REVALUE

COST OF CAPITAL

[D3.5]

[20-March-2018]

Deliverable	*3.5*
Title	*Cost of Capital*
Editor(s):	*Maastricht University*
Contributor(s):	
Reviewers:	*Savills, RICS, Bax & Company, Savills, Vanhier Accountants*
Type (R/P/DEC):	*P*
Version:	*1*
Date:	*20 March 2018*
Status:	*Draft*
Dissemination level:	*Public*
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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649705. The sole responsibility for the content lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.

Executive summary

The purpose of this deliverable is to provide an analysis of the potential effect of energy efficiency on the cost of capital to finance – affordable – rental dwellings. The note is based on an up-to-date review of the scientific literature on this topic, and a review of expert opinions extracted from a roundtable organized last year in Maastricht.

At the individual project level, the cost of capital results from the weighted sum of the cost of equity and cost of debt associated to the asset. The empirical evidence linking environmental performance of assets to their cost of capital is still limited. However, there seems to be a consensus in the academic literature suggesting that sustainability performance of real estate is associated with lower systematic risk to both the lender and the asset owner, both in housing and in commercial real estate. Moreover, recent research that specifically aims to assess the equity cost of capital for sustainable real estate shows a financing cost reduction of 38 basis points relative to conventional real estate.

On the debt side, empirical evidence indicates that environmental performance of assets is associated with lower default and prepayment risk. And since risk is the key determinant of financing costs, this would likely translate into lower financing costs. It is important to note that all this evidence is for the United States, and that most of it concerns commercial real estate. Thus, any extrapolation to affordable housing and/or Europe should be made with caution. However, within Europe, as long ago as 2015, research recognized that, as properties which are energy efficient are cheaper to run, there is the potential for lenders to differentiate this in the mortgage offer. This in turn has ben and is being further developed through both a UK and now an EU project.

From the roundtable, there emerged interest in developing a market for financial instruments aimed at improving sustainability performance. However, the extent to which these lower financing costs also holds for loans financing sustainability enhancing investments into property is not yet clear, though it is being actively pursued. Representatives from different European financial institutions participated in the roundtable and described different programs in their institutions targeting the finance of green construction or retrofits.

Table of contents

Chapter 1 Introduction

Energy efficiency can affect the investment value (worth) of rental housing through the discount rate used to calculate the present value of cash flows.[1] That discount rate is in turn depending mostly on the risk inherent in the cash flows associated to a property and the owners cost of capital. For instance, if energy-efficient dwellings have a higher or more stable occupancy, their effective rental income will be more stable and predictable, and that should translate in a lower required risk premium and a lower discount rate - and ultimately in a higher value to the investor.

The purpose of this deliverable is to provide a systematic discussion of the potential effect of energy efficiency on the cost of capital to finance affordable rental dwellings, based on an up-to-date review of the scientific literature on this topic and review of expert opinions. In order to do that, the document will begin with an overview of the empirical evidence regarding the effects of energy efficiency on each aspect of the cost of capital. The next section will provide the key lessons of an expert meeting on this topic that was held at Maastricht University. The deliverable will end with a short summary and some conclusions.

Chapter 2 Cost of capital: empirical evidence

This section describes the existing literature exploring the effect of energy efficiency on the cost of capital, commonly used as discount rate in discounted cash flow valuation methods. The cost of capital is a result of the weighted sum of the cost of debt and the cost of equity. While there exists some literature regarding the effect of energy efficiency on these two components, most of that literature considers real estate assets in general, and does not focus specifically on housing. It also assumes that the investor is driven by the standard requirements of maximisation of return within acceptable risk constraints.

The cost of equity

The cost of equity, within a corporate environment describes the compensation that investors will typically demand in return of the risk associated to the asset and the availability of other investment opportunities. Vacancy is a key factor in the systematic risk of real estate, so the lower vacancy levels and the lower vacancy fluctuations of energy-efficient buildings imply lower risk. The literature exploring equity costs for energy-efficient assets in real estate is extremely limited. There are five papers which have been examined to establish whether they provide any information on this this association, of which the first two concern housing. The first one is Brounen and Kok (2011). The paper shows that, in the Netherlands in 2008 -09 when EPCS were first introduced, environmentally certified residential real estate transacted in the open market for a slight premium. It did not however explore the sources of finance used in the purchasing of these dwellings. Similarly Hyland, Lyons and Lyons (2013), studying owner-occupied transactions in Ireland following the global financial crash, showed that environmentally certified dwellings keep their value better in down markets, suggesting that they represent lower systematic risk – if owner-occupiers deemed risk profiling to be part of their purchase decision-making, but this point was not specifically addressed.

In the commercial real estate literature, Eichholtz, Kok and Quigley (2010) show that environmental performance in commercial real estate investment stock is positively related to occupancy levels In other words, energy-efficient real estate has less vacancy risk for the investor. Moreover, this paper shows that the occupancy of environmentally certified space is also more stable than that of conventional space. In real estate markets, vacancy rates tend to fluctuate with the business cycle, while contract rent levels are rather invariant to business cycle movements (Geltner et al., 2013).

Eichholtz, Kok and Yönder (2012) provide more direct evidence related to risk levels, as, in theory at least, these relate to attitudes to equity placement. They studied US Real Estate Investment Trusts (REITs[2]), which allowed them to assess

[1] For a detailed discussion on energy efficiency and discounted cash flow valuation method, see REVALUE 3.4 "Cash Flow Components".

[2] It must be borne in mind that REITS are very specific types of investors in that, depending on the jurisdiction in which they operate, they are not allowed to hold significant equity funds: in most countries there is a requirement to distribute the income received. They are therefore very different in structure and investment strategy to social housing providers who form the major component of the REVALUE study.

beta's directly by looking at the stock performance of these REITs.[3] The authors investigated whether REITs owning a higher share of environmental certified assets have a lower beta, and therefore lower risk. The results indicated that a one standard deviation increase in the portfolio share of energy-efficient buildings lowered beta with 0.6 standard deviations. In their study, this implies a decrease in average betas from 0.85 to approximately 0.65. However, Eichholtz, Kok and Yönder (2012) included in their sample all REITs, rather than restricting the sample to REITs specializing in residential property, of which there was too small a sample.

Parker (2018) in an analysis of global 'green' REITS found that their investment strategy had led to better returns but concluded that over time this will normalise as REITS increasing invest in 'green' stock as their standard policy. Eichholtz, et al., (2018) estimated the average beta for residential property companies, and found a mean global beta of 0.26, with a standard deviation of 0.10. Thus, if we extrapolate the Eichholtz, Kok and Yönder (2012) results to an energy-efficient residential environment, we would get an equity beta of approximately 0.2, suggesting that they offer risk advantages. In theory this should reflect back into the cost of capital and hence adopted discount rates.

Barron, Eichholtz and Yönder (2018) took a furtherer step in this analysis and estimated the cost of equity capital for environmentally certified real estate directly. Again, the authors focused on US REITs, since the REIT platform allows for a direct regression estimate of the cost of equity capital, and the US market provides the required sample size. The main conclusion of this paper is that a REIT that would have a 100% environmentally certified portfolio would have a cost of equity capital that would be 38 basis points lower than a REIT owning conventional buildings only.

However it must be borne in mind that the financing of REITs relates to corporate funding structures with equity raised on the capital market and through borrowing. Therefore, whilst it is tempting – and theoretically logical to extrapolate this to the individual building level, when discussing residential units, equity is not normally viewed through the same lens as with a corporate investor. If it did hold good it could arguable translate for an environmentally certified building to a 38 basis points lower cost of equity than a conventional building. It is important to note here that this result is entirely hypothetical as, to the knowledge of the authors, there is no study providing direct information for the equity cost of capital on residential real estate yet at either the portfolio (corporate) or individual level. From the date of the papers reviewed it is also clear that the study of cost of capital related to equity funds in environmentally superior property is in its infancy.

The cost of debt

There are only three academic papers investigating the relationship between energy efficiency in real estate and the cost to finance it (i.e. cost of debt). However, there are industry related initiatives and the REVALUE project is conducting investigating reported in REVALUE Deliverable 3.1.

Of the academic studies, the most recent is by An and Pivo (2018), who looked at the performance of a very large sample of commercial property mortgages in the US. Specifically, they studied default risk and found that environmental mortgages on energy-efficient dwellings are 20 percent less likely to default than mortgages on conventional buildings. For buildings with very strong environmental performance, the default risk can be even lower. The authors do not discuss whether this lower mortgage risk translates into a lower interest rate.

A slightly older, but again US based paper by Kaza, Quercia and Tian (2014) focused on home mortgages rather than mortgages on commercial buildings, making their results more applicable to this note. Specifically, they investigated the effect of dwellings' environmental performance on the two main risk factors in residential mortgages: prepayment and default risks. The authors found large effects of environmental performance on both dimensions. Prepayment turns out to be 32 percent lower in mortgages on homes certified by the US Energy Star label, while default is even 39 percent lower.[4] These findings are highly statistically significant, but they need to be interpreted with some caution, since the

[3] Beta is defined as "the asset's risk as a fraction of the overall average or market risk (variance in the market)" (Geltner et al., 2013), and is commonly used in Finance to compute the price of financial assets as a function of their associated risks.

[4] The prepayment clauses give the borrower the right (without obligation) to pay off the loan before the maturity stated in the loan contract. This creates risk for debt investors, as they use their investments to match the maturity of liabilities with the maturity of their

authors do not adequately control for possible endogeneity and reverse causality. The timing must also be considered. Their study was undertaken for the period 2000- 2010 which includes a period of almost unprecedented financial and employment instability in the US.

In sum, the preliminary conclusion of these two papers on mortgage performance is that environmental performance and mortgage risk are negatively related. However, that does not automatically imply that this lower risk translates into lower interest rates. The question is whether the real estate debt market already prices the lower risk. There is only one study that directly investigates this: Eichholtz, Holtermans, Kok and Yönder (2019). The authors analysed the spread on mortgages and bonds financing the assets owned by US REITs. For the bond spreads, they study spreads at issuance and in the secondary market. The analysis for mortgages suggests the existence of between 26 and 32 basis points lower spreads associated with certified buildings, while bond spreads are lowered by 17 to 67 basis points when a REIT would double the portfolio share of environmentally certified buildings. These results are robust in the sense that they remain statistically and economically significant when the authors control for endogeneity and reverse causality in a number of ways. However, for the study at hand, it is important to note that the results concern real estate investments in general (i.e. commercial and residential) rather than housing specifically and, unlike the first two papers, refer to portfolio investors, not individual home owners raising domestic mortgages. To the knowledge of the authors, there is no comparable research directly involving residential real estate.

The possibility of differential pricing on mortgage offers has been considered within a UK context. In 2015, the UK Green Building Council, with UCL published a report on the role of energy bill modelling in mortgage affordability calculations (Griffiths, Hamilton and Huebner, 2015). Their research into actual household expenditure associated with homes of different energy performance concluded that if mortgage lenders could include more accurate estimates of energy costs in their lending assessments, they could estimate more accurately their lending risks by reference to default rates. They also concluded the EPCs were not as good an indicator of energy costs as they should be. This paper had been followed by the LENDERS project (UKGBC, 2017),[5] the findings of which suggest that, if mortgage lenders improve the accuracy of the energy data they use to establish affordability of loans it could encourage home owners to invest in more efficient stock. By implication it would reduce lending risk. Similarly, EeMAP project is seeking to develop the market for a green mortgage project.[6]

Overall conclusions on energy efficiency and the cost of capital

The literature regarding the relationship between real estate's environmental performance and the cost of capital is still in its infancy, but it does provide an indication in terms of the direction of travel. The first main takeaway is that for large-scale investors who apply rigorous financial modelling to drive their investment strategies, energy-efficient real estate has lower vacancy and liquidity risk, translating into a lower beta (main measure of systematic equity risk). This is clearer for commercial than residential real estate. Estimates from the literature indicate that the equity cost of capital of environmentally certified real estate is lower by 38 basis points. Second, the cost of corporate debt financing for energy-efficient real estate is approximately 30 basis points lower than for conventional real estate. The exact effect on the weighted cost of capital and therefore on the discount rate that needs to be used for present value calculations depends on the leverage applied.

While these are the best estimates the literature currently provides in relation to corporate commercial level, it is not clear to what extent these numbers hold for rental housing. However, for the rented residential sector, in which owner-occupation tends to drive pricing models, whilst there is a theoretical case for differential pricing of mortgage product based on lower credit risk, this is not yet translated through to lender policy.

But a safe conclusion seems to be that the appropriate discount rate for energy-efficient rental dwellings should be lower than for the market generally, especially given the lower risk of the former.

assets. Moreover, prepayment is likely to occur when market interest rates have fallen relative to the rate paid on the loan, so investors will then have to reinvest at a lower rate, thereby reducing their return.

[5] https://www.ukgbc.org/wp-content/uploads/2017/09/Lenders_Core_Report_1.pdf

The Energy Effiicient Mortgage Action Plan (EeMAP) ttp://energyefficientmortgages.eu/

Chapter 3 Cost of capital: expert opinions

Given the limited empirical evidence on the topic and dearth of information in relation to social housing Maastricht University hosted the "Conference on Green and Healthy Homes; Finance, Investments, and Outlook" on October 21, 2016 (see Deliverable 3.5). It brought together some of the leading practitioners and academics in the field of green housing investment, with the aim to discuss the state of the art in research and financing products with practitioners and policy makers in (affordable) green housing and housing finance. The first part of that conference was a roundtable and discussion on the topic of green property financing, focused on housing. The remainder of this section provides the results of the roundtable.

Roundtable on green housing finance

The aim of the green housing finance roundtable was to gain new insights in the topic by bringing together a balanced mix of leading academics and practitioners. This was done in three sessions, the first of which concerned the cost of capital, the second the availability of capital and the aim of the third session was to bring this all together (see the program and speakers at the green housing finance roundtable below).[7]

Session 1: **Cost of Capital and Risk of Green Affordable Housing**
Chair: Piet Eichholtz, Maastricht University

- Peter Göbel, ING Real Estate Finance
  Incorporating Sustainability in Real Estate Financing
- Jan Martijn Buruma, Finance Ideas
  Financing Sustainability Investments in Social Housing
- Rogier Holtermans, University of Southern California
  Environmental Performance and the Cost of Capital

Session 2: **Availability of Capital**
Chair: Nils Kok, Maastricht University

- Jennifer Johnson, European Mortgage Federation
  Capital Availability for Owner Occupied Housing
- Teun de Jong, European Investment Bank
  The Juncker Funds and Capital Availability for Affordable Housing
- Anouk Blüm-den Heijer, ASN Bank
  Lending for Sustainability

Session 3: **Panel Discussion on the Future of Green Housing Finance**
Chair: Andrea Chegut, MIT Center for Real Estate

- Dirk Brounen, Tilburg University
- Sarah Sayce, Royal Agricultural University
- Speakers from first two sessions

First session

In the first session, Peter Göbel of ING Real Estate Finance underscored how important sustainability criteria were in ING's real estate financing approach. ING clearly saw the lower market risk of energy-efficient buildings, given the clear preferences of building users for such buildings. That implies lower vacancy risk, lower liquidity risk and stronger upward rent potential for green buildings. From the standpoint of risk management, ING clearly prefers to finance green buildings rather than brown ones.

ING stimulated its clients towards green buildings in a number of ways, for example it had created a Green Real Estate Finance App, to help clients assess the value effects of investments that increase the environmental performance of their buildings. ING also helped clients get subsidies for such investments, and could provide a free BREEAM or energy performance scan. Most important for the purpose of this note, however, is that ING also said they give their clients an incentive in the form of lower financing costs for green retrofits: up to 0.5 percent. Loans for green retrofits have a loan-

[7] For a detailed description of participants and speakers in the round table, please see REVALUE deliverable 5.8

to-value ceiling of 100%. Since the conference ING has stated that it has a policy to only invest in 'green' stock: 'brown', or non-sustainable buildings, it states will not be eligible for funding as of 2018 unless the owners have a sustainability plan in place.8

Rogier Holtermans of the University of Southern California discussed the financing costs of green real estate relative to conventional real estate, focusing on mortgages and bonds. Not only did he present empirical evidence of these costs, but he also provided a thorough discussion of the modelling requirements for a proper assessment of the relationship between real estate's sustainability performance and it financing costs.

His first point was to stress the importance of addressing property quality and location. For example, sustainable buildings tend to be either renovated or relatively new, and would be easier to rent out for these reasons alone. This would reduce vacancy risk, and likely also the interest rate required by banks and other financiers to finance such assets. Thus, a quantitative analysis that would not control for property quality would likely attribute lower potential financing costs to a building's sustainability performance where these lower costs would in reality be caused by the building's overall quality. Dr. Holtermans mentioned building location, size, and property type as the three other key building quality attributes that need to be involved in any modelling of financing costs.

The second main issue a proper analysis would need to address is the set of loan attributes. For example, a loan that has a high loan-to-value (LtV) ratio would normally be more expensive than a low LtV loan. On the other hand, the example of ING above shows that financiers may be willing to extend higher LtV loans to green assets, while these loans would be cheaper than those provided for conventional real assets. Thus, controlling for LtV is key, and that also holds for the time to maturity of the loan and the question whether it is a floating or a fixed rate loan.

Third, a proper modeling effort should control for the time at which the financing was done. Interest rate spreads relative to the government borrowing rate have gradually come down since the global financial crisis, just as green building investments have increased. So, empirical observations of building investments and the financing thereof are likely to show more green financing and cheaper financing at the same time, even if the two would be unrelated. Including year fixed effects in the model would address this issue.

The fourth key empirical issue to address are the potential endogeneity and reverse causality issues. For example, if one would find that property companies owning lots of green buildings tend to have lower financing costs, a researcher could be tempted to conclude that the assets' greenness are responsible for this. However, it may well be that both sustainability performance and low financing costs are accomplishments of a superior management team, that is able to negotiate successfully with banks and makes green investment decisions at the same time. And the causality could even run from the financing costs to the sustainability performance: increasing a portfolio's greenness necessitates capital investments, and it is possible that only those property investors that have good access to cheap capital are able to make these investments. These examples illustrate that endogeneity and potential reverse causality are key issues in this type of analysis, and that the researcher needs to apply methods that affirm causality unequivocally.

Holtermans' presentation then went on to discuss the results of his US empirical analysis on the topic, reflecting the considerations mentioned above. After controlling for property quality (location, size, property type, renovation, age, but also tenant quality and building amenities), loan attributes (LtV, time to maturity, fixed rate / floating rate, and cross collateralization), and year fixed effects, and by choosing an empirical specification that addresses endogeneity concerns, Holtermans concluded that green real estate is financed at lower debt costs than other, non-certificated real estate. Mortgages secured on green labelled buildings have an interest rate spread that is 25 to 37 basis points lower than mortgages financing non-labelled buildings. And buildings with the best sustainability performance – those labeled LEED Platinum and Gold – have mortgages with lower interest rates up to 79 basis points. At the company level, bonds issued by US Real Estate Investment Trusts have significantly lower interest rates if their portfolios cover more green-rated buildings: a doubling of the portfolio allocation to green buildings reduces bond spreads by 17 to 67 basis points, depending on the specification.

Dr. Holtermans mentioned one important caveat: the fact that there is no direct empirical evidence regarding the financing costs of green affordable housing. The existing evidence, including evidence provided by the research of

[8] https://www.ing.com/Newsroom/All-news/ING-will-only-finance-green-office-buildings-in-the-Netherlands-after-2017.htm

Holtermans himself, concerns commercial real estate in the US. It may be possible to generalize this evidence to (affordable) housing in Europe, but such a generalization should be done very carefully, and should take account differences in the institutional setting in other countries than the US, specifically concerning affordable housing.

Jan Martijn Buruma of Finance Ideas focused explicitly on the financing of green retrofits in (Dutch) affordable housing. He first outlined the ambition that the Dutch affordable housing sector has agreed upon with the national government: to increase the average energy performance of the full Dutch affordable housing stock to EPC label B by 2020. Finance Ideas did an assessment of the current investment programs among Dutch affordable housing providers, and concluded that the target date can only be met if these programs will be speeded up considerably.

Buruma showed that there are two extremes in the way to attain the national target: either many current D-E-F-G labeled dwellings will be upgraded to B, or far fewer E-F-G labeled dwellings will be upgraded to A++. In the former approach, almost 500,000 dwellings need to be refurbished, while this is reduced to 200,000 if the latter approach is chosen. To put this in perspective: the Dutch social housing sector owns about 2.4 million affordable dwellings.

Both strategies require a significant amount of capital: approximately € 17.5 billion if the first approach is taken and € 15.5 billion in the second case. Taken as a whole, the Dutch affordable housing sector has enough capital buffers to finance this, from its own equity and/or from additional debt. However, Finance Ideas has also done the capital availability analysis on the level of individual social housing institutions. The study concludes that 85 percent of these institutions have adequate financial buffers for the green investment ambitions. So overwhelmingly, financing the sustainability ambitions was shown to be possible within the Dutch affordable housing finance framework, with its government guaranteed lending system. This would allow social housing institutions to finance these investments at spreads that lie approximately 30 basis points above the risk-free rate. While this is very cheap, it is not cheaper than what a Dutch social housing institution would pay for a loan to finance an investment in a standard housing project.[9] Thus, although a sustainable housing project may represent a lower risk than a standard housing project, this is not relevant to the financier providing a loan to finance either of them at the moment, since both loans would be guaranteed by the party representing the lowest risk in the Dutch capital market: the government. This guarantee overrides any risk effect relating to a project's sustainability performance.

The overall conclusions of the first session of the Maastricht round table on green housing finance were that the capital market generally rewards sustainability performance through lower financing costs. But that finding does not necessarily hold for affordable housing, due to differences in the national and local institutional setting, as the Dutch example illustrates. The risk-reduction effect of a government guarantee on affordable housing loans trumps any difference in risk between sustainable and conventional housing.

Second session

The second session of the roundtable concentrated mostly on the availability of capital rather than its price alone. Jennifer Johnson of the European Mortgage Federation started with the EU's 2020 energy reduction target of 20 percent, and showed that the housing market can play a considerable part in attaining that goal. Jennifer then showed how the mortgage market could facilitate home owners to finance sustainability improvements to their dwellings, and argued that there should be a monotonous relationship between dwellings' sustainability performance and their financing costs: a better performance should lead to lower costs. However, she did not put numbers on that relationship.

A key insight deriving from her talk was that financing costs and financing availability tend to be two sides of the same coin, and in the mortgage market, higher LtV ratios usually go together with higher interest rates. However, if house values go up due to improvements in their sustainability characteristics, then larger loan sizes do not necessarily lead to higher LtV ratios. Essentially, this is the idea behind the EU Juncker Funds extension into mortgages: create second mortgage funding for refurbishments at the same interest rate as the original mortgage. She explained that the European Mortgage Federation was leading an initiative to collect data on the performance of existing mortgages and its relationship with the energy performance of the collateral.

[9] The Waarborgfonds Sociale Woningbouw (WSW) is the Dutch institution guaranteeing almost all of the debt issued by Dutch social housing institutions. The WSW is ultimately backed by the Dutch government and municipalities, and has triple-A ratings from Moody's and Standard & Poor's.

Teun de Jong of the European Investment bank said that the Bank's financing of social and affordable housing was a key element in its urban development investments; it started in 2000, now amounted to approximately € 9 billion, with strong growth in recent years, and much more to come in the future. The focus was on rental housing, with loans aimed at new constructions and green refurbishments. The bank's involvement could either be in direct loans to social housing providers or in loans through intermediaries, mostly commercial banks. The direct channel was used only for larger loans, while the indirect one was designed for medium- and small-sized lending. The question whether the European Investment Bank generally rewards sustainability performance through lower interest rates depend on the country in which the loan is made and the institutional setting of affordable housing in that country.

Anouk Blüm–den Heijer of ASN Bank provided an overview of the different (financing) tools for sustainable real estate investments that are available in the Dutch market. One of these is *Het Nationale Energiebespaarfonds*, that provides loans to private home-owners and condominiums who want to improve the energy efficiency of their homes. This is an initiative of ASN bank and RaboBank, backed by the national government. Although the instrument is claimed to provide loans at favorable terms, the interest rates were actually somewhat higher than those in the standard mortgage market.[10] At the time of the roundtable, ASN Bank itself did not (yet) provide cheaper loans for housing and commercial real estate with a superior sustainability performance, but given the bank's aim to be climate neutral by 2030, this might change in the future.

Third session

In the final discussion, involving Sarah Sayce of Agricultural University and RICS and Dirk Brounen of Tilburg University as well as the previous speakers and the experts in the audience, the importance of the local and national institutional setting was stressed again. It was also said that lack of financing was a structural barrier to the implementation of green housing refurbishments. Prof. Sayce quoted the results from a survey by the *Institute for Building Efficiency* where 41 percent of institutional housing owners said they did not have the financial means to invest in the sustainability performance of their assets.

Besides that, three main conditions were discussed that need to be met before structurally lower financing costs for specific financing tools towards green housing investments can be attained: 1. security of repayment; 2. standardization; and 3. deal volume and deal flow.

Having said that, some examples were given of (European) banks that already have policies in place linking lending rates to sustainability performance in commercial real estate and housing. For example, *Bayerische Landesbank* had created a three-fold approach to assist its real estate clients in sustainability investments: It offered support in the green certification process of buildings, it helped establish the value and risk effects of the sustainability of their clients' real assets and provides advice concerning building sustainability improvements that specifically enhance value and reduce risk. Last, and most relevant for the discussion at hand, clients that adhered to the bank's sustainability criteria got more favourable financing terms.

Another example is the Dutch bank *Triodos*, which has incorporated sustainability performance in its housing mortgage underwriting. It (partly) bases its mortgage interest rate on sustainability criteria, using the EPC label as a base. The mortgage rate falls 0.1 percent for every increase in the EPC label, so a renovation that boosts the home's energy performance from an F- to an A-label would reduce the mortgage interest rate by 0.5 percent. On top of that, homes with an A++ label are allowed to have € 8,000 more financing as compared to regular homes. ABN AMRO and Rabobank are other Dutch banks that provide loans at lower rates for real estate that performs well in the environmental dimension.

Another interesting development that was mentioned is the market for so-called "green bonds", which is rapidly developing not just in Europe, but also in North America. The Swedish real estate investment company Vasakronan was the first to issue such a bond in 2013, for a total value of just under $ 200 mln, and at an interest rate of 1.315 percent, which was considerably lower than standard commercial real estate financing at the time. This example showed the way for other real estate investors, such as Unibail Rodamco, which issued a loan of € 750 mln specifically aimed to finance the sustainable real estate investment policy of the fund. A majority of the buyers of the bond were dedicated socially

[10] This may be the reason why, as of 2018, only approximately 8,000 loans have been granted.

responsible investors. The loan was issued at 12 basis points lower than expected, due to overwhelming interest in the market. These examples show that there is ample bond market interest in lending towards energy efficiency performance, translating into favourable lending rates.

In sum, the key takeaway of the final sessions is that the market is already experimenting with lower interest rates linked to sustainability performance. However, the exact interest rate discount for loans financing sustainability enhancing investments into property is not yet clear.

Chapter 4 Summary and conclusions

This note gives insights into the relationship between sustainability performance of real estate and its financing costs. This is important in the framework of the REVALUE project since financing costs are one of the key underlying factors for the discount rate that is used for the investment worth appraisal of real estate, both commercial property and (affordable) housing.

One of the key starting points for the investment discount rate is the weighted average cost of capital, consisting of the cost of equity and the cost of debt. This will vary from investor to investor depending on their corporate risk profile as much as the value of the underlying stock against which money is secured. According to capital market theory, the equity cost of capital is determined by the – systematic – risk associated with the asset being financed. There is limited academic evidence showing that sustainability performance of real estate is associated with lower systematic risk, both in housing and in commercial real estate, but it is recognized that this field of study is in its infancy especially in relation to social housing where there is a dearth of literature. Moreover, recent research that specifically aims to assess the equity cost of capital for sustainable real estate shows a financing cost reduction of 38 basis points relative to conventional real estate.

On the debt side, the academic evidence regarding financing costs and sustainability performance is even more limited. There are a few papers showing that mortgages on energy efficient homes and commercial real estate perform better in the sense that they have considerably lower default and prepayment risk. And since risk is the key determinant of financing costs, this would likely translate into lower financing costs. Indeed, the only available paper that investigates whether that is really the case shows that mortgages on green rated commercial real estate have lower interest rates, and that bonds issued by real estate investors who own more green real estate have lower interest rates as well.

It is important to note that nearly all this evidence is from the United States, and that most of it concerns commercial real estate. Thus generalizing these results towards affordable housing in Europe should be made with caution.

Given the paucity of academic studies, the REVALUE project also involved an expert round table on the topic, which showed different bits of practical evidence pointing at lower financing costs for loans aimed at improved sustainability performance. There were ample examples of banks incorporating sustainability criteria in their mortgage acceptance and pricing policies, both in the Netherlands and in other European countries, and both for commercial real estate and for housing. One can observe similar developments in the upcoming market for so-called green bonds that are issued by real estate investors and other financial institutions. There seems to be a willing market for financial instruments aimed at improving sustainability performance. However, the extent to which these lower financing costs also holds for affordable housing institutions is not clear. The specific institutional setting pertaining to these organizations differs per country, and the Dutch example given by Jan Martijn Buruma in the roundtable showed that the presence of a government guarantee on affordable housing loans trumps any risk differences between loans on green assets and conventional assets, thereby nullifying the potential differences in loan rates. So here also, even though there is clear market evidence of lower financing costs for more sustainable real estate, one has to be very careful when extrapolating this evidence to affordable housing across Europe.

However whilst the academic studies provide a direction of travel for discount rates and cost of money, industry initiatives, such as the LENDERS project give a strong indication that the debt market is sensitizing to the issue of energy efficiency. This was a clear message from the Round Table: private sector financing to support investment in energy efficient stock either initially or through retrofit, is a growth market and driven primarily by investor intentions to fulfil climate change responsibilities and by risk reduction.

Literature

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