RENTCAL
European Rental Housing Framework for the Profitability Calculation of Energetic Ret rofitting Investments

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Results of four empirical studies

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I. Project synopsis

1.1 Objectives of the project

The EU directive 2010/31 on the energy performance of buildings (recast) of 19th May 2010 (EPBD recast)1 sets out requirements regarding the energy performance of new buildings, as well as minimum requirements for the energy performance of existing buildings, building units and building elements that are subject to major renovation (Art. I No. 2 (c)). These minimum requirements shall not prevent any member state from maintaining or introducing stronger measures. As a minimum requirement, a “cost optimal level” shall be reached (Art. 14, Art. 2 No.14). The EPBD recast directive establishes the calculation for the “cost-optimal level” of minimum energy performance requirements including a comparative methodology framework, distinguishing between new and existing buildings and between different categories of buildings. Unlocking the barriers to proven economic saving potentials offered by energy efficiency investments in the existing building stock are considered crucial for meeting European energy efficiency targets. This is especially important for rental housing, which represents the majority of the multifamily housing stock in most participating countries.

Although the calculation methodology established within the EPBD framework suggests that in general, retrofitting investments are financially viable within given cost conditions, there is no sufficient energy investment.

One reason is the limitation of the methodology framework to the financial perspective of the owner-occupier, thus neglecting other relevant stakeholder groups such as the rental housing sector.

A set of market failure mechanisms summarised under “split incentives’ barriers” are obstacles for investment in the rental housing sector. Split incentives may not only arise from the factual separation of investor and beneficiary (landlord-tenant disincentive), but also from asymmetrical risk exposition during the refinancing period (temporal disincentives) or from free rider problems (landlord-landlord dilemma) within owners’ associations.

[1] http://www.eceee.org/policy-areas/buildings/EPBD_Recast/EPBD_recast_19May2010.pdf

Article 19 of the EU directive 2012/27 on energy efficiency of 25th October 2012 states, that "Member States shall evaluate and if necessary take appropriate measures to remove regulatory and non-regulatory barriers to energy efficiency, without prejudice to the basic principles of the property and tenancy law of the Member States, in particular as regards the split of incentives between the owner and the tenant of a building (…)" with a view to ensuring that these parties are not deterred from making efficiency-improving investments that they would otherwise have made by the fact that they will not individually obtain the full benefits or by the absence of rules for dividing the costs and benefits between them (…)".[2]

Therefore, the essential challenge for improving the attractiveness of investments within the rental housing industry will be the removal or mitigation of investment barriers. To date there is no standardised methodology for calculating the profitability of refurbishment investments, not even within the property valuation standards of individual countries.

1.1.1 Objective I: profitability assessment in the rental housing sector

RentalCal's first objective is to develop a comparable methodology for the profitability assessment of energy efficient retrofitting investments in the rental housing sector. This methodology needs to incorporate given national cost levels (investments and operational costs) and efficiency improvements on the one side. On the other side it needs to consider returns (rental and appreciation returns of "green value") as well as technical, legal and financial framework conditions (construction costs, capital costs, taxation e.g. depreciation allowances, legal status of contract rents etc.).

1.1.2 Objective II: Improving the transparency of investment conditions

Due to a lack of supranational competencies in the housing sector, there is a lack of systematic and comparable assessment of the level of current investment barriers in EU countries and their impact on the renovation rate in the rental housing stock. Moreover, satisfactory information is not even available on the level of a mere qualitative assessment of specific issues like the handling of landlord-tenant-disincentives within national rental statutes.

[2] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:315:0001:0056:en:PDF

Therefore, the second objective of RentalCal is to provide comparable and transparent information on the profitability of energy efficiency investments that can be used both for the assessment of investment decisions, and for the comparative analysis of existing barriers in the private rental housing stock of participating countries. Within this objective, the technical, legal, financial and institutional framework conditions for energy saving investments in the rental housing sector of selected European member states will be analysed. Furthermore, the project emphasises the cross-national comparative analysis of the profitability calculation of energy retrofitting investments. In this context, RentalCal aims to contribute to a harmonisation of the methodologies and calculation standards in the field of profitability assessments for energy retrofitting investments in the existing housing stock.

1.1.3 Objective III: disseminate knowledge on green value issues in the rental housing industry

RentalCal specifically aims to prepare the ground for investment in the existing rental housing stock. In this sense, the development of a theoretical framework can ultimately help change the behaviour of property investors and ought to have great impact for climate change adaptation in the real estate industry. The immediate beneficiaries of our output are landlords and property investors who will be better informed regarding the feasibility of a proposed investment. With this approach RentalCal is significantly targeting the business case for energy efficiency retrofitting which is extremely important. In doing so, the proposed project provides insights into the pricing of energy efficient buildings that stakeholders can use to assess the enhancement of asset values and understand the market mechanisms. This will ultimately strengthen the financing and attractiveness of sustainable energy investments.

1.2 The RentalCal Consortium

RentalCal is an international research project funded by the European Union under the H2020 framework that links together eleven partner organisations - universities, public research institutes, and practitioners in the field of real estate economics, housing policy and energy efficiency.

The RentalCal consortium partners represent housing markets from eight EU member states (Czech Republic, Denmark, France, Germany, Great Britain, Poland, Spain and the

Netherlands), each with a distinct regulatory and socioeconomic framework for housing provision. RentalCal's consortium members cover a majority share of EUs largest rental housing markets with a total of about 33 million dwellings in the private rental sector, with about 46 % of it built in 1980 or earlier.

II. The scope of WP 5 in the general project context

The core objective of WP5 is to compile, interpret and discuss the empirical evidence on the market pricing of energy-efficient features and buildings (market framework conditions). In addition to carrying out econometric analyses in selected European markets, this work package conducts a comparison of the relevant national, regional and local trends in the take-up of energy-efficient buildings and the potential constraints for pricing energy-efficient building features. Based on this information, policy recommendations for the removal of existing market barriers are derived in conjunction with the results of WP3 (legal framework) and made ready for communication and dissemination activities related to policy makers in WP9.

This work package has also the objective of analysing and outlining existing subsidies and financing mechanisms for investments in energy efficiency in the private rented sector of the participating countries (financial framework conditions). Particularly, the focus is on compiling information on availability of green mortgages and other debt financing instruments with favourable rates and conditions.
Work package 5 results are presented in the following deliverables:

- D5.1: Report with 8 country specific sections, containing a description of packages of measures and best practice approaches for reducing/removing market barriers for increased willingness to pay.
- D5.2: Report with 8 country specific sections, containing a description of "green-premiums", i.e. energy efficiency related value drivers (rental premiums, sales price premiums, higher occupancy rates) and operating costs.
- D5.3: Report with 8 country specific sections, containing a description of grants and other subsidies for each partner country.

- D5.4: Report with 8 country specific sections, containing a description of financing conditions (Interest rate, durations, conditions) for each partner country.
- D5.5: Report featuring the results of four country specific empirical studies (hedonic pricing models of green premiums)

III. Interrelation with other work packages

The setting of WP 5 within the project is presented in Figure 1.1-1. Both market and financial framework conditions will be made available in WP5 for using the generated data as input parameters for profitability calculations in WP6. All information collected will be analysed and aggregated in the form of comprehensive country specific fact sheets (brief descriptive summary and basic statistics/analysis of collected data).

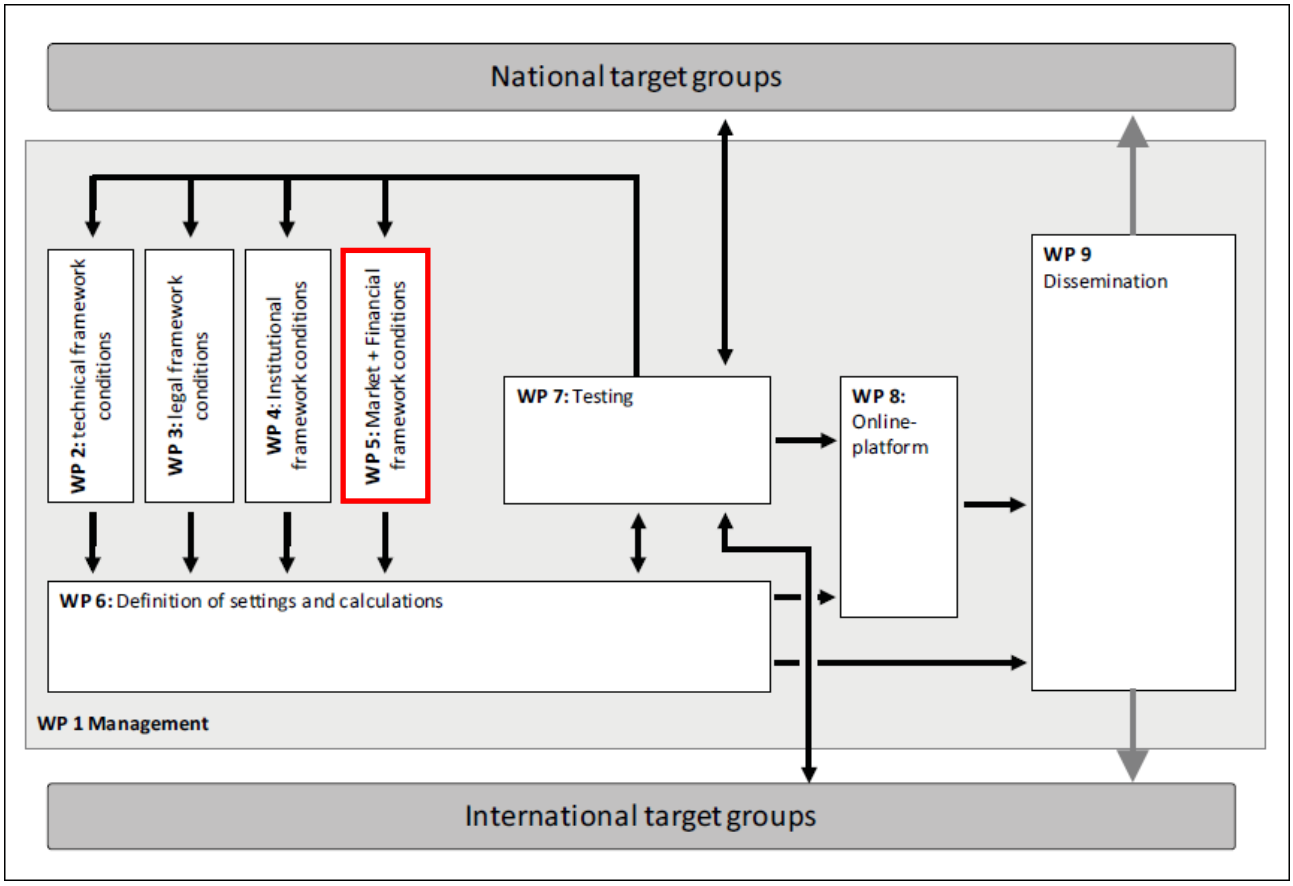

Figure 1 work package flow chart

1 Overview on research efforts of deliverable 5.5

1.1 Current state of research

Green buildings are often regarded as future-proof investments and as one of the most important areas for promoting a low-carbon economy. The precise definition of what constitutes a ‘green building’ is debatable. In the European Union, the Energy Performance Certificate (EPC) of the building is the most common measure used to assess how ‘green’ a building is. EPC is expressed on a letter scale, from A to G, where A is the most efficient and G is the least efficient. The primary objective of this green certification is to reduce uncertainty about quality and to drive prices by subsequently generating an increase in the demand for energy efficient buildings. Through the price mechanism, homeowners can use the EPC certificate to signal the efficiency level of the property they are selling, enabling them to recoup their initial retrofit investment via higher capital gain if the value outweighs the cost. Buyers in the market, on other hand, can use the EPC rating to screen out inefficient properties by opting for favourable EPC-rated dwelling in which they can easily let out, charge higher rent or inhabit and pay less energy bills. That is, the EPC labelling is a remedy for the market failure of imperfect information, a factor widely cited to impede investment in energy saving measures of buildings in the energy efficiency gap literature.

1.2 Central questions to be answered in D 5.5

This deliverable reviews the empirical evidence on the economics of energy efficiency retrofits in the context of pricing buildings with high environmental performance. The pricing of real estate sustainability can be best demonstrated through a green certification and its impact on the sale price in the market place. More so, since the green value is part of the overall market value, it needs to be isolated from other value drivers, and empirical research on the existence and the extent of green premiums is imperative in evaluating the pricing of energy efficiency. Consequently, empirical findings from the real estate market are examined in order to understand the bidding process and the subsequent influence of green labelling on sale prices, rental rates and time-on-market in selected countries.

1.3 Procedure

- Chapter 1 contains an overview on the project and a description of the work flow
- Chapter 2 contains review of the empirical literature on green premiums.
- Chapter 3 contains summaries of four selected empirical studies conducted by RentalCal Partners followed by cross-country comparisons of the results.

2 Literature Review

2.1 Literature on the capitalisation of green features into sale prices

Much of the recent research emerging has largely focused on the effects of intrinsic energy efficiency in the commercial real estate market, predominantly the price effects of voluntary energy labels on US commercial office prices. Broadly, the findings revealed a positive relationship between environmental labels and prices (see Wiley et al., 2010; Eichholtz et al., 2010 and 2013; Fuerst and McAllister, 2011). Despite the shortage, a handful of empirical studies have investigated the energy efficiency ratings in the residential housing market. Berry et al., (2008) conducted one of the first studies on the effect of mandatory green certification on residential house prices using market data. This study was the first of its kind and commissioned by the Australian Department of the Environment, Water, Heritage and the Arts. Housing transactions in the Australian Capital Territory (ACT), which imposed mandatory energy disclosure for all properties in 1999, were surveyed between 2005 and 2006. The study reported a statistically significant relationship between the energy efficiency rating of a dwelling and its sale price, with premiums of 1.23% found in 2005 and 1.91% found in 2006, in response to a 0.5 score increase on the energy rating scale. A few years later, a study by Brounen and Kok (2011) examined the impact of energy labels on residential house prices in the Netherlands, and it suggested that the energy labels encourage a transparency in the energy efficiency of houses and that this information is capitalised into house prices. By studying the transaction processes of approximately 32,000 properties between 2008 and 2009, they found that residential properties with a green label rated A, B and C command premiums of 10%, 5.5% and 2.2% respectively, relative to properties rated D. The data set contained a large number of control variables and attempts were made to reduce the likelihood of biases in the sample by using the Heckman`s correction for selection bias. In another closely related study, Hyland et al., (2013) applied a standard hedonic method to show that for a sample of 15,060 dwellings on the market between 2008 and 2012, there was a 9.3% price premium for A-rated dwellings compared to D-rated dwellings; the premium was 5.5% for a B-rating, and there was a 10.6% discount for F and G ratings. Fuerst et al., (2015) drew a similar conclusion by reporting a price effect of higher energy performance in the English housing market for a large sample of sale transactions. They report significant positive premiums for dwellings

rated A/B (5%) or C (1.8%), compared to an average D-rated dwelling. For dwellings rated E (−0.7%) and F (−0.9%), statistically significant discounts are found. The relative price effects are also found to be highest for terraced dwellings. A small but positive relationship between energy performance and sale prices is also found for the housing market in Northern Ireland (Davis et al., 2015. Additionally, Zheng, Kahn and Deng (2012) found significant price premia for green properties in the Chinese housing market and Deng and Quigley (2012) reported substantial economic returns to green buildings in Singapore. A study by Kok and Kahn (2012) also compared transactions of a sample of 4231 certified properties in California with a comparable sample of 1.6 million non-certified properties to show green price premiums of 2-4%. This result is robust due to the number of key control variables accounted for, including property size, age, amenities and the use of propensity score matching during the model estimation stage as a robustness check. Furthemore, a recent study in Demark suggests that energy performance rating of properties play an important role in relation to sale price (Jensen et al., 2016).

The above studies suggest a significant price premium attached to properties with favourable energy efficiency ratings. Other studies, however, suggest a weak or negligible impact on prices. By using Swedish housing transactions between 2009 and 2010, Cerin and Semenova (2014) show that energy performance is not rewarded across all property-price classes and ages of residential properties. They also show that there is little evidence of price penalties for the least energy efficient properties, although, within the most energy efficient houses, a statistically significant association between energy performance certification and house prices is reported. In a related study, Amecke (2012) surveyed owner-occupied dwellings in Germany that were purchased after 2009, the year when the EPC became obligatory for domestic buildings in Germany. Through examining factors affecting purchasing decisions, they conclude that the impact of EPCs is insignificant and unhelpful in understanding the financial implications of the energy efficiency of a dwelling. Similarly, Yoshida and Sugiura (2010) used data on the transaction prices of condominiums in Tokyo to show that there was a significant price discount of 5.5% and a lower depreciation rate for newly constructed green condominiums. Interestingly, this suggests that properties with high energy efficiency ratings are likely to command lower market prices. Also, factors such as the use of renewable energy, use of eco-friendly materials and greening are re-

ported to aggravate discounts. This may be due to buyers' perceptions of higher future repair costs or uncertainty about the quality of materials.

Table 1: A selected sample of empirical studies investigating capitalisation of energy efficiency features and green labelling into house prices.

Studies:	Methodology	Country	Results
Amecke (2012)	Standard Hedonic model	Germany	Energy performance certificates have a limited effect on purchasing decisions
Berry et al., (2008)	Standard hedonic Model.	Australia	A, B or C rated properties command premiums of 10%, 5.5% and 2.2% relative to properties rated D
Brounen and Kok. (2011)	Heckman`s two-step estimation (FGLS)	Netherlands	Building with a green label sells at a premium of 3.6 % relative to otherwise comparable houses with a non-green label
Cerin et al., (2014)	Standard hedonic model	Sweden	Energy rating does not on average contribute to the market price premium of a house
Chen et al., (2014)	Standard Hedonic model	Taiwan	Price Premium exists for green features but premium for green label is insignificant
Davis et al., (2015)	Standard Hedonic model	Northern Ireland	A small but positive relationship between energy performance and sale prices
Deng and Quigley (2012)	Standard Hedonic Model and Fixed effect	Singapore	Substantial economic returns to green buildings in Singapore.
Fuerst et al., (2015)	Standard Hedonic Model	England	14% premium of the highest band of energy ratings relative to lowest band
Fuerst et al., (2016)	Standard Hedonic Model	Wales	18.5% and 4% for A/B rated and C rated buy-to-let properties and no significant discount for lower-rated properties.
Hyland et al., (2013)	Standard Hedonic model	Ireland	A-rated property receives a price premium of 11%, and a B-rated property increases the price by 5.8% relative to a D rated property.
Högberg (2013)	Standard Hedonic Model	Sweden	Home buyers take into account the information available in the EPCs which entail a price premium.
Jensen et al., (2016)	Standard Hedonic Model	Denmark	Energy performance rating of properties play an important role in relation to sale price
Kok and Kahn (2014)	Standard Hedonic Model and Propensity score Matching to a lesser extent.	USA	Green price premiums of 2-4 %
Yoshida and Sugiura (2010)	Standard Hedonic Model	Japan	Green residential buildings trade at a price discount of 5.5%
Zheng et al., (2012)	Standard Hedonic Model	China	Significant price premia for 'green' properties in the Chinese housing market

Table 1 presents a summary of empirical studies examining the possible impact of energy efficiency ratings on residential house prices. The evidence for a price premium is partly contradictory, but it is generally skewed to a premium in terms of higher transacted prices for properties with high environmental performance. Despite this, it is quite apparent that there is a clear lack of empirical studies examining the effect of green certificates in the buy-to let segment of the residential housing market. There is only a recent study conducted in Wales in the extant literature. Fuerst et al., (2016) reported green price premiums for high EPC-rated buy-to-let properties with premiums of 18.5% and 4% for A/B and C-rated properties respectively, relative to D-rated properties. However, no significant discount for F/G-rated buy-to let properties was found. The authors attribute this to the split incentive problem, i.e. landlords base their willingness to pay on achievable rental values which are net of utility costs as these are borne by the tenants.

2.2 Literature on the capitalisation of green features into rental prices

Empirical studies examining the capitalisation of energy efficiency in the private rented sector are extremely rare. The apparent gap in the literature is somewhat not surprising, given the inherent shortage of data of good quality. To a greater extent, previous analyses of this topic have examined the effect of energy efficiency ratings in the commercial office market. This more established literature has typically relied on appraisal-based data or asking rent data to show a significant and positive link between energy efficiency ratings and office rents. For instance, an early study by Banfi et al., (2008) suggests that tenants are prepared to pay up to 13% higher rent for buildings that have adopted energy-saving measures. Similarly, Eichholtz et al., (2013) report that office buildings that were labelled energy efficient by one of the two major US rating agencies (Green Building Council and EPA's Energy Star) command a 'green' rental premium relative to office buildings that were never certified. They estimate that, holding property characteristics constant, an office building registered with LEED or Energy Star commands an average green rental premium of 3%. This green premium is found to be higher for buildings with a triple net rental contract, suggesting that tenants prefer to pay energy bills separately when leasing space in green office spaces. In related research, Fuerst et al., (2013) use a dataset containing actual contract rents and lease terms to show that UK office spaces with favourable energy performance ratings attract a significant rental premium relative to buildings with

average energy performance ratings, although, this premium is largely limited to highly energy efficient, newly built buildings.

Investors in the residential rental market are likely to be different from investors in commercial buildings in the absence of easily accessible information on the energy efficiency of buildings (Kok and Kahn, 2014). Empirical literature emerging from the private rental market has up until now been very limited, quality concerns and suitability of available data sources are often cited limitations and there is no clear consensus on the scale of the price effect of energy efficiency yet. A few case studies from Sweden, Germany and Ireland all report a positive relationship between energy efficiency ratings and residential rents. Zalejska-Jonsson (2014) uses a Swedish database that includes occupants living in green and conventional multi-family buildings to show a green premium of 5% of total rent in green buildings. However, environmental certificates are found to have a negligible effect on renting decisions. Similarly, Hyland et al., (2013) adopt a Heckman`s selection technique to investigate the effect of energy efficiency ratings on Irish residential property values and rents. They report that relative to D-rated properties, A-rated properties have a green sale price premium of 11% and a green rent premium of 1.9%. Interestingly, not only does this study suggest a positive relationship between energy efficiency ratings and rental and sale prices, but it also suggests that buyers exhibit a stronger willingness to pay for energy efficiency than tenants. In related research, Kholodilin and Michelsen (2014) examined the residential rental market in Berlin and found that energy efficiency savings are generally capitalised into rental prices. Earlier, Rehdanz (2007) arrived at similar conclusions in their study of German housing markets. Some evidence therefore exists that green buildings do command higher rental prices than conventional ones.

3 Summaries of Four Selected Emprical Studies conducted by RentalCal Partners

3.1 Empirical Study 1: Evidence of Green premium in the German Private Rental market

Improving the energy efficiency levels of the housing stock is of particular concern in the private rental market where landlords and tenants do not share capital costs and utility cost savings in equal measure. This problem is particularly pronounced in Germany where rental properties make up the majority of the housing stock. The present study is the largest to date to investigate the effect of energy efficiency ratings on rental values. Using a semi parametric hedonic model and an empirical sample of nearly 500k observations across 12 markets in Germany with full hedonic characteristics, we find strong evidence that energy-efficient rental units are rented at a significant premium. However, this effect is not confirmed for the largest metropolitan housing markets. In a second step, a survival hazard model is estimated to study the impact of the ratings on time-on-market. It is found that energy-efficient rental properties tend to lease up more quickly than their non-efficient peers.

3.2 Empirical Study 2: Evidence of Green premium in the Dutch Private Rental market

Using a large dataset on the Dutch rental market we investigate whether dwellings with high energy efficiency are rented out at a premium. Given the importance of the buildings sector in the energy-related greenhouse gas emissions improving energy efficiency is a key contribution to mitigating the climate change. The energy performance in the residential rental sector is of particular interest since the incentives to undertake efficiency improving investments are distorted. While the landlord has to bear the costs, the tenant benefits from reduced utility expenses. This “split incentives problem” has been put forward to explain discrepancies between energy performances in the rental dwelling stock compared to the owner-occupied dwelling stock. A solution for the landlord to recoup the energy related investments is to raise the rent such that the tenant’s overall living expenses remain constant. We employ a hedonic regression approach to assess whether energy efficiency is

implicitly priced on top of standard dwelling attributes. The dataset contains observations on rental rates charged in the Netherlands between 2012 and 2015 as well as information on location, age, size, type and general condition of the dwelling. Moreover, energy labels and a continuous measure of energy performance are assigned to each dwelling. This allows us to estimate the rent elasticity with respect to energy performance. Our findings indicate a positive rent premium for dwellings with high energy efficiency. This result implies that tenants are willing to pay for improved energy efficiency. Thus, the split costs and benefits of energy related investments should not hinder landlords from improving energy efficiency of their homes.

3.3 Empirical Study 3: Evidence of Green premium in the English Private Rental market

In the UK, a prominent segment of the built environment is contained in the private rented sector. This sector, which often houses low-income families and the young urbanised population in cities, offers a flexible form of tenure and contributes to increased labour mobility in the economy. The dynamics of residential rents are important within the housing and investment property mix. Given the fundamental link between capital values and rental rates, important insights about the underlying investment rationale in the rental market can be gleaned from studying the price effect of energy efficiency on rental prices and time-on-market. To date, researchers have yet to glean insights into the rental market and the implicit pricing of energy efficiency. In the analysis presented in this study, proprietary micro-data sources are exploited to evaluate whether tenants are willing to share the cost of efficiency investments and the extent that green-rated properties generate higher rental income streams via rental increments and a quicker letting period. The created database combines a wide array of information on rent prices, EPC ratings, property characteristics, and key socio-economic area variables. Given that the private rental market in England is unregulated, landlords and tenants can freely negotiate terms. The listed rental prices and the resulting letting period are thus the result of genuine market mechanisms. The present study examines listed rental values in England by employing the hedonic pricing model to empirically uncover the implicit prices of the key factors that serve as their determinants. Drawing on the unique micro level data of rental units, units with favourable energy efficiency ratings are found to achieve a small but significant price premium on monthly rent.

This price effect may be due to the expected energy savings realised by inhabiting high EPC-rated rental units as well as the additional benefits of energy efficient features. A separate estimation of the empirical relationship between time-on-market and energy efficiency rating is found to be inconclusive but points to a letting premium. On average, rental units with high energy efficiency ratings appear to achieve a quicker letting period.

3.4 Empirical Study 4: Evidence of Green premium in the English But-To-Let Market

The buy to let market segment is an important component of the housing market as it is often intertwined with other fundamental aspects of an economy, including labour market conditions, financial stability and building regulations. For this reason, numerous factors enter an investor`s “decision function” when choosing to purchase a property as an investment. For example, a common assumption is that tenants are willing to pay a premium for increased energy efficiency. Following this argument, buy-to-let investors are then likely to pay more for energy efficient properties. The current study investigates the effect of Energy Performance Certificate (EPC) ratings on prices of buy-to-let properties in England. Based on a comprehensive sample of individual dwelling units, high EPC ratings in dwellings are found to lead to a significant premium on sale prices, relative to average EPC-rated dwellings. In contrast, buy-to-let properties in the lowest EPC rating category of F/G achieve a statistically significant price discount. The evidence is less conclusive, but it is skewed towards a positive association between favourably labelled properties and rates of price growth.

3.5 Empirical results of the four selected studies

Table 2 presents the results of empirical studies conducted by the Rentcal parners. The consensus among these empirical studies appears to be that energy efficiency investments are capitalised into sales and rental prices and that significant green premiums exist in the selected markets. For instance, in the German rental market, the results provide strong evidence that asking rents of energy efficient dwellings are significantly higher compared to those with elevated energy consumption. When focussing on the aggregate German private rented sector, asking rents within the energy categories A+, A, B and C, are up to 4.1 %, 3.0 %, 1.8 % and 0.6 % higher than the reference category D respectably, whereas fats in the subsequent categories show negative coefficients, i.e. a substantial rental discount. Similar results are reported in the UK rental market in which B-rated units are found to command a green rent premium of approximately 5.2-5.3% relative to D-rated properties, while C-rated rental units are found to achieve a premium between 4.6% and 4.9% of rent per square metre. In the Dutch rental market, significant rent premiums are also found in that label A raises the average rental rate by 21%, label B 16%, label C 10% and label D 3% compared to a simple label G dwelling. These results are consistent with prior research surveyed in the literature (section 2.2). Some of these studies also point to additional benefits of energy efficiency investments in terms of increased lettability of favourable rated rental units. Furthermore, the fourth empirical study investigates the effect of green certificates in the buy-to let segment of the residential housing market in England. This study is one of first of its kind and shows that high EPC ratings in dwellings are found to lead to a significant premium on sale prices, relative to average EPC-rated dwellings. In contrast, buy-to-let properties in the lowest EPC rating category of F/G are found to achieve a statistically significant price discount. The price premiums reported are in line with the findings of Fuerst et al., (2016) in Wales in which premiums of 18.5% and 4% are found for A/B and C-rated properties respectively, relative to D-rated properties.

Table 2: Results of the four emprical studies conducted in selected RentalCal partner countries

Empirical Studies conducted	RentalCal Country	Emprical Findings: Green price premiums	Emprical Findings: Additional green benefits
Cajias, Fuerst & Bienert (2016) Are energy efficiency ratings ignored in the German housing market? – Evidence from a large sample hedonic study	Germany	A+, A, B and C, achieve up to 4.1 %, 3.0 %, 1.8 % and 0.6 % rental price premiums relative to the reference category of D-rated dwellings respectably. Whereas flats in the subsequent categories show a substantial rental discount	Results show that energy efficient dwellings appear to lease up more quickly than their non-efficient counterparts.
Brounen & Aydin (2016) Energy Capitalization in the Dutch Rental Market	Netherlands	All else equal, label A raises the average rental rate by 21%, label B 16%, label C 10% and label D 3% compared to a simple label G dwelling.	-
Adan & Fuerst (2016) Evidence of Green premium in the English Private Rental market	England, UK	B-rated units are found to command a green rent premium of approximately 5.2-5.3% relative to D-rated properties. While C-rated rental units are found to achieve a premium between 4.6% and 4.9% of rent per square metre.	Results point to a negative relationship between time-on-market and energy efficiency rating but this is inconclusive.
Adan & Fuerst (2016) Evidence of Green premium in the English But-To-Let Market	England, UK	Using category D as the hold-out, positive price premium of approximately 5% is found for B/C rated dwellings. For properties in the F/G category, a significant discount of 9-11% is found compared to D-rated properties.	-

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5 Attachments

The full study texts are availabe as attachment:

- Are energy efficiency ratings ignored in the German Housing market? Evidence from a large sample hedonic study.
- Evidence of Green premium in the Dutch Private Rental market.
- Capitalisation of Green Features into Property Sale and Rental Prices in English Housing markets.
- Do Green Rated Properties Command Rental Premiums and Quicker Letting Period Than Their Counterparts?