a lot of importance, as the construction industry has a very high environmental impact (operational and embodied, energy consumption, and related CO<sub>2</sub>eq emissions, material consumption, waste generation, etc.) increasingly concerned with energy-saving and CO<sub>2</sub> reduction during the construction and operation phases of buildings, i.e. reduction of raw materials and reduction of residues and waste. The Dutch government declared an ambitious goal: to have the building industry 100% circular by 2050. In this context, circular design and circular renovation play a crucial role in reaching the government's goals.

The research's goals: This research aims to explore how to optimize the energy efficiency and circular renovation associated with educational building renovations in the context of climate change. We aim to maximize the use of existing buildings and combine the following three strategies: First, to develop a transferable circular design strategy for educational building renovations. These include "circular design" to transform educational buildings (bio-based material design, reuse design, demountable design, etc.). Second, to develop zero energy renovation strategies (investigations into building envelope improvements, HVAC and the integration of renewable energy sources, etc.), and third, to develop architectural transformation for future learning environments (flexibility, adaptability, materiality, and programmatically diversity, etc.).

Methods: The research adopts a mixed-method qualitative approach comprising analysis of multiple-case studies to extend theoretical knowledge and framework by integrating strategies and measures from real-world cases. The selected cases are exemplary for implementing circular principles in the building or sustainable renovation. This research selects six building cases and analyzes and summarizes the circulation strategies of Matrix (by ir. S.J. Van Embden), Neuron (by ir. S.J. Van Embden), Floriade (by DP6), Circl (by de Architekten Cie), Echo (by UNStudio), and Emergis (by Emergis Living Lab).

Results: This research will analyze and compare these building cases to analyze and summarize the circulation strategies of Matrix, Neuron, Floriade, Circl, Echo, and Emergis, and show results in diagrams. To inform design practices that not only enhance energy efficiency and reduce environmental impact but also contribute to creating educational spaces that are adaptable, sustainable, and conducive to diverse learning needs.



## ASKING PRICES AS PROXY FOR TRANSACTION PRICES? NEW EVIDENCE FROM THE BERLIN HOUSING MARKET

Tobias Just, Daniel Oeter

**KEYWORDS:** residential real estate markets, housing, transaction prices, asking prices

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With increasing data availability through online real estate listing platforms more and more asking price data is used in research as a proxy to investigate price dynamics in real estate markets. This practice is facing criticism with regard to the robustness of the results generated, as asking price data only provide a biased picture of the underlying dynamics due to possible deviations from the price actually paid (transaction price). There has been limited research, whether the spread between asking and transaction prices is systematic or erratic. This study adds to this literature by being the first paper to analyze the relationship for a large data set of micro locations of the Berlin housing market. We analyze two unique data sets from the Berlin Expert Committee for Property Values and Immoscout24, containing all registered transaction and asking prices between 2007 and 2022. With the available variables, we are able to create distinctly assignable transaction/offer price pairs for almost all observations in the dataset and therefore estimate representative spreads in Germany's largest housing market.

**THEME Z:  
PHD SESSION**



# TENANT PREFERENCES AND DECISION-MAKING IN GREEN BUILDING SELECTION: AN ESG PERSPECTIVE

Bowen Yan

**KEYWORDS:** sustainable real estate, green building certification, tenant preferences, ESG in commercial property

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## THEME Z: PHD SESSION

Environmental, Social, and Corporate Governance (ESG) has garnered significant attention in the economic realm, yet its exploration within the real estate sector, particularly in the London office market, remains under-researched. This paper delves into the influence of ESG factors on the London office market, scrutinizing the dynamics from both occupiers' and investors' perspectives. Employing a quantitative methodology, the study meticulously examines various facets: the inclination of tenants across diverse industries to lease green buildings, the interplay between a firm's ESG rating and its occupancy costs, the impact of ESG performance on attracting and retaining tenants, and the influence of ESG considerations on rental pricing strategies. Preliminary findings suggest a positive correlation between ESG ratings and occupancy costs, highlighting that offices with superior BREEAM ratings command significant rental premiums. Additionally, the research uncovers a heightened willingness among tenants in specific sectors to pay a premium for green features. By integrating stakeholder theory, the study offers a comprehensive view of the London office market's societal role, underscoring the imperative of creating value for all stakeholders. The insights from this research augment the understanding of ESG's importance in the London office market and hold substantial implications for real estate professionals, investors, and policymakers pursuing sustainable and socially responsible real estate practices.





# URBAN PULSE OR SUBURBAN EASE: UNVEILING THE FUTURE OF OFFICE LOCATIONS

Hannah Salzberger, Tobias Just


**KEYWORDS:** spatial allocation, office location, monocentric city model, aggregated travel costs

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## THEME Z: PHD SESSION

Following the Covid-19 pandemic, the future of office buildings has become a popular topic, heightened by the pervasive adoption of the work-from-home model. As remote work transitions from being a rare obscurity to a part of daily routines, the spatial dynamics of office locations undergo a profound reassessment in terms of cost-benefit analysis for central and peripheral office space. This research presents a model that illustrates the optimal or minimum aggregated travel cost location based on distinct working modes. Initially, a city model is introduced, operating on the premise that individuals prioritize proximity to their workplace. The central focus revolves around the dichotomy between central business districts (CBD) and peripheral office locations, envisioning at first a monocentric city with higher population density near the CBD. This framework compares aggregated commuting costs to the CBD against those associated with travel to peripheral office locations. Subsequently, four satellite office locations are evaluated in relation to the Central Business District (CBD) based on their aggregated commuting costs. The analysis distinguishes between two distinct working models: team-dependent tasks and tasks that can be performed independently, suggesting a transformative shift in the role of office spaces towards collaborative hubs on the one hand and traditional space facilitating single-desk office work. A simulation is employed to vary team sizes, determining whether, for each size and working model, offices are better situated in the city center or on the outskirts. By contributing to the ongoing discourse on the evolution of office spaces, this study aims to provide valuable insights into the optimal office location based on commuting costs, considering the nature of collaborative and individual work models.



# TOURIST CITIES AND RESIDENTIAL REAL ESTATE: TOWARDS A SPATIAL- TEMPORAL VALUATION FRAMEWORK FOR MARKET VALUES

Eugenio Muccio, Hilde Remoy, Maria Cerreta


**KEYWORDS:** tourist cities, housing prices, real estate market values, short-term rentals

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## THEME Z: PHD SESSION

In the active landscape of contemporary urban development, the intricate interplay between tourism dynamics and the real estate market has emerged as a critical area of concern. Tourist cities, characterized by their diverse urban functions and services, face complex phenomena that reverberate through the real estate markets. This research addresses the need to make explicit and quantify the impacts of tourism on residential real estate values within the context of these multifaceted urban environments. The purpose of this work is further to spatially evaluate the urban impacts on housing prices resulting from tourism dynamics, taking into account the shift of residential real estate from the ordinary market to the short-term market. By tracking changes over time, this research aims to unveil the spatial patterns and trends in real estate market dynamics in response to touristification processes, ultimately assessing the correlation between tourism dynamics and housing prices change. This work is part of a research that aims to develop a valuation framework that enables decision-makers to understand and visualize the complexities of tourism and real estate issues comprehensively. This integrated approach acknowledges the need for decision-makers to navigate the intricate relationship between tourism and real estate values relying on robust multi-scalar and multi-dimensional monitoring tools, offering a practical solution for informed policy formulation and urban planning strategies. The research methodology considers a data-driven approach in a GIS environment, within the perspective of developing an innovative Spatial Decision Support System (SDSS) capable of informing decision-makers in a structured way by means of a spatial-temporal analysis of market values to be overlaid with different variables (housing market, short-term rentals, activities development and cultural processes). These issues are addressed through a case study of Rotterdam, starting from a mapping conducted from fine-grained spatial data on housing transactions over the past dozen years. The resulting maps, obtained through specific data aggregation procedures and classification methods, show the overlay of the considered variables, bringing out spatial patterns, new tourism hotspots and areas of (non-)homogeneous growth with respect to short- and long-term market values, facilitating an effective way of reading the city and its complex evolutionary dynamics. This work provides an advancement in implementing a variable set for evaluating real estate evolutionary dynamics of tourist cities within a spatial-temporal framework, acknowledging such a tool as a key instrument for fostering sustainable urban development models, providing actionable insights for informed decision-making in the complex intersection of tourism and real estate.



## SERENITY OR CAUSE FOR CONCERN? REAL ESTATE INVESTORS' RESPONSE TO POLITICAL UNCERTAINTY

Julius Range, Lars Jagemann

**KEYWORDS:** real estate development, spatial regression, uncertainty measures

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This study examines the linkage between political uncertainty and residential real estate market behavior in Germany. Using spatial regression techniques to address neighborhood spillover effects, we identify county level residential real estate transaction activity to be negatively associated with increased political uncertainty. We measure political related uncertainty by applying the media-based Uncertainty Perception Index (UPI). We find the results to appear robust in various applied regression specification. Controlling for a broad range of market fundamentals, we find rural areas to be influenced significantly stronger by increasing political uncertainty than urban areas. Further, we use the quarterly flow of building permits to isolate the effect of uprising uncertainty on residential construction activity. Our results indicate a strong negative impact of political uncertainty on issued building permits. The results suggest that political uncertainty not only has a significant impact on the behavior of real estate investors, but also on residential developers.

**THEME Z:**  
**PHD SESSION**



# LEGAL POSSIBILITIES OF USING AI IN REAL ESTATE VALUATION – POLISH PERSPECTIVE

Dominik Wasiluk


**KEYWORDS:** property valuation, automated valuation models, artificial intelligence, real estate appraisers

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AI-based automated valuation models (AVMs) exhibit best among all types of AVMs and truly commercially-viable qualities. Therefore for many professionals the use of AI algorithms for property valuation seems to be a natural progress and a necessity in this field. However the application of AI to property valuation raises a number of questions of a legal nature. First and foremost, is the use of AVM by appraisers to perform valuation reports allowed under current legal regulations? In my paper, I will present an analysis of Polish legal provisions regarding real estate valuation and prove that, unlike in many other European countries, they have almost explicitly allowed the use of AVMs by appraisers, including those based on artificial intelligence, for many years. In the second part of the report, I will present my conclusions on the professional liability of an appraiser for possible AVM errors. In order to investigate both research problems, I use linguistic and hermeneutical analysis of law, which I supplement with sociological methods - in-depth interviews with Polish property appraisers. Finally, based on an extensive literature review and international industry standards, I will present a proposal on how an appraiser should assess the quality of an AI-based AVM, both before and during its use.

**THEME Z:**  
**PHD SESSION**



# THE PLATFORMISATION OF THE PROPTech AND REAL ESTATE INDUSTRY - WHAT ARE THE DETERMINANTS OF SUCCESS FOR DIGITAL PROPTech PLATFORMS?

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**KEYWORDS:** platform economy, PropTech, digital transformation, success factors

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The increasing dominance of big tech companies has resulted in a surge of digital platformisation across various industries, including real estate. According to the annual PropTech Germany study, as an example, around 33% of PropTechs reported using a platform as their fundamental technology and business model in 2023. In 2021, the share was even 69%. The real estate sector in the DACH region has few dominant platform structures, particularly in the B2B market. The platform economy has the potential for significant disruption across sectors. Its characteristics can lead to oligopolistic market structures, especially if indirect network effects are used and a critical mass of users is reached by solving the chicken-and-egg problem. Academic research has examined individual success factors of digital platforms. However, this research has often been limited to qualitative analyses. This paper aims to fill a research gap in the literature by using extensive datasets to identify the success factors of digital platforms. The study focuses on examining individual characteristics of platform features that are still lacking in the scientific community, using a quantitative approach. Two different panel datasets from the PropTech industry in the DACH region will be analyzed. The first stage involves developing hypotheses about the factors that contribute to success and identifying different clusters of digital platforms within the real estate industry. This will be done analytically, based on the first panel dataset and relevant literature. The second panel dataset will then be used to test these hypotheses quantitatively by incorporating individual characteristics of platform features. Results will be derived for the DACH region. The methodological design and suggestions will also be relevant for further international studies. This working paper is designed for the ERES PhD sessions. The discussion will focus on the study's initial empirical results and methodological design.



# HOUSING AFFORDABILITY IN POLAND

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**KEYWORDS:** housing affordability, housing affordability index, housing policy

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The affordability of housing in Poland has been declining in recent years. According to data from the National Census, the population of Poland in 2021 was more than 38.036 million, while the number of housing units was more than 15.227 million. Using the indicator of the number of housing units per 1,000 residents, it can be calculated that the numerical dimension of housing availability is 400.35, of which 12.1% are unoccupied. The average size of housing stock for EU countries is 501.95 housing units per 1,000 citizens. Which means that Poland does not compare well in this comparison. There are many reasons contributing to this situation, such as the rising cost of housing, the increase in mortgage interest rates, and the country's housing policy. In Poland, the insufficient number of dwellings is a serious social, economic and political problem. Also under discussion is how to measure housing affordability. Previous methods were based mainly on the economic aspect, while as described above in this also represents a social and political problem. The main reason for addressing this topic is the ever-increasing problem of housing affordability and the ongoing debate in the scientific and political community over the shape of Polish housing policy. The main problems of Polish housing policy are the lack of a coherent housing policy, lack of stability and long-term action. The main objective is to identify recommendations and courses of action for Polish housing policy that could help improve the housing situation of Polish society.

## THEME Z: PHD SESSION



# EVALUATING THE BARRIERS TO TURKEY'S TRANSITION TO LOW- CARBON ENERGY

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**KEYWORDS:** energy transition, low carbon energy, energy policies, Fuzzy AHP

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The most crucial issue that urgently needs to be addressed for the problems of global warming and the greenhouse effect is carbon emissions. Carbon emissions are extensively generated throughout all stages of the building life cycle, from material production to building design and operation. Therefore, it is essential to rapidly develop and adopt low-carbon design methods. The aim of this study is to identify the challenges faced by Turkey in the transition to low-carbon energy, prioritize these challenges, and highlight the key factors of strategic importance for the effective implementation of energy policies. In the initial phase of the study, challenges in transitioning to low-carbon energy were classified through a literature review, and criteria were established. Subsequently, these criteria were compared through a focus group study. Binary comparison results were then used to obtain an equation based on weighting through the Fuzzy Analytic Hierarchy Process (FAHP) method, determining the challenges in Turkey's energy sector and their priorities for transitioning to low-carbon energy. The findings are crucial for understanding and producing strategic solutions to the obstacles in achieving energy-efficient transitions in Turkey. Furthermore, the results of the study encompass insights for transitioning to high-energy performance buildings. The analyses conducted to identify the key factors in Turkey's transition to low-carbon energy are strategically important for ensuring the effective implementation of energy policies. The outcomes of this study will serve as a valuable guide for policymakers and industry experts to comprehend and address the difficulties encountered in Turkey's energy transformation.

## THEME Z: PHD SESSION



# CORPORATE SOCIAL SUSTAINABILITY: A STUDY ON TURKISH REAL ESTATE COMPANIES

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**KEYWORDS:** corporate social sustainability, sustainability, ESG, real estate companies


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Corporate social sustainability is an approach aimed at minimizing environmental and social impacts while sustaining economic activities of businesses and fulfilling responsibilities towards society. This approach not only aims to generate profit but also endeavors to preserve environmental resources, be sensitive to societal needs, and create long-term sustainable value. Corporate social sustainability encourages businesses to operate in an environmentally and socially sensitive manner, moving away from a sole focus on profit. The real estate sector, while shaping the physical fabric of cities and societies, is also a significant sector that needs to be mindful of its environmental impacts. Real estate properties contribute to a certain percentage of environmental issues due to factors such as energy consumption, water resource utilization, and waste management. In this context, real estate companies are required to embrace and implement corporate social sustainability principles to reduce environmental impacts and meet societal needs. Practices such as green building design, energy efficiency measures, and waste management systems constitute a significant part of sustainability efforts in the real estate sector. Thus, real estate companies contribute to a sustainable future by both mitigating their environmental impacts and operating in a socially responsible manner. Within the scope of this research, the aim is to evaluate the perspectives of real estate companies operating in Turkey regarding corporate social sustainability and their efforts in this regard. To achieve this aim, a closed-ended survey was conducted targeting real estate companies listed and unlisted on the stock exchange in Turkey. The research is deemed beneficial in shedding light on the perspectives of real estate companies operating in Turkey towards sustainability and informing policymakers about measures to be taken at the company level to promote sustainability.





# INFLUENCE OF LIFESTYLE MANAGEMENT ON THE INCREASE OF HOUSEHOLD ENERGY SELF-CONSUMPTION

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**KEYWORDS:** energy self-consumption, net-billing, lifestyle management, photovoltaic installation

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**Purpose** - This study aims to examine the satisfaction of photovoltaic installation users with the facilities they were provided and the whole process of energy production from the sun. Secondly, their attitudes towards increasing self-consumption of the energy that is being produced in their households were under question combined with their readiness to buy new equipment to grow the demand for the energy for their own needs. Finally, a trial to look at the prosumers' moods towards changing law circumstances was undertaken showing the possible future of net-billing/dynamic regulations regarding the process of buying/selling of the produced energy.

**Design/methodology/approach** - To undertake the research a survey among photovoltaic installation users was conducted. The questionnaire consisted of 31 questions which after being formulated were sent to 9 directly chosen PV owners to evaluate them and to make needed amendments. After clarifying minor ambiguities the final version of the survey was administered via the Internet among members of different groups gathering energy prosumers. As the answers were being collected without remuneration and among random participants it is considered to ensure the credibility and impartiality of the research.

**Findings** - The results show that most PV users are satisfied with their installations and do not encounter major technical problems. More than 90% of them reckon the facilities as cost-effective and what is very important at least 20% among them has contracts already on net-billing rules which are less beneficial. Around 70% of respondents try to use the energy in the peak hours of production and nearly 60% adapt their lifestyles to the rhythm of energy production. However, only 36% consider buying/installing new energy sources to increase the level of energy self-consumption.

**Originality/value** - Compared to other studies of this kind that had been previously conducted in various countries, this research was undertaken in the environment of changing law circumstances which gives a lot of valuable data. Moreover, while the past studies focused mainly on the other factors determining the development of photovoltaic installations, this survey examined the dependence between lifestyle management and people's attitudes on the increase of household energy self-consumption, thus showing its indirect influence on the development of PVs.

## THEME Z: PHD SESSION



## LEADING INDICATORS IN QUANTILE INDEX PERCENTILE

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**KEYWORDS:** quantile index, machine learning, time series, leading indicators

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This paper aims to investigate whether quantile price indices for residential real estate possess specific percentiles that drive others. The data used is composed of 133,108 residential real estate transactions from Warsaw, Poland, spanning from 2005 to 2022. To address the inherent noise and volatility in real estate data, characterized by thin markets and asset heterogeneity, we test four distinct quantile index methodologies. These include a standard quantile index, a frequency conversion technique via the Generalized Inverse Estimator (Bokhari and Geltner, 2010), a Recentered Influence Function (RIF) approach (Firpo, Fortin, and Lemieux, 2009), and a combined method utilizing both the frequency conversion and RIF technique. To investigate the existence of leading percentiles, we use a Lag-weighted Lasso Vector Autoregressive (VAR) model with a two-quarter lag. Our findings indicate that the combined method yields the most stable quantile index. Further analysis reveals that the 70th percentile is the leading indicator, as evidenced by non-zero VAR coefficients for this percentile alone. This suggests heightened informational efficiency among economic agents within this percentile, likely due to increased financing risk and transaction values. This research contributes to understanding the dynamics of real estate markets and the predictive power of quantile indices.

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The European Real Estate Society (ERES) was established in 1994 to create a structured and permanent international network between real estate academics and professionals across Europe. The Society is dedicated to promoting and advancing the field of real estate research. Incorporating many national property research societies, academic researchers and real estate practitioners, ERES provides a forum for information flow and debate on research issues. The ERES Annual Conference is the leading real estate research meeting in Europe, usually attracting more than 250 delegates. In addition, ERES organizes Industry Seminars and Education Seminars on a regular basis. The Journal of European Real Estate Research is published in partnership with ERES.

The ERES organization is managed by an all-volunteer team. The Society is a non-profit organization affiliated with regional sister societies of the International Real Estate Society (IRES) network, which represents all continents throughout the world.

The objectives of ERES are:

- Real Estate Research - to encourage research and promote education in real estate and closely allied areas, especially in European Countries.
- Connect Researchers - to improve communication and exchange information in real estate and allied matters among college/university faculty members and practitioners who are teaching or engaging in research in property, real estate and land use.
- Facilitate Collaborations - to facilitate the association of academic, practicing professional and research persons in the area of real estate and closely allied areas.
- Encourage Professionalism - to encourage professionalism in practices related to real estate and closely allied areas as well as other activities promoting the purposes of ERES.
- Real Estate Research Events - to organise events where researchers and educators in the broad area of real estate can interact.
- Real Estate Research Forum - to organize events where researchers and decision-makers from both academia and practice can exchange their views with respect to the research needs in the field of real estate, but also discuss the best ways of using research results to enhance decision-making in the field to promote in any other feasible way the development of real estate research and education in Europe.

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