Introduction

The Cambridge Real Estate Research Centre (CRERC) co-ordinates and acts as a focus for applied research in real estate within the Department of Land Economy and across the University of Cambridge. It has two principal aims: (i) to ensure that real estate research in the University is ‘world class’ and (ii) to raise the profile and impact of real estate research by members of the University in the wider academic, policy, and business communities. The Centre works with other academic organisations, professional bodies, and industry partners to ensure that research is high-quality, impactful, and industry-relevant.

Research on real estate within the Centre is broad-ranging and international in scope, focused on the key issues for industry and our partner organisations. The Centre’s current main areas of research activity relate to:

- analysis of real estate as an investment
- the interaction of real asset and credit/capital markets and the wider economy
- loan and mortgage finance
- sustainability and environmental performance
- digital and machine learning technology and its use in real estate
- behavioural influences in finance and decision-making processes

The Centre is extremely grateful for the support, financial and otherwise, of partners and supporters including the Cambridge Land Economy Advisory Board (CLEAB).

This Annual Report gives an overview of the Centre’s activities during 2023 and highlights key initiatives and priorities for the future.

Resources

The Centre continues to act as a hub for the various data sources available on real estate for staff and students, and is actively engaged in discussions for new and improved data sources. If this is something you are interested in, please email us at crerc@landecon.cam.ac.uk.

Looking Forward

The Centre aims to build on its strengths and successes as outlined in this report to enhance its position as a leading centre of rigorous and relevant research into real estate markets.

We will seek further funding and partnerships to help address important challenges for the industry and policymakers.

We will bring together researchers and practitioners to explore emerging issues in the market, new sources of data, and new analysis techniques. As a hub for international research, we will bring researchers (both academic and professional) to Cambridge as visitors, as associate members of the Centre, and through conferences, seminars, and meetings.

We will continue to actively seek high-quality doctoral students interested in undertaking research in our priority areas and are keen to find supporters to help us overcome funding constraints for these research students.
Research Themes and Priorities

1.0 Real Estate as an Investment:

1.1 Long Run and Cycles:
Real estate plays a major role in global wealth and the economy. Our research explores how real estate has performed as an investment over the long and very long run as well as the drivers and indicators of cycles and shorter term performance. The aim is to inform discussion in the industry about the realistic net returns in the asset class and help inform policymakers, including those responsible for financial stability.

1.2 Real Estate Investment in a Multi-Asset Context:
This work explores the drivers of risk and return in real estate and how they differ from other asset classes. It explores some of the trends impacting on the real estate market in different sectors, notably the influence of technology and changes in working and consumption patterns. It also examines a number of approaches to identifying both known risk factors and uncertainties in investment and how to integrate real estate into multi-asset class frameworks.

1.3 Structures and Vehicles for and Ownership Patterns/Globalisation of Investment into Real Estate:
It is increasingly recognised that the risk and return of real estate depends not only on the income and capital appreciation of the underlying assets, but also on the vehicle in which the properties are held. This research explores how different characteristics of investment funds and vehicles, their capital structures, and other features influence risk and performance and the overall efficiency of real estate markets. It also explores changing ownership patterns and the implications of capital flows on market performance and values.

1.4 Non-Traditional Real Estate Investments:
As real estate investment changes with greater lease flexibility and increased investment in residential and other non-traditional sectors such as life sciences, data centres, etc., this research explores the risks and performance of these emerging investment sub-sectors and how these influence how real estate fits within wider investment portfolios.

2.0 Technology, Data, and Machine Learning:
Sensors, imaging and other new sources of data provide new sources of information for real estate analysis. This stream of work explores how new techniques and new sources of data can be used to identify characteristics and preferences that might influence attractiveness, demand, and ultimately pricing.

3.0 Sustainability, Resilience, and Performance:
The Centre researches sustainability and real estate markets at different scales—energy performance and environmental sustainability at building level and its link to value and return, complemented by a broader perspective on sustainability and urban resilience.

4.0 Locational Choice, Urban Development, and Regeneration:
This theme looks at a range of issues related to how individual properties and developments perform and the wider context for local economic performance including interaction with local economies, infrastructure and policy.

5.0 Behavioural Economics, Perceptions, and Decision-Making:
Decisions by private and institutional investors are influenced by beliefs, attitudes, and perceptions, many of which result in suboptimal or irrational decisions which are difficult to reconcile with standard finance and economic theory. This research area seeks to quantify the extent to which the aforementioned factors play into the decision-making process of various agents in housing, land, and capital markets and to find ways to improve these decisions.

6.0 Housing Finance:
This research looks at a range of issues in housing markets and housing finance including individual choices, factors that influence housing outcomes and how policy interacts with housing markets.
Our People

The Centre is led by Nick Mansley (Executive Director of CRERC and Course Director for the MSt in Real Estate) and draws together the wide-ranging interests and world-leading research expertise of a number of Department of Land Economy staff.

Nick Mansley draws on extensive experience in investment management including as head of the global multi-manager business at Aviva Investors, responsible for c. $20 billion of investments across all asset classes, as well as a long track record of applied economics and real estate research.

Prof Colin Lizieri is Emeritus Professor of Real Estate Finance. He was previously Grosvenor Professor of Real Estate Finance and served as Head of the Department of Land Economy from 2016 to 2019. For over 40 years, he has advised international bodies, governments, professional bodies, and private organisations on real estate investment, and he has published widely on real estate finance, investment risk management, and office market dynamics.

Prof Thies Lindenthal is the new Grosvenor Professor of Real Estate Finance. He works on real estate performance in the very long term and researches the impact of technology on the analysis and behaviour of property markets.

Prof Helen Bao is a Professor of Land Economy at the Department and a Fellow at Newnham College. Helen’s research focuses on government policy and interventions that facilitate market operations and mitigate market failures in urban settings. She specialises in the application of behavioural insights and hedonic price modelling in land and housing markets, and has strong links with Chinese state and private organisations, research institutes, and real estate investors.

Prof Franz Fuerst is Professor of Real Estate and Urban Economics at the Department and a Fellow at Trinity Hall. His research interests include ‘green’ real estate economics, financial analysis of sustainable investments, portfolio and risk management, real estate market forecasting, and spatial economics.

Dr Özge Öner is an Associate Professor in Spatial Economics and Real Estate at the Department and a Fellow at Sidney Sussex College. Her research is focused on Urban and Regional Economics and deals with issues related to migration, labour mobility, micro-geography of segregation and ethnic enclaves, retail and service geography, urban amenities, the geography of entrepreneurship, and political geography.

Dr Carolin Hoeltken is a Senior Teaching Associate in Real Estate, Economics, and Finance at the Department and a Cambridge University Land Society Fellow. Her research interests include housing economics, household finance, and economic and urban history.

Dr Zilong Wang is a Senior Research Associate. His research specialism is Finance and Risk. He also teaches quantitative methods for the MSt in Real Estate. Prior to undertaking his PhD, Zilong worked in investment banking as a financial analyst.
PhDs

In line with the Centre’s goal of fostering excellence in the real estate research community, CRERC members supervise the research projects of number of PhD students. Current PhD students associated with the Centre are:

- **Thuqan AlHindawi**: Can BD/ML techniques enhance real estate markets’ transparency by providing a more efficient/robust way to examine the risk/return profile of real estate as an asset class?
- **Floris Blok**: Alpine land and climate change: A Ricardian analysis
- **Maximilian Exler**: REITs in bear markets: To what extent drivers of returns and volatility change in times of high uncertainty
- **Xinyan Huang**: ESG disclosure and access to finance: Insights from analysis of REITs
- **Yu Jin**: Climate risks, regional disparities and residential property markets
- **Lesedi Kgaka**: (Energy) Uncertainty and investment returns
- **Kahshin Leow**: Spatial dependencies and their effects on real estate funds
- **Qiumeng Li**: The impact of the pandemic on the urban spatial structure and people’s travel behaviour
- **Yangfanqi (Sonny) Liu**: Nudging people towards better housing decisions: The long-term effect of focalism interventions on households’ travel patterns and social capital
- **Katharina Minkow**: How does technological infrastructure impact on rents, sales prices, and occupancy rates of office buildings in the UK?
- **Mengqi Qiu**: Combining spatiotemporal models with machine learning methods for property valuation
- **Yiwen Qiu**: Firm locations, industrial structures, regional development paths from a dynamic perspective: A case study in China
- **Saad (Mohammad) Siddiqui**: The nexus between international capital flows and real estate markets
- **He (Tony) Tang**: Political uncertainty in the real estate industry
- **William Wells**: Markers of behavioural biases in commercial real estate private equity

Finally, congratulations to **Yana Atkinson**, whose PhD was approved in November 2023. Her thesis title was *How can energy data analytics platforms affect small firms? A study of a reduction in energy use in the service sector and its spillover effects.*
On 1 March 2023, Thies Lindenthal was elected to the position of Grosvenor Professor of Real Estate Finance. He has been lecturing at the Department of Land Economy since 2014 and is a professorial fellow at Pembroke College and a J M Keynes Fellow in Financial Economics. He is the course director for the MPhil in Real Estate Finance and has served on the board of the American Real Estate and Urban Economics Association (AREUEA). Before joining the Department, Professor Lindenthal worked as a postdoctoral researcher at the MIT Centre for Real Estate, focusing on the market for virtual locations such as Internet domain names. His PhD is from Maastricht University.

‘The first year of my professorship centred around people’, Professor Lindenthal explains. ‘Retirements and departures had left a big gap in the real estate team: three out of seven positions were vacant. Fortunately, we were successful in convincing three exceptional young colleagues—Sofie Waltl, Philip Kalikman, and Daniel Ruf—to join the Department.’

This was possible, he suggests, because of what CRERC and the Department have to offer young real estate scholars: ‘The Department of Land Economy is a true research department with a strong research culture. It is interdisciplinary at its core and at the same time our real estate group has critical mass. Colleagues are joining a research-intensive team committed to tackling the big real estate finance research questions with previously underresearched data sets and new approaches such as advanced machine learning and econometrics. Being in Cambridge opens doors, and that is something that we in CRERC seek to leverage as far as possible; we have developed and maintain an invigorating network with industry players on the one hand and other academic institutions on the other.’

‘All this research activity is supported’, he adds, ‘by manageable teaching loads and a positive and empowering working atmosphere. Our three new colleagues hit the ground running, delivering elements of the core curriculum across the whole range of our real estate courses—Tripos, MPhil, MST, and PhD. At the same time, this generational handover offered an opportunity for the gentle updating of course content and methods, ensuring that our teaching remains at the cutting edge of real estate research. But being unable to compete with other institutions in the remuneration of such colleagues’, he notes, ‘remains a real challenge.’

Professor Lindenthal’s own research interests are twofold: first, he analyses property investments in the very long term, tracking rents, prices, and returns over spans of up to 500 years. His second line of research focuses on applying machine learning techniques to utilise high-dimensional ‘Big(ish)’ data. That is, he uses images and other data that are too complex for spreadsheets to handle to better understand property values, household preferences, and decisions made by very human and not always rational agents. Current projects include a new textbook on commercial real estate investments, research on realistic estimate of returns to real estate investments, and a dose of machine learning wizardry as well. He is looking forward to hosting the joint University of Cambridge–University of Florida–University of Hong Kong Real Estate Finance and Investment Symposium in Cambridge in September 2024.
Our Research

A full list of our members’ publications is contained in Appendix 1, with working papers available on our website: https://www.landecon.cam.ac.uk/cambridge-real-estate-research-centre/page/crerc-publications. The strength and quality of the research produced by the Centre is consistent with our goal of being rated as ‘world class’ in real estate research. The results of the 2021 Research Excellence Framework are a testament to this fact: 67% of the work in the Department of Land Economy’s joint submission with the Department of Architecture was rated as ‘world leading’, the best in the UK in the relevant field and ahead of the Cambridge average of 62%. A few examples of our research on topics within our main research themes are set out below.

Real Estate as an Investment

Quantifying the non-Gaussian gain
David Allen, Stephen Satchell, and Colin Lizieri
Journal of Asset Management

In this paper, we quantify the economic gain from accounting for departures from normality for the mean-variance (MV) investor. We provide two models that account for the key empirical regularities of financial returns: stochastic volatility, asymmetric returns, heavy tails, and tail dependence. We show that accounting for departures from normality leads to significant gains in expected utility commensurate with or exceeding typical active management fees. The majority of the uplift in expected utility derives from accounting for stochastic volatility.
doi: 10.1057/s41260-023-00338-9

The two-component Beta-f-QVAR-M-lev: A new forecasting model
Michel Ferreira Cardia Haddad, Szabolcs Blazsek, Philip Arestis, Franz Fuerst, and Hsia Hua Sheng
Financial Markets and Portfolio Management

We introduce a new joint model of expected return and volatility forecasting, namely the two-component Beta-f-QVAR-M-lev (quasi-vector autoregression in-mean with leverage). The maximum likelihood estimator for the two-component Beta-f-QVAR-M-lev is an extension of theoretical results of the one-component Beta-f-QVAR-M. We compare the volatility forecasting performance of the two-component Beta-f-QVAR-M-lev and two-component GARCH-M (generalised autoregressive conditional heteroscedasticity), also considering their one-component frameworks. The results for G20 stock market indices indicate that the forecasting performance of the two-component Beta-f-QVAR-M-lev is superior compared with the two-component GARCH-M and their one-component versions.
doi: 10.1007/s11408-023-00431-4

Uncertainty premia in REIT returns
Marton Lotz, Daniel Ruf, and Johannes Strobel
Real Estate Economics

We provide a systematic study of how financial and real estate uncertainty affect the aggregate return performance of the U.S. REIT market from 1994 to 2017. A temporal causality analysis reveals a negative uncertainty impact on REIT returns. The asset pricing analysis confirms the predictive relation and suggests that REITs are statistically significantly exposed to changes in market-wide uncertainty, for which investors require a return compensation. We also identify economic state variables to explain time-varying uncertainty exposures as well as periodic hedging characteristics of REITs. Finally, we find evidence that the source of uncertainty matters for compensating expected REIT returns.
doi: 10.1111/1540-6229.12423
Good growth, bad growth: Market reaction to capital raising for REIT expansion
Nick Mansley, Zilong Wang, Xiaoyu Weng, and Wenjing Zhang
*International Review of Financial Analysis*

When a firm issues security to finance its growth, how does the market react and do investors differentiate between good and bad growth? By manually reading the intended use of proceeds of each security offering of US REITs during 2000–2020, we classify whether the proceeds are used for expansionary or other purposes and analyse whether security offerings that are used to finance sub-optimal growth matter for shareholders’ wealth. Adopting an event study method, we find that the expansionary use of proceeds does not affect shareholders’ wealth following a debt offering announcement. However, when we distinguish good growth from bad growth, we find that debt financing used for good growth is associated with an increase in shareholders’ wealth (+1.734% abnormal return in the 5-day event window) and debt financing used for bad growth is associated with a decrease in shareholders’ wealth (~0.563% abnormal return in the 5-day event window). For equity offering announcements, on average, neither the expansionary use of proceeds nor the nature of growth significantly affects shareholder wealth.


What drives the distress risk–return puzzle? A perspective on limits of arbitrage
Yezhou Sha, Ziwen Bu, and Zilong Wang
*International Journal of Finance and Economics*

Empirical research has documented a negative relationship between distress risk and stock returns. This negative risk–return trade-off, known as the distress puzzle, poses a challenge to asset pricing models. In this study, we provide a new explanation of the distress puzzle by considering the effect of arbitrage asymmetry. We find that the negative distress risk–return relation is stronger in stocks that have higher limits of arbitrage. The investors are virtually unable to short sell mispriced high distress risk stocks due to the low supply of lendable stocks from institutions and that arbitrage is costly. In addition, we show that the limits of arbitrage effect is distinct from liquidity effect in explaining the distress puzzle.

doi: 10.1002/ijfe.2608

Price diffusion across international private commercial real estate markets
Bing Zhu, Dorinth van Dijk, and Colin Lizieri
*Journal of International Money and Finance*

We explore spatio-temporal aspects of global commercial real estate price movements and consider two channels where prices may spill over between global cities: (i) through a dominant market and (ii) through “neighbouring” markets. Neighbouring, here, is defined as the degree of overlap in ownership. We document significant ripple effects from both channels in commercial real estate prices across 22 markets from 2007 to 2020. In particular, London is found to be the dominant market and price shocks significantly diffuse across other global cities in the short- to medium-run. Additionally, shocks from neighbouring markets are important in the short- to medium-run. In the long-run, macroeconomic factors play a much more critical role. The spillover effect through both channels is more predominant during the financial crisis. In fact, the dominant market channel is mostly driven by the financial crisis. By contrast, the neighbouring market channel is significant throughout the economic cycle.


Technology, Data, and Machine Learning

Interpretable machine learning for real estate market analysis
Felix Lorenz, Jonas Willwersch, Marcelo Cajias, and Franz Fuerst
*Real Estate Economics*
Machine Learning (ML) excels at most predictive tasks but its complex nonparametric structure renders it less useful for inference and out-of-sample predictions. This article aims to elucidate and enhance the analytical capabilities of ML in real estate through Interpretable ML (IML). Specifically, we compare a hedonic ML approach to a set of model-agnostic interpretation methods. Our results suggest that IML methods permit a peek into the black box of algorithmic decision making by showing the web of associative relationships between variables in greater resolution. In our empirical applications, we confirm that size and age are the most important rent drivers. Further analysis reveals that certain bundles of hedonic characteristics, such as large apartments in historic buildings with balconies located in affluent neighborhoods, attract higher rents than adding up the contributions of each hedonic characteristic. Building age is shown to exhibit a U-shaped pattern in that both the youngest and oldest buildings attract the highest rents. Besides revealing valuable distance decay functions for spatial variables, IML methods are also able to visualise how the strength and interactions of hedonic characteristics change over time, which investors could use to determine the types of assets that perform best at any given stage of the real estate investment cycle.

doi: 10.1111/1540-6229.12397

Sustainability, Resilience, and Performance

Ali Ataullah, Simeon Coleman, Hang Lee, and Zilong Wang
Regional Studies
We examine the role of social capital in explaining the highly unequal regional distribution of firms’ carcinogenic releases. Our model predicts that social capital, by enabling information-sharing and coordination among community members, decreases carcinogenic releases. Our analysis, based on the US county-level releases derived from around 2 million chemical-facility-level reports during the period 1998 to 2019 and the instrumental variables approach, confirms our prediction. However, the impact is reduced when counties rely on waste-releasing firms for economic opportunities. An important policy implication of our study is that the efficacy of initiatives to alleviate environmental injustice is likely to depend on communities’ social capital.

doi: 10.1080/00343404.2022.2159023

Building trust after pollution emergency: A strategic perspective on corporate social responsibility
Yechi Ma, Yibing Ding, Zilong Wang, and Wenjing Zhang
Energy Economics
We use extreme regional pollution emergencies to provide new evidence regarding the motivations for corporate social responsibility (CSR). We document that local firms strategically improve CSR to build trust following pollution emergencies, and this is specifically true for highly polluting firms. Firms face different intensities of external pressure from their stakeholders. In particular, following pollution emergencies, political dependency, institutional investors, and public monitoring are the main sources of stakeholder pressure and drivers of the increased CSR. We further find that firms that gain trust through CSR activities after pollution emergencies are rewarded. CSR serves as a buffer against financial constraints, financing distress, and the negative profitability effect following emergencies. This study contributes to the CSR literature on trust-building-motivated CSR strategies.

The effect of the policy mix of green credit and government subsidy on environmental innovation

Yechi Ma, Yezhou Sha, Zilong Wang, and Wenjing Zhang

Energy Economics

We examine to what extent the ‘policy mix’ of green credit policy and government subsidy affects the high-quality environmental innovation of high-polluting firms. The green credit policy is a special environmental regulation that guides the distribution of credit from banks. Using the difference-in-difference method, we find that Green Credit Guidelines (GCGs) have a negative impact on the high-quality environmental innovation of high-polluting firms in China. However, the negative relationship between GCGs and high-quality environmental innovation depends on the level of government subsidy. Subsidies can effectively correct the negative impact of GCGs. The mechanism analysis shows that GCGs hinder high-quality environmental innovation through two channels: (1) increase in compliance costs and (2) lack of long-term bank credit that supports environmental innovation. Government subsidies can play a moderating role in the second channel.


Assessing the ecological impacts of coastal reclamation on cropland protection: An integrated index system

Lefeng Qiu and Helen X. H. Bao

Land Degradation & Development

Coastal land reclamation has been practised widely to accommodate rapid urbanisation. But the exploitation of coastal wetlands also imposes ecological risks and jeopardises ecological security in many countries. The overall effects of coastal land reclamation must therefore be assessed. We developed a conceptual framework to evaluate the ecological effects of coastal land reclamation on cropland protection along three dimensions: land quantity, ecological environment, and land quality. An integrated index system was constructed accordingly and tested by using data from Cixi, a coastal city in eastern China. Our index system generated rich information to assess the impacts of reclamation on added cropland area, landscape ecological risk, and cropland soil quality. The results showed that between 1985 and 2020, a total area of 393.71 km² of coastal wetlands were reclaimed in Cixi City, which played a crucial part in upholding the equilibrium between the land supply and demand during urbanisation. However, its adverse ecological effects were also evidenced. Coastal reclamation not only increased the landscape disturbance and ecological risk but also significantly decreased the overall cropland soil quality. The city’s original reclamation-driven development strategy is unable to meet the updated requirements of “quantity-quality-ecological balance” for cropland protection. Our index system can help land use policymakers monitor the ecological effects of coastal reclamation. The knowledge gained will have major policy implications for the land use management that promotes sustainability in coastal regions.

doi: 10.1002/ldr.4875

Locational Choice, Urban Development, and Regeneration

Understanding local government debt financing of infrastructure projects in China: Evidence based on accounting data from local government financing vehicles

Helen X. H. Bao, Ziyou Wang, and Robert Liangqi Wu

Land Use Policy

This study develops an analytical framework to investigate the complex relationship between local government debt issuing for infrastructure financing, state control, land finance, and development activities in the private sector in China. Using local government financing vehicles’ accounting data, we find that local governments are working creatively to meet infrastructure development targets handed down by the central government. Moreover, local government financing vehicles became more responsive to development activities from the private sector in their debt-issuing decisions after the regulations of local government debt issuing in 2013/14. By modelling the effect of three distinct forces, i.e., the central government, local
governments, and the market, in one unified framework, our study provides reliable evidence of how infrastructure financing works in China. Our research extends the studies of land finance into the infrastructure development domain. The findings are also helpful for studies on China’s land use policy under its leasehold land right system, particularly the impacts of different land planning uses on infrastructure development.


Are Estimates of Rapid Growth in Urban Land Values an Artifact of the Land Residual Model?
John M. Clapp, Jeffrey P. Cohen, and Thies Lindenthal
Journal of Real Estate Finance and Economics
Separating urban land and structure values is important for national accounts and for analysis of real estate risk over time. A large part of the literature on urban land valuation uses the land residual method, which relies on the assumption that structures are easily replaced. But urban land value depends on accessibility to nearby land uses, implying that infrastructure and the slowly changing built environment are the most important components of land value. Investments in structures are only slowly reversible, implying that land and structure function as a bundled good whereas land residual theory severs the connection between land value and structure value over time. We develop a simple theoretical model that includes option value and compare to a nested land residual model before and after a shock to values. Cross-sectionally our model shows that land residual theory overestimates structure value. Over time almost all of any change in property value is allocated to land residuals. Data from Maricopa county, AZ, 2012–2018 strongly support option value models when nested within a general model that also includes land residuals. FHFA estimates use entirely different cost estimation methods: our analysis of FHA data suggest that our conclusions generalize to the U.S. as a whole, and that high and rising land value ratios over 50 years (the ‘hockey stick’ pattern found in the literature) are likely an artifact of the residual model.

doi: 10.1007/s11146-021-09834-4

On the Strategic Timing of Sales by Real Estate Developers: To Wait or To Presell?
L. Li, Helen X. H. Bao, and K. W. Chau
Journal of Real Estate Finance and Economics
In timing property listings, real estate developers can exercise the ‘option to wait’ or ‘option to presell’ to mitigate price uncertainty risk. In this study, we study the effectiveness of both strategies under a unified framework. We test our hypotheses using residential development data from Hong Kong between 1995 and 2015. Empirical evidence shows that when the presale option is unavailable, developers tend to adopt the waiting strategy when facing price uncertainty risk. Conversely, when a presale option is available, developers will accelerate sales when price volatility is high. Moreover, the effectiveness of the presale option depends substantially on government restrictions. Our approach facilitates the identification of the net effect of either tool and provides an opportunity to unify conflicting findings in the literature.

doi: 10.1007/s11146-022-09894-0

Behavioural Economics, Perceptions, and Decision-Making

iBuyer’s use of PropTech to make large-scale cash offers
Jackson T. Anderson, Franz Fuerst, Richard B. Peiser, and Michael J. Seiler
Journal of Real Estate Research
The expansion of iBuyer’s use of PropTech to major housing markets raises a series of questions for both buyers and sellers when making instant, all-cash offers. This study uses a sequence of experiments to identify the proper implementation of existing behavioural real estate concepts to improve the iBuying process, a burgeoning area of residential real estate. We find strong evidence of anchoring for all-cash offers.
in that sellers are nearly twice as likely to transact when they are first presented with the net proceeds offer price (market value minus costs) rather than starting with the higher gross market value offer price. After the sale, seller regret aversion becomes strong when the seller’s house is subsequently sold for 10% or more than the all-cash buyer paid, but regret aversion is mitigated with communication of the improvements made to enhance the selling price. We further find that sellers do not know which all-cash buyer’s Automated Valuation Model (AVM) is the most accurate and are therefore much more influenced by brand awareness than model sophistication. Finally, while the extant literature has examined offer price strategies for home sellers, this is the first investigation of buyer offer price strategies. In stark contrast to selling strategies, pricing strategies do not matter when making an offer to buy.

doi: 10.1080/08965803.2023.2214467

Between carrots and sticks, from intentions to actions: Behavioural interventions for housing decisions
Helen X. H. Bao

*Housing, Theory and Society*

Through a systematic and critical review of the literature, we assembled a list of behavioural biases identified in the housing market and a taxonomy of behavioural interventions tested extensively in the last two decades. Based on these findings, we developed an analytical framework for behavioural interventions for housing decisions. We suggest that behavioural interventions have the most significant potential in areas where market incentives and government regulations are ineffective. The application of behavioural interventions in the housing market should focus on encouraging and supporting decision-makers to narrow the intention-action gap.

doi: 10.1080/14036096.2023.2267060

Reference dependence in the UK housing market
Helen X. H. Bao and Rufus Saunders

*Housing Studies*

The study of reference dependence in housing markets is of practical importance due to the unusual characteristics of property transactions, such as high information asymmetry caused by many individuals’ lack of experience in housing markets. The overall low transaction frequency and general illiquidity of housing markets can exacerbate and reinforce behavioural anomalies such as reference dependence. The knowledge gained through an empirical investigation in the UK housing market can assist in the understanding of these behavioural biases. By conducting an online experiment at a UK online panel data platform, we identify the presence of reference dependence in the UK housing market, and the extent to which they are caused by both historical and recent prices. The influence of expectations and social norms is also investigated in this novel context. The findings of this study pave the way for reliable economic modelling of such anomalies and a better understanding of behaviours in the housing market.


Tracking home-owners’ sentiments: Subjective indices and convergent validity
Sofie R. Waltl and Anthony Lepinteur

*Journal of Real Estate Finance and Economics*

Surveys regularly ask home-owners to guess what their property might be worth in the current housing market. We develop suitable statistical techniques to construct hedonic and repeat-sales style house price indices from these owner-estimated values (OEVs). The resulting series are then linked to a large set of quality-adjusted residential property price indices estimated from transaction data allowing us to perform a variety of convergent validity tests. Based on results for 20 countries, several decades and different OEV elicitation techniques, we conclude that the ‘wisdom of the home-owner crowd’ is sufficient to study objective house price dynamics. Yet, surveys fail to accurately measure house price levels.

doi: 10.1007/s11146-023-09949-w
Housing Finance

Housing wealth distribution, inequality, and residential satisfaction
Helen X. H. Bao and Charlotte Chunming Meng
Regional Studies
This research investigates the relationship between housing wealth and residential satisfaction. Using household panel survey data from the UK, we find that individuals’ asymmetric responses to changes in housing wealth distribution, that is, loss aversion experienced by the worse-off group, could offset the gain from an increase in housing wealth at the aggregate level. Consequently, housing wealth growth does not necessarily improve residential satisfaction for society as a whole if it leads to housing wealth inequality. Given the significant impact of housing wealth distribution on residential satisfaction, it is important to consider housing wealth inequality in making public policy decisions.
doi: 10.1080/00343404.2022.2159938

Forward to the past: Short-term effects of the rent freeze in Berlin
Anja M. Hahn, Konstantin A. Kholodilin, Sofie R. Waltl, and Marco Fongoni
Management Science
In 2020, Berlin introduced a rigorous rent-control policy responding to soaring prices by capping rents: the Mietendeckel (rent freeze). The German Constitutional Court revoked the policy only one year later. Although successful in lowering rents during its duration, the consequences for Berlin’s rental market and close-by markets are per se not clear. This article evaluates the short-term causal supply-side effects in terms of prices, quantities, and landlords’ strategic behavior. We develop a theoretical framework capturing the key features of first-generation rent control policies and Berlin-specific aspects. Using a rich pool of detailed rent advertisements, predictions are tested, and further empirical causal inference techniques are applied for comparing price trajectories of dwellings inside and outside the policy’s scope. Mechanically, advertised rents drop significantly upon the policy’s enactment. A substantial rent gap along Berlin’s administrative border emerges, and rapidly growing rents in Berlin’s (unregulated) adjacent municipalities are observed. Landlords started adopting a hedging strategy insuring themselves against the risk of contractually long-term fixed low rents following a potentially unconstitutional law. Whereas this hedge was beneficial for landlords, the risk was completely borne by tenants. Moreover, the number of available properties for rent dropped significantly, a share of which appears to be permanently lost for the rental sector. This hampers a successful housing search for first-time renters and people moving within the city. Overall, negative consequences for renters appear to outweigh positive ones.

Owner-occupied housing, inflation, and monetary policy
Robert J. Hill, Miriam Steurer, and Sofie R. Waltl
Journal of Money, Credit and Banking
Owner-occupied housing (OOh) is currently excluded from the harmonised index of consumer prices (HICP) in Europe. Using microlevel data for Sydney and aggregated data for the United States, France, and Germany, we compare the impact of alternative treatments of OOh on measured inflation. We recommend including OOh in the HICP using a simplified version of the user-cost method. This would improve the harmonization of the HICP, help close the credibility gap between measured inflation and public perceptions of it, and allow the ECB to lean against a housing boom without departing from its inflation target.
doi: 10.1111/jmcb.13059
PhD Publications

Congratulations to current and former PhD students Yana Akhtyrska, Marco Felici, Qiumeng Li, Tony He Tang, and Wayne Xinewei Wan, who published the following journal articles alongside senior academic members of CRERC in 2023:

The effectiveness of climate change regulations in the commercial real estate market
Yana Akhtyrska and Franz Fuerst
Energy Policy
Legislation to increase building energy efficiency is a key climate change policy instrument in many countries. Although most of these regulations concern the housing stock, office buildings are also a considerable source of greenhouse gas emissions. Office markets face fewer pricing regulations than the residential market and may thus provide a clearer pricing signal of any policy impacts. This paper focuses on the introduction of Minimum Energy Efficiency Standards (MEES) in England and Wales. Applying machine-learning methods, Difference in Differences (DiD) and Fixed Effects (FE) panel data estimation to a comprehensive database of the London office market, our results suggest that the MEES policy has had a measurable and significant impact and lowered the rents of the combined group of affected office units by 6–8% following the announcement of MEES and in the run-up to implementation. A weakly significant 4.4% rental discount is detected for the bordering but unaffected class of EPC E-rated office buildings relative to the A–C EPC group, perhaps due to market expectations of a further expansion of MEES.
doi: 10.1016/j.enpol.2023.113916

The heterogeneous relationship of owner-occupied and investment property with household portfolio choice
Marco Felici and Franz Fuerst
Journal of Housing Economics
The dual nature of property as both a consumption and investment good presents a challenge for household portfolios. Prior theoretical literature predicts a constraint imposed by property on investment decisions, and empirical studies support this notion. However, previous research often overlooks investigating the heterogeneity of this constraint and fails to differentiate between owner-occupied and investment property. Building on a stochastic control model, we analyse the UK’s Wealth and Assets Survey panel and find that along the distribution of how households allocate their wealth a one percentage point (pp) increase in the share of owner-occupied property in the total portfolio is associated with a 0.07 pp decrease in the share of stocks in liquid assets. However, this association varies significantly based on the value of the owner-occupied property share. For low values of the owner-occupied property share, the association with stockholdings is negligible. As the share of owner-occupied property increases, the negative association with stockholdings becomes more pronounced: when the owner-occupied property share reaches 90%, a further 1 pp increase corresponds to a 0.14 pp decrease in the share of stocks in liquid assets. By contrast, buy-to-let property shows no significant relationship with stockholdings, supporting the idea that the constraint on portfolio decisions is primarily driven by the role of property as a consumption good.

Do shared e-bikes reduce urban carbon emissions?
Qiumeng Li, Franz Fuerst, and Davide Luca
Journal of Transport Geography
Under the threat of climate change, many global cities nowadays are promoting shared commuting modes to reduce greenhouse gas emissions. Shared electric bikes (e-bikes) are emerging modes that compete with bikes, cars, or public transit. However, there is a lack of empirical evidence for the net effect of shared e-bikes on carbon emissions, as shared e-bikes can substitute for both higher carbon emissions modes and cleaner commuting modes. Using a large collection of spatio-temporal trajectory data of shared e-bike trips in two provincial cities (Chengdu and Kunming) in China, this study develops a travel mode substitution model to identify the changes in travel modes due to the introduction of shared e-bike systems and to
quantify the corresponding impact on net carbon emissions. We find that, on average, shared e-bikes decrease carbon emissions by 108–120g per kilometre. More interestingly, the reduction effect is much stronger in underdeveloped non-central areas with lower density, less diversified land use, lower accessibility, and lower economic level. Although the actual carbon reduction benefits of shared e-bike schemes are far from clear, this study bears important policy implications for exploring this emerging micro-mobility mode to achieve carbon reduction impacts.


**Political uncertainty and carbon emission trading: Evidence from China**

Tony He Tang and Helen X. H. Bao

*Cities*

This study explores the impact of political uncertainty on sustainable urban development by examining carbon emission trading systems (ETS) in four major markets in China (Beijing, Shanghai, Guangdong, and Hubei) from 2014 to 2022. As an alternative to carbon taxes, carbon ETS markets have become increasingly popular due to their success in reducing greenhouse gas emissions. However, their effectiveness is often hindered by political instability and uncertainty. Utilising logistic regression and AR(1)-GARCH estimations, we identify a negative relationship between political uncertainty and carbon trading volume. Our study also reveals significant variations in the responses of these markets to political uncertainty. The paper contributes to the understanding of how ETS markets operate in a complex and constantly changing political environment. We suggest that policymakers need to consider the impact of political uncertainty on carbon trading when designing and implementing urban policies that promote sustainable development. Additionally, our research contributes to the development of urban policies that can be effectively implemented in both developed and developing regions.


**Testing machine learning systems in real estate**

Wayne Xinewei Wan and Thies Lindenthal

*Real Estate Economics*

Uncertainty about the inner workings of machine learning (ML) models holds back the application of ML-enabled systems in real estate markets. How do ML models arrive at their estimates? Given the lack of model transparency, how can practitioners guarantee that ML systems do not run afoul of the law? This article first advocates a dedicated software testing framework for applied ML systems, as commonly found in computer science. Second, it demonstrates how system testing can verify that applied ML models indeed perform as intended. Two system-testing procedures developed for ML image classifiers used in automated valuation models (AVMs) illustrate the approach.

doi: [10.1111/1540-6229.12416](http://dx.doi.org/10.1111/1540-6229.12416)
Research Projects: New and Ongoing Collaborations

Land Use Policies for Smart City Development in Hong Kong: A Participatory Platform Supported by Spatial Analysis Technologies
July 2021–June 2023
Funding Body: Interdisciplinary Research Fund in Smart Cities (IRF-SC), Hong Kong
Principal Investigator: Prof Geoffrey Qiping Shen (The Hong Kong Polytechnic University)
Co-Investigator: Prof Helen X. H. Bao
Budget: HKD 500,000 (approx. £50,000)

This project provides an innovative participatory platform based on spatial analysis technologies to support land use policy-making on smart city development in Hong Kong (Kowloon East development as the study area). Local environmental impacts and infrastructure capacity are two major concerns of land use policies for urban land development. This platform can simulate local environmental impacts through 3D spatial analysis technologies based on different scenarios with different restrictions. Moreover, 3D visualisation and scenario analysis in this platform could help the non-professional public understand the developing land and its future development, which is beneficial to public engagement. Stakeholders/decision-makers could readily understand and participate in public consultation for better land use policy-making with the assistance of this platform. Therefore, the proposed platform can be used as a policy-making support tool for the government to assess whether the current land use policies are compatible with smart/sustainable city development or not, and to let more stakeholders/the public truly engage in the public consultation process.

January 2022–December 2025
Funding Body: National Natural Science Foundation of China
Principal Investigator: Prof Lei Feng (Renmin University of China)
Co-Investigator: Prof Helen X. H. Bao
Budget: RMB 480,000 (approx. £55,600)

This study constructs a dynamic institutional change model from the perspective of micro-motivation and endogenous changes. It examines the path characteristics, determining conditions, and influencing factors of China’s rural land institutional change by using a combination of theoretical modelling, measurement testing, questionnaire survey, simulation, and case analysis methods. 1) Based on endogenous institutional change theory, behavioural economics, learning theory, and game theory, we construct individual utility function that include endogenous preferences in order to investigate the micro-mechanism of dynamic modelling and consolidate the micro-foundation of institutional change theory. 2) We build a mathematical model of dynamic change based on the individual’s utility function and integrate short-term change and long-term evolution into a unified analysis framework, moving beyond the dichotomy of imposed-induced/rational construction-spontaneous evolution. This framework is expected to explain both individual institutional changes and the continuous process of multiple institutional changes, both the success and the failure of reform. 3) To conduct a large number of extensive empirical tests and systematically summarise and analyse the experience and lessons of the rural land institutional reforms since the founding of the China, we plan to combine traditional questionnaire survey-quantitative methods with behavioural economics field experiments, computer simulations, and dynamic tracking survey methods. These works help to explore the commonalities and laws and provide theoretical guidance and empirical support for deepening the implementation of a number of central reforms and promoting the integration of urban and rural development.

Local Effects of a Pandemic: A Holistic Assessment of the Austrian Residential Housing Market
March 2022–February 2025
Funding Body: OeNB Anniversary Fund (Grant No. 18767)
Industry and Public Bodies

Centre members continue to play leading roles supporting industry and other public and academic bodies:

**Nick Mansley** concluded his eight-year tenure as Chair of the Lord Chancellor’s Strategic Investment Board at the Ministry of Justice and continues as Industry Adviser to the Official Solicitor and Public Trustee. He serves as investment adviser to a major UK pension scheme, is a member of the investment committee of the Forestry Carbon Sequestration Fund, and sits on the investment committee of a fund investing in high street retail. He is also the independent investment committee member of a fund investing in private market rented housing for local authority pension funds and the independent investment committee member of the Principal Eurozone Durable Income Fund, which invests in longer-lease real estate in Europe.

**Colin Lizieri** is a Fellow of the Society of Property Researchers.

**Thies Lindenthal** served as a board member for AREUEA and as an expert witness for US courts on matters relating to internet domain names.

**Franz Fuerst** advises businesses and government authorities on matters relating to real estate and co-edits *Spatial Economic Analysis*.

**Helen Bao** is an Associate Editor of *Cities*.

**Carolin Hoeltken** chaired the organising committee of AREUEA International 2023 in Cambridge and is AREUEA’s Social Media Chair.

**Zilong Wang** works closely with industry and is involved in projects funded by EPRA, IPF, INREV, and ANREV. He is an Associate Editor of *Economic Analysis & Policy*.

**Sofie Waltl** is a Member of the Scientific Advisory Board, Housing Module, for the Austrian Socio-Economic Panel (ASEP) and Statistics Austria.

**Philip Kalikman** has served as an adviser to fintech startups, venture capital firms, and a hedge fund, and as an expert witness in real estate matters.
Conferences and Events

American Real Estate and Urban Economics Association International Conference 2023

19–22 July 2023, Jesus College, Cambridge, UK

The Department of Land Economy and the Cambridge Real Estate Research Centre were delighted to host the American Real Estate and Urban Economics Association (AREUEA) International Conference at the University of Cambridge in July. This annual conference provides a forum for academics, practitioners, and policymakers in the areas of real estate finance, development and investment, housing, urban planning, urban economics, and public policy to exchange ideas on important issues.

During the conference, more than 100 papers were presented by researchers from all over the world. Topics ranged from land markets to machine learning, prop-tech to air pollution, REITs to EPCs, and many more. The conference programme is available here: [https://www.conftool.org/areuea-cambridge2023/sessions.php](https://www.conftool.org/areuea-cambridge2023/sessions.php).

A highlight of the conference was Professor Colin Lizieri’s keynote address on Friday 21 July, titled ‘Beliefs, Uncertainty, and Decision-Making in Commercial Real Estate Markets’. You can download a copy of the keynote from our website: [https://www.landecon.cam.ac.uk/sites/default/files/2023-08/lizieri_keynote6.pdf](https://www.landecon.cam.ac.uk/sites/default/files/2023-08/lizieri_keynote6.pdf).
International Workshop on Behavioural Sciences and Urban-Rural Development in Developing Countries

24–26 July 2023, Newnham College, Cambridge, UK

The Department of Land Economy was also pleased to welcome nearly 40 international delegates to its International Workshop for Behavioural Sciences and Urban-Rural Development in Developing Countries. The workshop—organised by Professors Helen Bao and Colin Lizieri, and assisted by Departmental doctoral students—marked the culmination of a research project examining the impact of behavioural interventions and nudge policies for financial market development in China, jointly funded by the UK Economic and Social Research Council and the National Science Foundation of China.

Delegates included government officials, academics, postdoctoral researchers, and postgraduate students from eleven countries and four continents, with interests ranging across economic development, regional policy, planning, housing, infrastructure, management, and marketing. The participants worked in groups, exploring exercises and experiments that illustrated key behavioural principles and listening to expert lectures on behavioural interventions and their applications in public policy.

The lessons from the Workshop were drawn together by each of the eight groups, who presented their ideas about how particular behavioural interventions could be used to help meet certain policy aims. The presentations covered topics as diverse as encouraging electric vehicle uptake in Africa, promoting healthy eating habits in East Asia, and supporting pregnant women and new mothers in the labour markets in Asia and South America. These proposals provoked lively debate and helped to illustrate the complexities involved in designing and implementing behavioural interventions in practice.

Throughout 2023, Centre members also played an active role in chairing, presenting, and discussing research at a wide range of conferences and events attended by academics and industry professionals in Cambridge and around the world.
Postgraduate Courses

MSt in Real Estate

With its Master of Studies in Real Estate, CRERC has been leading on the development and delivery of part-time Masters’ Degrees at the University of Cambridge since 2016. The MSt draws on the multi-disciplinary strength of the Department of Land Economy and wide-ranging expertise of CRERC members. It is aimed at experienced professionals and those identified as future leaders in the real estate industry, with the part-time format of the MSt permitting students to continue with their professional careers while studying. The course combines academic rigour with significant industry input and aims to equip participants with a broad understanding of all aspects of the real estate industry, insight into a variety of long-term themes and strategic issues in the market, and a range of research, technical, and other skills, enabling them to be agents of change in the real estate industry and beyond.

Our 2022–24 MSt cohort joined us in Cambridge for three residential sessions this year. In March, they learned about private real estate, funds, and international investment for their REM3 module, while the focus in July was on real estate securities (REM5) and real estate development (REM6). During their residential in December, the cohort made progress with their individual dissertation projects, visited developments in London, and enjoyed talks from a number of industry speakers.

In September, we also welcomed our 2023–25 cohort onto the course. They have successfully submitted their REM1 (real estate as an asset class) and REM2 (research methods) assignments and will be back in 2024 for three further residentials. We look forward to seeing them again soon!

MPhil in Real Estate Finance

The MPhil in Real Estate Finance is a one-year, full-time course which aims to provide integrated theoretical and practical instruction in finance, investment, economics, and law as they relate to global commercial property markets. Students are provided with the methods and techniques of analysis needed for commercial property financing, investment, and development. The course is designed to ensure that property specialists are able to interact with other corporate finance related professionals. To this end, particular emphasis is placed on ensuring that students are familiar with the latest concepts in mixed-asset portfolio analysis, risk management, financial engineering, and option-based valuation models.

The MPhil in Real Estate Finance continues to go from strength to strength, with 48 students enrolled in the 2022–23 cohort and a further 54 in 2023–24. Congratulations to all those students who graduated this year—we wish them every success in their future careers!

2023 Prizes and Awards

The Douglas Blausten Prize for Best Overall Performance on a Real Estate Finance Dissertation was awarded to Harvey Newiss.

The IPF Student membership and £500 Dissertation Prize was awarded to Harvey Newiss.

The Alistair Ross Goobey Prize for Best Overall Performance on the Real Estate Finance MPhil was awarded to Rolf Cheng Long Hensgens.
Appendix 1

Published Research: 2023


Cambridge Real Estate Research Centre

‘A leading international research centre at the forefront of driving the development of the real estate agenda in the UK and beyond.’

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