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Upgrading housing: the potential and limits of borrower-based measures*

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Abstract

In this paper, we explore how borrower-based measures (BBMs) can be adjusted to provide additional funding for housing-related energy-efficiency investments without compromising financial stability objectives. We first show that lower energy costs and higher house price values resulting from renovation work allows an easing of borrowing limits while keeping loan risk metrics unchanged. We then focus on three recent easing measures implemented in Slovakia, Hungary, and Latvia and assess their effectiveness using a bank survey. We find that these policy changes did not significantly affect banks' credit portfolio risk profile and thus financial stability. At the same time, they did not generate a significant increase in loans for energy-efficient investments. We thus suggest combining BBM adjustments with other policy measures to improve energy-efficiency in real estate.

JEL codes: C8, E44, E50, G21

Keywords: housing renovation, borrower-based measures, green loans

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Non-technical summary

Improving the energy efficiency of housing is central to meeting the European Union's climate objectives. Buildings account for a large share of energy consumption and greenhouse gas emissions, and most of today's housing stock will still be in use in 2050. This means that upgrading existing homes—through insulation, heating improvements, and other renovation measures—will be essential. However, the pace of renovation remains slow across Europe, and current levels of public funding are insufficient to cover the investment needed. As a result, private financing, especially bank lending, must play a larger role in supporting energy-efficient housing upgrades.

Access to credit is particularly important for households that do not have enough savings to fund renovations upfront. Yet expanding household borrowing can also create risks: excessive debt may leave borrowers vulnerable to future shocks and increase banks' credit risk. For this reason, macroprudential authorities often apply borrower-based measures, such as limits on loan-to-value, debt-to-income, and debt service-to-income ratios, to ensure that lending remains sustainable and financial stability is preserved.

This paper examines whether such measures can be adjusted to support housing upgrades without undermining financial stability objectives. The key idea is that energy-efficiency improvements can strengthen household finances and, in some cases, reduce credit risk. Renovations can lower monthly energy bills, effectively freeing up disposable income that can help service a loan. Upgrades may also increase a property's market value, improving collateral quality for banks and reducing losses in the event of default. In addition, public subsidies can lower the net cost of renovation and further reduce credit risk. Taken together, these effects mean that a carefully designed easing of borrowing limits for renovation-related loans can be "risk-neutral" – i.e., it can expand financing opportunities without materially increasing loan risk.

To explore how this works in practice, the paper reviews recent policy measures in Slovakia, Latvia, and Hungary, where central banks introduced targeted relaxations of BBMs to support energy-efficient housing. In each case, policymakers sought to calibrate the changes cautiously, aiming to reflect expected energy-cost savings and/or improvements in collateral value.

Because these measures are recent and detailed quantitative data are still limited, the paper assesses their effects using a survey of major banks in the three countries. The survey results suggest that banks did not observe a material increase in risk in their credit portfolios following the BBM adjustments. Most institutions reported that the probability of default and loss given default for these loans did not change significantly, and that the volume of housing upgrade loans remains small relative to total lending.

At the same time, the survey indicates that the impact on housing upgrade loans has been modest. Banks generally did not observe a strong increase in demand for such loans linked to the BBM easings. This suggests that BBM adjustments alone are unlikely to deliver a large-scale acceleration in housing renovations. We identified two main reasons explaining this limited effect. First, the measures affect only a narrow group of borrowers—those close to existing borrowing limits who would renovate if credit constraints were eased. Second, easing BBMs does not, in itself, make renovation projects more financially attractive; it only increases households' borrowing capacity once a renovation decision is already economically viable.

The paper therefore concludes that BBM adjustments can support climate objectives at low risk to financial stability, but their effectiveness is limited unless combined with additional policies. These include public subsidies, tax incentives, or guarantees that improve households' incentives and ability to renovate, as well as measures that reduce administrative burdens for banks and borrowers. Greater public awareness, simpler eligibility rules, and easier access to information and documentation could also increase take-up. Overall, BBM adjustments can be a useful supporting tool—but they should be part of a broader policy package to achieve meaningful progress in upgrading Europe's housing stock.

1. Introduction

Upgrading the energy performance of housing is crucial to achieving the European Union's (EU) climate objectives.[1] Currently, buildings account for approximately 40% of the EU's total energy consumption and about one-third of its energy-related greenhouse gas (GHG) emissions, making them one of the most significant contributors to climate change.[2] Although GHG emissions from the EU's real estate sector decreased by approximately one-third between 2005 and 2023, a similar reduction is necessary in the next decade to meet the EU's climate targets for housing.[3]

Given that most buildings in use today will still be in use in 2050, retrofitting housing to improve energy efficiency is central to achieving this objective.[4] However, the current renovation rate – below 1% per year on average in the EU – remains well short of the 3% goal set by the European Commission's Renovation Wave strategy.

The European Commission estimates that around € 275 billion in additional investment in renovation is needed per year to achieve the EU's 55% emission reduction target by 2030. While EU funding schemes and national public subsidies exist, they are insufficient to close this gap. Mobilising private finance at scale for renovations is thus paramount. Households, which own a large share of the housing stock, play a central role here, but many owners have limited financial resources to finance large-scale renovations.[5] Access to bank loans is thus crucial, especially in countries where other funding is scarce.

Yet broad access to bank loans can also lead to over-indebtedness, endangering financial stability. To avoid that, macroprudential policymakers have, among other measures, implemented borrower-based measures (BBMs), policy tools designed to limit the amount households can borrow. BBMs are used to mitigate systemic risks in the financial system, particularly those stemming from the housing market and household debt. However, BBMs can also constrain funding for households seeking to improve the energy efficiency of their housing. In short, BBMs' financial stability objective may conflict with the energy-efficiency objective of housing upgrade loans.

This paper argues that the trade-off between objectives does not always need to prevail and that relaxing BBMs for bank loans to fund retrofitting projects – hereafter, housing upgrade loans – can, in some situations, improve households' access to funding without negatively impacting financial stability[6]. Such a risk-neutral approach is possible when these loans enable households to invest in projects that generate material energy-

[1] Under the European Climate Law, the EU has committed to reducing its net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels and to becoming climate neutral by 2050. The Energy Performance of Buildings Directive (EPBD) is part of the policy package implemented in this direction. It aims to achieve a fully decarbonised building stock by 2050.

[2] Source: European Commission and European Environment Agency.

[3] Source: European Environment Agency.

[4] According the European Commission, between 85% and 95% of buildings in use today will still be in use in 2050.

[5] Financial constraints are often cited as the main barriers to households' engagement in such projects, especially for low-income households. For example, Romer and Salzgeber (2023) found in a survey that 41% of German homeowners view financial constraints as the main barrier to energy upgrades. This proportion rises to 68% for low-income households. Schleich (2018) finds that households in the lowest income quintile are generally less likely to undertake retrofitting investments, but financial support increases their probability of upgrading work. Similarly, domestic surveys in Hungary indicate that the pricing of loan financing materially incentivises households to make their investment decisions about renovation.

[6] Although the BBMs easings studied in this paper also cover mortgage loans for energy-efficient home purchases, we by large focus our discussion on loans used for renovation purpose. Real estate buying decisions might involve different economic factors than renovation choices. Moreover, newly built energy-efficient houses, while contributing to improving overall housing energy efficiency, do not necessarily reduce emissions from the existing housing stock.

cost savings, when these investments increase a building's market value, and when subsidies and other public financial support mitigate the risk to banks.

Focusing on recent measures taken in Slovakia, Latvia and Hungary, we investigate how macroprudential policymakers eased their respective national BBMs for housing-upgrade loans to support renovation objectives through risk-neutral approaches. We assess how these measures affected banks' loan offerings and risk profiles by surveying selected institutions in each country.

The survey results indicate that, overall and in all three countries, commercial banks providing housing upgrade loans did not observe, and do not expect to observe, a significant alteration of their credit portfolio risk profiles following the easing of BBMs. Most do not see or expect substantial changes in the probabilities of default and loss given default for these loans, which remain marginal in their portfolios. However, banks also emphasise that they did not observe, or do not expect, substantial growth compared to other loan markets, suggesting these easings are likely to support environmental objectives only marginally. Banks highlighted that other factors, such as public subsidies and policies that require compliance with energy-efficient standards, are central to triggering large-scale housing upgrades.

Two main reasons explain why easings of BBMs do not more effectively support environmental objectives. First, these measures affect only a relatively small number of borrowers – households that own real estate and are willing to renovate but are constrained by current BBMs. Second, an easing does not, per se, constitute a financial incentive that makes renovation projects economically more attractive. It just expands the amount they can borrow when a project is financially attractive.

Against this background, we suggest two complementary sets of measures to enhance the impact of easing BBMs. First, public policies that offer financial incentives to households and banks to undertake and finance renovation work, such as subsidies, fiscal incentives, and public guarantees. Monetary instruments – such as targeted refinancing operations – and lower capital requirement - as suggested by commercial banks – are also possible measures, keeping in mind differences in central banks' mandates and potential conflicts with price and financial stability objectives. Second, measures to reduce the cost and complexity of due diligence and administrative processes for banks and households, thereby enhancing their attractiveness.

2. A risk-neutral approach to housing upgrade loans

In this section, we explore the main determinants of demand and supply for housing upgrade loans, highlighting the impact of public policies, including BBMs. We then discuss how a risk-neutral approach to BBMs can be implemented and present an illustrative calibration based on Slovak data.

2.1. Demand for housing upgrade loans

Applying for a housing upgrade loan economically makes sense for a homeowner when the present value of the renovation work's *expected* financial benefits (B) exceeds its financial cost (C).[7]

$$PV(\mathbb{E}[B]) > PV(C)$$

The expected financial benefits come through four main channels: savings (S_t) on the household's energy bills, the monetary values (π_t) of the reduction in risk premium associated with uncertainty about future energy bills,

[7] In addition, households might consider non-financial benefits of renovating their houses and apartments when assessing the opportunity to take out a loan, such as increased comfort (e.g., temperature control, noise reduction) and environmental preferences. They might also consider non-financial costs, such as the disruptions associated with renovation work (Curtis *et al.*, 2024). See Liu *et al.* (2022) for an overview of the factors influencing homeowners' renovation decision-making.

possible tax benefits (T_t) associated with renovation projects and the expected increase in the house's selling value consequent to renovation (ΔV_T):

$$PV(\mathbb{E}[B]) = \sum_{t=1}^{T} R_t(\mathbb{E}[S_t] + \pi_t + \mathrm{T}_t) + R_T\mathbb{E}[\Delta V_T]$$

where R_t is the household's discount rate for the period t and T is the period at which the household expects to leave and sell the house.[8]

Savings on energy bills can come from reduced energy consumption after renovation, lower energy prices driven by an increasing share of renewable energy, and proceeds from selling in-house-produced energy to the grid. Less volatile energy bills – resulting from lower energy consumption and more stable renewable energy prices – can reduce risk premiums. Finally, there is strong empirical evidence that renovation work increases housing market value.[9]

The financial costs mainly include the present value of debt service payments and the risk that servicing the loan puts the household in financial distress in the future.

$$PV(C) = \sum_{t=1}^{M} R_t(DS_t(L, r_l) + \Delta p_t \Lambda_t) - \sum_{t=\tau}^{M} R_t \Delta DS_t(G)$$

Debt service payments (DS_t) are a function of the loan amount (L), interest rate (r_l) and maturity (M). If the household receives public subsidies (G) after renovation work completion – e.g., at time $\tau > 1$ – it can use them to repay part of the loan to reduce remaining debt services (ΔDS_t). The cost of financial distress is the additional probability of being in distress associated with taking a loan (Δp_t) times the losses given distress (Λ_t).

2.2. Supply of housing upgrade loans

For a bank, it economically makes sense to offer a loan for a renovation project when the rate of return on that loan (r_l) exceeds its cost rate (c_l).

$$r_l > c_l$$

The cost rate of a loan is the market rate liquidity required to fund it, the capital required by regulatory requirements, operating costs, and potential costs in the event of the borrower's default.[10]

$$c_l = r_m + k \cdot r_e + c + p \cdot LGD(V)$$

where r_m is the market rate paid by the bank to raise the liquidity needed to fund the loan, k is the required regulatory capital ratio, r_e is the cost rate of equity, c is the operating costs as a fraction of the loan, p is the

[8] The discount rate is a function of, inter alia, the household's time preferences and the risk-free yield curve.

[9] Gholamzadehmir *et al.* (2025), for example, estimate that in the EU buildings subjected to deep energy retrofitting are more attractive to potential buyers, willing to pay a premium of 13.5% over properties in pre-retrofit conditions; Bellon *et al.* (2025) find that, in the United States, properties undergoing climate-proofing projects after getting a loan for that experience an average total appreciation in home sale prices of 19% to 25%. Ertl *et al.* (2021) find that, after controlling for location and property characteristics, family houses in Hungary with a good energy rating show a premium of roughly 15-20% compared to the 'average' FF category. Hajnal *et al.* (2022) find that, in Budapest, homes with an energy rating of BB or better are 5.1% more expensive than homes with an energy rating of CC.

[10] In the following equation, we assume, for simplicity, that the loan is fully funded with liquidity at its origination.

probability of default and LGD are the losses given default as a fraction of the loan. Note that empirical evidence tends to show that households living in energy-efficient houses have a lower probability of default than others.[11]

2.3. Public policies and their impacts

Public policies can directly influence several determinants underpinning banks' supply and households' demand for housing upgrade loans.

Carbon prices and grid connection policies affect potential savings on energy bills. Feed-in tariffs with guaranteed prices reduce the volatility of energy bills. Tax credits for insulation, heat pumps, and efficient heating systems provide fiscal incentives. Mandatory energy performance standards can secure market value for renovated housing. Subsidies and their rapid disbursement reduce households' debt service payments. Policies to reduce the cost and complexity of due diligence and administrative processes alleviate loan costs for banks. All these policies improve the financial viability of renovation projects or housing upgrade loans, thus facilitating energy-efficient investments.

Other policies, such as caps on interest rates or lower capital requirements, come with trade-offs and downsides. Caps increase households' demand by lowering loan costs but reduce supply by lowering banks' returns.[12] Lower capital requirements decrease banks' costs but reduce their capacity to absorb financial losses, which runs counter to the primary financial resilience objectives of these requirements.

2.4. BBM and their interactions with energy-efficiency objectives

The primary objective of BBMs is to prevent excessive leverage in the economy, ensuring that credit growth remains sustainable. BBMs target risk at the borrower level by setting credit limits that are proportionate to each borrower's financial situation. This protects banks from excessive loan defaults and individuals from taking on unsustainable debt burdens.

The main BBMs traditionally used are: loan-to-value (LTV) ratios limiting the maximum loan amount to a percentage of the property value; debt-to-income (DTI) ratios limiting total debt to a percentage of the borrower's income; debt service-to-income (DSTI) ratios limiting monthly debt payments to a percentage of monthly income; and loan maturity limits restricting maximum repayment terms.

BBMs in each country are implemented by the respective macroprudential policymakers. At the end of 2023, LTV limits were in place in 72 countries, and DSTI limits in 61.[13] In the European Economic Area, 25 countries have LTV limits currently implemented, 18 have DSTI limits, 15 have loan maturity limits and 6 have DTI or loan-to-income limits.[14]

BBMs generally prove efficient at achieving financial stability objectives. A recent large meta-analysis of the empirical literature concluded that they are relatively successful in affecting the flow of household credit (Biljanovska *et al.*, 2023). For the European Union (EU), Giannoulakis *et al*. (2023) find that BBMs decrease

[11] Billio *et al.* (2022) find a negative relationship between a building's energy efficiency and the owner's probability of default in Italy. Billio *et al*. (2025) find that green-labelled residential mortgage-backed securities in the EU exhibit delinquency rates 47.6% lower than those of their non-green counterparts. Guin *et al.* (2022) find that mortgages secured by energy-efficient properties are less frequently in payment arrears than mortgages secured by energy-inefficient properties in the United Kingdom.

[12] Note that, based on empirical evidence, banks do not seem to voluntarily reduce rates for housing upgrade loans (see, e.g., Hajnal *et al.* 2022, Bell *et al.* 2023)

[13] Source: IMF's Integrated Macroprudential Policy (iMaPP) Database (accessed on March 11, 2025).

[14] Source: ESRB's Macroprudential Measures Database (accessed on April 1, 2025)

households' default probability and loss given default, with a higher impact on households with lower income and net wealth.[15]

BBMs do not, per se, influence the costs and benefits of housing upgrade loans for banks and households. However, the constraints they set for financial stability reasons can limit the amount some households can borrow to finance renovation work, thereby going against energy-efficiency objectives. In some cases, BBMs may prevent some households from undertaking projects that have been made affordable and profitable by financial incentives provided by other public policies.

2.5. Risk-neutral approaches for energy-efficiency objective adjustments in BBMs

The potential trade-off between the energy-efficiency objective and the financial stability objective does not necessarily always prevail. We argue that, in two specific cases, an easing of BBMs for housing-upgrade loans is quasi-risk-neutral: when energy savings are accounted for in future households' income within BBMs, and when some public schemes back housing-upgrade expenses.

Retrofitting a house can significantly reduce regular energy expenses. These savings effectively increase borrowers' disposable income. Macroprudential policymakers can account for these savings when assessing households' income for LTI and DSTI limits. Upgraded houses are also likely to have a higher market value and potentially a lower risk of becoming a stranded asset, which can be accounted for in LTV limits.[16] Both changes are equivalent to increasing borrowing limits based on current income and collateral value. This increase would not come at the expense of financial stability, since after renovation work, households' ability to meet debt obligations is higher and their collateral is more valuable.

Macroprudential policymakers could also consider relaxing BBMs when relevant government financial support programmes are in place. When households benefit from public subsidies or tax incentives for renovation, they are partly relieved of financial costs and risks. Consequently, loans for such projects are less risky for banks.

Finally, note that changes in BBMs related to housing upgrade loans would likely not significantly affect systemic risk, as they affect only a marginal share of total bank loans. The limited number of borrowers affected by such measures is unlikely to significantly increase banks' aggregate loan portfolio risk.

2.6. An example of risk-neutral calibration

We illustrate how energy bill savings can impact the assessment of the DSTI ratio with an example based on Slovak data.[17] Consider a household consisting of 2 adults and 2 children, with a total net income of approximately 2,330 €, i.e. earning average wages. In Slovakia, the income relevant for the DSTI computation is net income, lowered by the subsistence minimum, resulting in 1,615 € entering the DSTI ratio for this household.

The household would like to renovate an old family house (energy certificate E). The total cost is 42,000 €. Annual energy costs before renovation are 4,600 €. After renovation (achieving energy certificate B), total annual savings amount to 2,577 €, equivalent to monthly savings of 215 €. The household covers the

[15] Jurca *et al.* (2020) found similar results for Slovakia.

[16] The newest version of Regulation (EU) No 575/2013 (Capital Requirements Regulation (CRR)) Article 229 (1) applicable as of 1st January 2025 in the EU allows accounting for such potential higher property value after renovation: "The property value may exceed that average value or the value at origination, as applicable, in the case of modifications made to the property that unequivocally increase its value, such as improvements of the energy performance or improvements to the resilience, protection and adaptation to physical risks of the building or housing unit."

[17] The example is taken from the Slovak Environment Agency's Housing Renovation website: https://obnovdom.sk

renovation costs with a consumer loan with an 8-year maturity and a 9% interest rate, resulting in a monthly debt service payment of 615 €.

We consider two options to account for energy bill savings in the computation of the DSTI ratio: first, adding the savings to households' income; and second, subtracting the savings from the debt service payment.[18] Table 1 presents the resulting DSTI ratios.

Table 1 DSTI and energy bill savings accounting scheme

	Savings not accounted	Savings accrued to income	Savings accrued to debt service payments
Income	1,615 €	1,830 €	1,615 €
Debt service payment	615 €	615 €	400 €
DSTI	**38%**	**34%**	**25%**
Risk-equivalent loan if savings are not accrued		37,065 €	27,325 €

Source: own calculations

The differences in DSTI are 4 and 13 percentage points when savings are accrued to income and to debt payment, respectively. The DSTI limit for renovation loans could thus be between 4 and 13 percentage points higher than limits for other consumer loans. The calibration depends on the assumption the regulator makes about how households use the savings – the higher the savings dedicated to debt repayment, the greater the possible increase in DSTI limit.

Compared to the 42,000 € that a household can get for renovation loans, a household could get a traditional, non-renovation loan of 37,065 € while achieving the same DSTI when savings are accrued to income, and 27,325 € when accrued to debt service payment. The bank's credit risk for such loans should be similar to that of renovation loans, given the savings they generate for households.

3. The case study of the Slovakian, Latvian and Hungarian schemes

3.1. European and domestic policy background

The implementation of housing upgrade schemes within the macroprudential framework in Slovakia, Latvia, and Hungary occurred in specific contexts. In each jurisdiction, the central banks faced different BBM frameworks, mandates and environmental policies.

Background BBM frameworks

In the EEA, national macroprudential policymakers are responsible for implementing macroprudential instruments, including BBM. The European Systemic Risk Board (ESRB) plays a coordinating role, issuing recommendations, warnings, and opinions on national policies. In Slovakia, Latvia, and Hungary, the national central banks are responsible for determining and implementing macroprudential policy, including BBMs. Table 2 presents the different BBMs implemented in each country.

[18] The underlying assumptions are, in the first case, that the household do not necessarily use the savings for debt service repayment but can also use them for other expenses, and in the second case, that the households dedicate the whole saved amount to repay debt.

Table 2 BBMs frameworks in Slovakia, Latvia and Hungary

	DTI	DSTI	LTV	Maturity
Slovakia	**Ratio of 8** (exceptions: ratio of 9 for 5 percent of loans to lower-income clients younger than 35 years old and progressive tightening of ratio for clients older than 40 years old)	**Limit of 60%** for housing and consumer loans (exceptions: 70% for 5 percent of new loans).*	**Limit of 80%** (exceptions: 90% for 20 percent of new loans)	Limits at **8 years** for consumer loans and **30 years** for housing loans.
Latvia	**Ratio of 6** for all housing and consumer loans	**Limit of 40%** for all housing and consumer loans	**Limits of 90%** for housing loans to consumers exceeding 100 minimum wage (exceptions: 95% for housing loans secured by a state guarantee, 70% for buy-to-let housing loans or similar)	Limits at **7 years** for consumer loans and **30 years** for housing loans
Hungary		**Limit from 10% to 60%** depending on the loan purpose, the currency, the borrower's income and the maturity and interest rate fixation period.	**Limit from 30% and 80%** depending on the loan currency and the type of loan - mortgage, vehicle loans (exceptions: 85% for financial leases and 90% for first-time buyers)	

*Income is defined as disposable income - i.e. net income less minimum subsistence costs.

Source: authors.

Mandate and legal context regarding macroprudential policy and sustainability

The EU acknowledges that the macroprudential framework and its instruments can play a role in addressing climate-related risks. The sixth EU Capital Requirements Directive (CRD VI) introduces the possibility of setting a systemic risk buffer to prevent and mitigate macroprudential or systemic risks from climate change.[19] However, current EU laws do not reference BBMs.

The Národná banka Slovenska (NBS – Slovakia's central bank) has a clearly defined mandate, including financial stability. The bank has expressed its willingness to contribute, within its mandate, to the global response to climate change.[20]

The Latvijas Banka (LB – Latvia's central bank) also has the mandate, inter alia, to contributes to the overall stability of Latvia's financial system. In the area of sustainability, the bank has adopted a comprehensive sustainability strategy.[21]

Since 2021, the Magyar Nemzeti Bank (MNB – Hungary's central bank) has the mandate support of the Hungarian government policies on environmental sustainability, without prejudice to its primary objectives of maintaining price stability and preserving financial system's stability.[22]

[19] Directive (EU) 2024/1619 of the European Parliament and of the Council of 31 May 2024 amending Directive 2013/36/EU as regards supervisory powers, sanctions, third-country branches, and environmental, social and governance risks Article 133 (1).

[20] See Climate Pledge of the National Bank of Slovakia. The bank is fully aware that the intensifying impacts of climate change pose direct and indirect risks to the real economy and financial stability. Under its environmental policy, the NBS aims to express its attitude towards the environment, respond to environmental challenges and participate in solving environmental issues (see National Bank of Slovakia Environmental Policy)

[21] Bank of Latvia' sustainability strategy includes, among other things, specific determinations and expectations related to its daily work and functions. The bank publishes its Climate-Related Disclosures Report, which covers its initiatives to foster sustainable development and address environmental, social, and governance (ESG) issues. For more information, please see the Bank of Latvia homepage.

[22] These mandates are stated in the Act on the Magyar Nemzeti Bank. The MNB has identified the outdated technological and thermal condition of the vast majority of Hungary's housing stock as a source of transition risk. The MNB has implemented several monetary and prudential programmes and regulations, including some with a macroprudential dimension aimed at enhancing the green loan markets (see Annexe A).

Climate policies to support housing upgrades implemented by public agencies

In Slovakia, one of the key measures for the green transition under the recovery and resilience plan is to support the large-scale renovation of more than 25,000 family homes. Households may request funding from the Slovak Environment Agency to cover 60% of the renovation costs, with upper limits of € 14,000 for 30–60% energy savings and € 19,000 for more than 60% energy savings.[23] Costs are refunded only after the renovation is completed.

In Latvia, national strategies and regulations will gradually require that all new buildings comply with high energy-efficiency standards. ALTUM (a state-owned development finance institution) has implemented multi-year programmes to boost reconstruction and development, including energy efficiency in housing. These programmes typically involve a guarantee or a loan from ALTUM when a project meets national and EU criteria.[24]

In Hungary, several programmes have been implemented recently to support energy-efficient renovation with fiscal subsidies from the national government budget and EU funding. For example, between 2021 and 2022, the Home Renovation Programme provided non-refundable public grants combined with mortgage loans offering subsidised interest rates.[25] These programs had high uptake, with nearly 10% of the housing stock undergoing renovation. Similar schemes have been restarted in July 2024.

3.2. Housing upgrade BBM schemes

The schemes implemented in Slovakia, Latvia, and Hungary are similar, but they differ in the limits they adjust, the motivations behind these easings, and the methods used to calibrate them.

Adjustments to BBMs

All three countries modified their DSTI limits for housing-upgrade loans. In addition, Slovakia eased its maturity limit, Latvia its DTI limit, and Hungary its LTV limit (see Table 3).

Table 3 Housing upgrade BBMs frameworks in Slovakia, Latvia and Hungary

		DTI	DSTI	LTV	Maturity
Slovakia	2023		Maximum instalment implied by actual DSTI limit (60%) increased by 50 €		Maximum maturity extended from 8 to 10 years
Latvia	2024	Ratio up to 8 from 6	Up to 45% from 40%		
Hungary	2025		Up to 60% from 50% regardless of the income threshold for HUF loans with at least 10 years' fixed rates or maturity	Up to 90% from 80% for HUF mortgages and leases	

Source: authors

[23] Socially or health-disadvantaged applicants may request 95% of costs if primary energy savings exceed 30%.
[24] For more information, see ALTUM's energy efficiency programme of apartment buildings and ALTUM's loan for renovation of apartment buildings.
[25] Established by government decree 518/2020. (XI. 25.).

Rationale for the adjustments

In all three countries, supporting environmental objectives was a clear motivation for relaxing BBMs limits, but all central banks carefully weighed the consequences for financial stability. They all concluded that potential energy-cost savings and higher market values for energy-efficient buildings allow increasing limits without negatively affecting financial stability.

We observe some differences in how they articulate these dimensions in their choices (see Table 4). In Slovakia, supporting co-financing of house renovation from the EU Recovery and Resilience Facility is at the origin of the easing, while keeping strict risk neutrality is the guiding implementation principle. In Latvia, supporting a structural shift from energy-inefficient housing is emphasized. The considerable potential energy-cost savings for Latvian households[26] are also highlighted, as is the risk of forming stranded assets, especially in an environment in which higher interest rates stimulate demand for older, energy inefficient but cheaper buildings, and in which energy-inefficient mortgages already dominate banking mortgage portfolios. In Hungary, the preferential treatment is motivated by potentially more favourable credit risk characteristics – a lower default rate and higher collateral value – which allow for refining the regulation's risk sensitivity.[27] The MNB also points to evidence that borrowers with lower savings could be unable to access the market for energy-efficient real estate, or be financially stretched out more often, without easing the BBMs' limits.

Table 4 Climate and financial stability objectives in Slovakia, Latvia and Hungary

	Objective	Risk management	Eligibility
Slovakia	Cofinancing of house renovation from EU Recovery and Resilience Facility	Strict risk neutrality based on expected savings in energy expenses. Reflecting the longer-term effects of higher value of houses after renovation	Renovation qualifies Slovak Environment Agency scheme (e.g. save primary energy by at least 30%)
Latvia	Facilitating a structural shift in lending for energy-efficient housing	Reflect the saved costs for utilities for households in energy-efficient vs. energy-inefficient housing	Energy Efficiency Certification (EEC) ranges from A+ to C
Hungary	Improve the transition risk sensitivity of the BBM regulation by providing more room to upgrade the energy efficiency of dwellings without materially increasing credit risk	Lower maintenance costs allow larger proportion of income on loan repayment. Demand for green real estate is more resilient compared to less efficient real estates	Real estate purchases and loans for renovation purposes that finance the purchase and construction of energy-efficient apartments and efficiency-enhancing renovations

Source: authors

In all three countries, eligibility is contingent upon achieving a significant improvement in energy efficiency. The new or renovated house must meet a minimum energy-efficiency rating defined by national or EU regulations. In Slovakia, the debtor must also benefit from a grant from the Slovak Environment Agency's scheme.

Calibration of the adjustments

In Slovakia, a strict risk-neutrality approach was adopted. The key principle was that the loan's riskiness should not increase, while the expected benefits of the renovation should be taken into account. NBS estimates suggested that, for the current DSTI limit, factoring in energy bill savings could lead to higher repayments,

[26] See Paula and Semjonovs (2021).

[27] The MNB provides empirical evidence of the lower risks associated with these loans in Hungary (see See Hajnal et al. 2022, Ertl et al. 2021 and MNB Green Finance Report 2022, pp. 86-88.

allowing loan sizes to increase by between €5,000 and €10,000 with virtually no change in delinquency risk. The loan maturity limit was also increased to reflect the long-term benefits to households from renovation work.

In Latvia, the LB employed a cost-saving approach, relying on the hypothesis that monthly credit payments can be increased by the average annual savings on heating bills. Monthly cost savings were estimated from two simulation exercises – using thresholds of energy efficiency classes and cross-checking against actual renovation results.[28] The resulting increase of the DSTI limits (5 percentage points) is based on estimated annual savings in heating cost, taking into account the possibility of higher-than-expected energy costs and potential additional financial stress for average- and median-income households, which are characterised by rather low income levels in Latvia. The LB also relaxed DTI limits to avoid being overly restrictive in a lower-interest-rate environment. The new coefficient was calibrated based on historical mortgage interest rates since 2004 to account for changes in the interest rate cycle.

The MNB took a different approach. Instead of assessing energy-cost savings, it estimated the potential loan volume that the easing could generate. The MNB used a simplified calculation to determine an upper threshold for expected loan growth. For that, the MNB inflated the volume of loans close to the LTV limit and accounted for occasionally binding DSTI limits, as well as the share of loans collateralised by high-energy-efficient housing above the current LTV limit. These estimates suggest a limited systemic impact on credit growth and real estate prices, indicating limited risks to financial stability.

4. Insights from the bank survey

4.1. Survey and sample

Given the recent implementation of housing upgrade BBMs in Slovakia, Latvia, and Hungary, data on loans supported by these schemes are scarce and do not allow for a robust statistical assessment. To assess the efficiency of these measures, a qualitative survey was conducted among the largest banks in the three countries.

The survey covers four main areas: banks' green loan offerings and practices; evaluation of prospects for domestic green loan markets; assessment of the impact of housing-upgrade BBMs on green loans; and other potential macroprudential measures to support housing upgrades.[29]

For Slovakia, three banks responded, covering around 58% of banking sector assets and 61% of domestic private loans. In Latvia, seven banks responded, accounting for approximately 82% of banking-sector assets and 77% of domestic private loans. In Hungary, seven banks responded, accounting for approximately 87% of banking-sector assets and 86% of domestic private loans.

4.2. Green loan offerings and institutions' practices

All banks consider green loans to be an important component of their business strategy.[30] Accordingly, all but one offer at least one loan product linked to housing energy efficiency upgrades. Most banks began offering these loans well before the BBM easing was implemented.

Most banks (14 out of 16) promote green loans on their commercial websites. In addition, 11 banks also use social media platforms, and 10 rely on in-branch marketing and customer engagement. Only a minority of banks utilise other promotional platforms, such as traditional media and partnerships with real estate and energy-efficiency service providers. Most banks highlight the attractive rates and fees (14 out of 16) and the potential energy cost savings (13 out of 16) to promote green loans. The potential increase in property value

[28] See Bojāre (2024).
[29] The questions in the survey are available in Annexe A.
[30] The survey questions covered green loans in general, which include, but are not limited to, housing upgrade loans.

(11 out of 16) and the environmental impact (9 out of 16) are less highlighted. While banks utilise these channels, we lack a measure of the intensity with which green loans are advertised through them. Anecdotal evidence suggests that, in some cases, green loans and the newly announced BBM easing are not promoted at all.

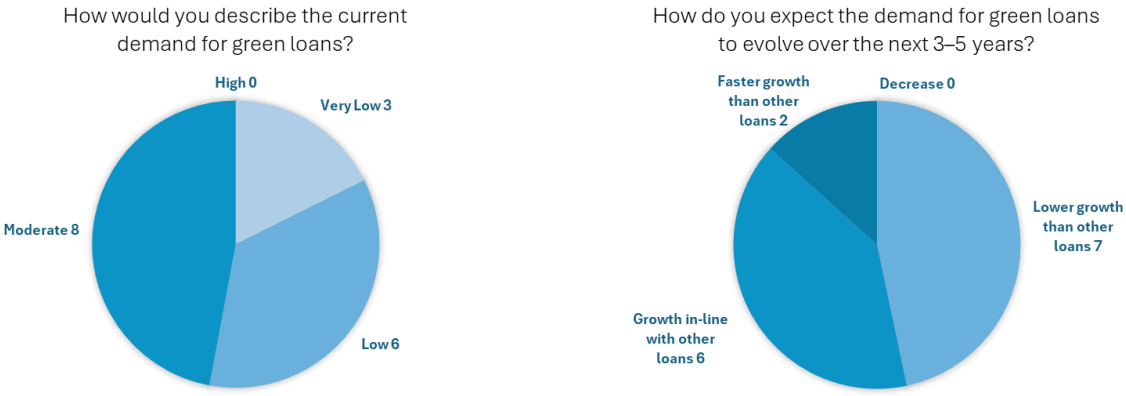
For all banks, implementing green loans requires staff training and the development of systems to collect, track, and report data. Some also needed to implement advisory services (10 out of 16), specific internal audits (9 out of 16), and energy-saving assessment tools (8 out of 16).

The treatment of climate and environmental risks varies significantly between banks. For some, these risks are not considered in green loan pricing or risk assessment. For others, they are integrated into the bank's general ESG framework. Some banks explicitly incorporate climate risks into green loan pricing and risk management, generally treating green loans as less risky than other loans.

4.3. Green Loan Market Prospects

About half of the banks (9 out of 17) judge the current demand for green loans to be low or very low. The rest estimate demand to be moderate, and none consider the current demand high. This situation is unlikely to change significantly over the next few years. About half (7 out of 15) expect lower growth for green loans than for other loans over the next three to five years. Only two expect green loans to grow faster. The remaining six foresee growth in line with other loans (see Figure 1).

Figure 1 Current and future demand for green loans



Source: authors

Banks view the absence of clear government support or subsidies, as well as the risk of changes in current policies, as the primary barrier to green loan growth. The insufficient supply of green projects and real estate, as well as significant upfront expenses – even when a loan is available – are other substantial barriers. All banks consider the lack of consumer awareness and understanding of green loans, as well as the absence of attractive pricing options such as reduced interest rates or fees, to be a moderate or significant barrier. Note that these two factors are largely determined by banks' policies. Banks see their limited capacity and expertise as less relevant (see Figure 2).

Figure 2 Barriers to green loans market growth

	Not important	Moderately important	Important
Lack of consumer awareness and understanding of green loans	0	9	7
Upfront expenses for green projects even with loan availability	2	5	9
Lack of attractive pricing, such as reduced interest rates or fees, to motivate borrowers	0	8	9
Absence of clear government support or subsidies or risk of changes in current policies	0	5	12
Difficulty in defining and certifying what qualifies as a green loan or project	2	6	8
Limited bank capacity and expertise	7	4	5
Low supply of green projects and real estate	2	6	9
Other (please specify)	0	0	0

Source: authors

When identifying factors likely to significantly impact future demand for green loans, almost all banks cite policies or subsidies for energy-efficient construction, renewable energy projects, or eco-friendly renovations. Other financial factors, such as energy cost savings and lower interest rates or tax benefits, are also key drivers. Banks' opinions diverge on drivers such as competition to attract customers and less favourable tax and credit conditions for non-renewable energy projects. Factors such as growing consumer awareness and concerns about environmental issues, as well as worries about possible asset depreciation, are expected to have a limited impact (see Figure 3).

Figure 3 Drivers of loans market future growth

	No impact	Small impact	Significant Impact
Policies or subsidies promoting energy-efficient construction, renewable energy projects, or eco-friendly	0	2	15
Growing consumers' awareness of environmental issues and desire for eco-friendly products	0	10	5
Financial savings from energy-efficient upgrades, such as reduced utility costs for energy-efficient homes	0	3	13
Banks offering attractive, competitive green credit products to differentiate themselves	0	7	10
Less favourable tax and financial credit conditions for non-renewable energy projects or less energy-efficient homes	2	7	8
Lower interest rates or tax benefits associated with green credit products	0	5	12
Worries about possible asset depreciation or difficulties to sell non energy-efficient assets	1	13	2
Other (please specify)	0	1	1

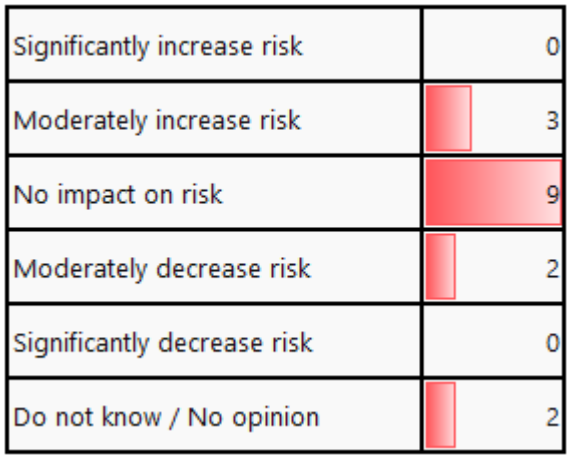
Source: authors

4.4. Impact of BBM easing

Half of the banks indicated that they had not seen any significant change in green loan demand since the introduction of BBM easing in Slovakia and Latvia, and they are not expecting larger changes in Hungary. The other half has experienced an increase in demand for green loans. In their opinion, the easing of BBM has marginally contributed to this increased demand.[31] Banks indicate that the green loans covered by the BBM easing were especially relevant to purchasing real estate with improved energy efficiency but less to finance renovation work. Some banks (3 out of 13) indicate that the easing of BBM allowed some households to enter the credit market.

Most banks (9 out of 14) anticipate that the easing of BBM for housing-upgrade loans has no impact on the risk profile of their green loan portfolios. Three indicate a moderate decrease in their green loan portfolio risk profile, and two banks indicate a moderate increase (see Figure 4). Most banks (10 out of 13 and 9 out of 11, respectively) evaluate the probability of default and the loss given default for green loans as similar to those for other loans. Three and one, respectively, evaluate the probability of default and the loss given default to be lower for green loans than for other loans. One bank evaluates the loss given default to be higher for green loans than for other loans.[32]

Figure 4 Anticipations of the net impact of relaxed BBMs on the green loan portfolio credit risk



Source: authors

4.5. Other macroprudential policy measures to support housing upgrade

When asked which further adjustments to prudential regulatory measures they would find helpful to support sustained growth in green lending, banks outlined three categories of measures.

The most frequent suggestions concerned adjustments in capital and liquidity ratios. About half of the banks suggested reducing capital requirements for green loans. A few suggested a similar reduction for liquidity requirements or adjustments to the Net Stable Funding Ratio. Such relaxation could reduce banks' costs of granting green loans and incentivise them to increase supply, potentially translating into lower customer rates. However, easing capital requirements could also be significantly constrained by microprudential or financial stability concerns.

[31] Note that of the seven banks that highlighted a marginal contribution of the regulatory changes, five are in Hungary. Their answers correspond to their expectation of regulatory changes rather than their actual experience, since these measures were introduced a few weeks before the survey (December 2024).

[32] Three and four banks, respectively do not know or have no opinion on the difference in probability of default and loss given default for green loans related to other loans.

Several banks mentioned that simplifying or subsidising the administrative process for identifying eligible loans could help them expand their green loan offerings by reducing the additional operational costs associated with these loans. Concrete suggestions included a simpler and more transparent definition of green projects, unified tools for assessing EU taxonomy compliance, online access to central energy performance certificate registers, and sector-specific templates. Banks would also welcome greater coverage of energy performance data and guidance on the controls and sanctions they should apply to green loans.

Some banks highlight that fiscal policies supporting housing upgrades are central to the growth of green loans. They suggest public subsidies for housing upgrade investments, especially for renovation, and fiscal incentives such as lower property taxes.

5. Policy insights

5.1. Limited scope and incentives

An easing of BBMs affects only a relatively small number of borrowers – households that own real estate and are willing to renovate it but are constrained by current macroprudential borrowing limits. The size of this group also depends on the extent to which limits are increased and whether lenders find it prudent to exploit the headroom. The new measures will thus likely affect only a marginal number of borrowers.

The limitation of households that could benefit from the new measures aligns with financial stability objectives. The potential higher risks that looser measures imply will likely stay marginal in banks' loan portfolios and thus not change their aggregate risk profile. Banks' survey responses confirm this: a large majority do not expect the new BBMs to affect their credit portfolio risk. Most also estimate that the probability of default and the loss given default for green loans are similar to those of other loans.

Furthermore, if easing BBMs can unlock some households' access to the credit market, it does not, per se, constitute an incentive for them to engage in housing upgrades. Easing BBMs does not make renovation projects financially more attractive; it just increases the amount they can borrow when the projects are financially attractive. Easing BBMs does not fundamentally change banks' cost-benefit analysis of housing upgrade loans, either. A bank that does not find it economically profitable to fund a renovation project will not change its financial assessment if it can lend more following an easing of BBMs.

The limited number of households benefiting from the modified BBMs and the lack of financial incentives that change households' demand and banks' supply of housing upgrade loans strengthen the case for implementing BBM easings alongside other policies. On their own, BBM modifications are not expected to make a significant enough contribution to climate objectives.

5.2. Combination with other policy incentives

Under current circumstances, easing BBMs can only marginally support housing-upgrade efforts on their own. Their lack of financial incentives is an important contributor to their limited impact. Providing financial support and incentives to households is key to engaging them in renovation or acquisition projects.

Fiscal measures are at the forefront. Public subsidies, tax incentives, and fiscal releases could provide such support. Easing BBMs for housing upgrade loans can complement them by reflecting the benefits they provide to households. Financial guarantees from public authorities for housing-upgrade loans could also support the development of this market. When a housing upgrade project is funded by public money, it can be considered a very low-risk investment for banks. Under these conditions, BBMs applied to these loans could be lifted entirely, although some form of creditworthiness assessment should still be carried out.

Monetary measures, such as targeted refinancing operations, could also support the growth of housing upgrade loan markets, provided they align with central banks' mandates. Targeted refinancing operations can

reduce banks' loan refinancing costs, thereby increasing their margins on housing upgrade loans and incentivising them to expand their offerings.[33]

5.3. Better administrative processes and marketing

Several banks highlight the cost and complexity of due diligence and administrative processes associated with housing-upgrade loans. They suggested simplifying the definition of green projects, developing unified tools to assess EU taxonomy compliance, providing banks with online access to central energy performance certificate registers, and creating sector-specific templates. Providing such an administrative and technical infrastructure could make offering housing upgrade loans more profitable for banks. Digital technologies are emerging to provide such instruments at low cost. Some jurisdictions have begun implementing public and private solutions to lower the cost of managing green eligibility data and to facilitate its access to all relevant parties.[34]

Customers must also be aware of the possibilities that financial instruments offer for a housing upgrade project. Banks play a central role in marketing these products and should be encouraged to do so. Public authorities can also present the benefits of housing upgrades to a large national audience by providing households with simple tools to assess the financial viability of housing-upgrade projects and to apply for public support schemes.

5.4. Calibration of measures

The calibration of BBMs for housing-upgrade loans must balance two objectives: it must be eased enough to include many households for climate objectives, but not so much as to jeopardise financial stability objectives. Central banks in Slovakia, Latvia, and Hungary have opted for a risk-neutral approach, using estimates of potential energy-cost savings for households or of the growth in new loans to calibrate the new limits. In Slovakia, a relaxation of BBMs is also conditional on eligibility and enrolment in public subsidy programs for renovation investments – i.e., on some public backing of the loan, contingent on the actual completion of the renovation work.

If giving more weight to financial stability objectives than to climate objectives and using conservative risk estimation makes sense for macroprudential authorities, there might be some room to ease policy to support climate objectives without significant consequences for financial stability. The number of households affected by such easing is likely to remain marginal in total banks' loan portfolios. Furthermore, most banks estimate that housing upgrade loans pose no significantly greater risk to them than other loan types. Against this background, macroprudential authorities could consider increasing BBMs further without necessarily impairing their financial stability mandate. Given the uncertainty about the impact of BBM relaxations on financial stability, central banks could consider progressively increasing limits and adapting the calibration based on experience (Hiebert and Monnin 2023).

6. Conclusions

Upgrading housing's energy efficiency is crucial to achieving the EU's climate objectives. Access to bank loans is central to households' ability to fund house-upgrading investments, given that other funding sources are very limited in some countries. Sometimes, BBMs can prevent households from engaging in housing upgrade

[33] See Colesanti Senni and Monnin (2023) for examples of targeted refinancing operations used by central banks for different economic objectives. Qaisar (2025) explores the main design elements in refinancing operations that can be applied to support some targeted segments of the economy.

[34] Zhang, Knaack and Shao (2025), for example, show how pilot zones in China's Zhejiang province are implementing innovative standards, financial products, and digital platforms to facilitate the issuance of green loans for households and small enterprises.

investments. However, housing upgrade investments typically come with energy cost savings, collateral revaluation, and public schemes that can justify higher BBMs without increasing threats to financial stability.

The evidence collected in a bank survey after the implementation of such risk-neutral schemes in Slovakia, Latvia and Hungary shows that banks did not observe, or do not expect, a significant change in their credit portfolio risk profile following the easing of BBMs. However, banks also emphasise that they did not observe, or do not expect, housing upgrade loans to grow substantially more than other loans, indicating that relaxing BBMs is likely to support environmental objectives only marginally on its own.

We identify two main reasons why BBM limit easings do not strongly support environmental objectives. First, an easing affects only a relatively small number of borrowers. Second, an easing does not, per se, constitute an incentive for households and banks to borrow or lend for housing upgrades. They do not improve the cost-benefit balance of renovation projects; they just expand the amount households can borrow when a project is already financially attractive.

Against this background, we propose two sets of measures to amplify the impact of a BBM easing. First, they can be combined with other public policies that provide financial incentives to households and banks for housing upgrades, such as public subsidies, tax incentives, fiscal releases, and public loan guarantees. Targeted refinancing operations by central banks, when they are aligned with the central bank's mandate, can also, indirectly and marginally, lower funding costs for banks. Banks also suggest lowering capital requirements for housing upgrade loans, though this option raises concerns about financial stability. Second, public authorities can implement measures to reduce the cost and complexity of due diligence and administrative processes of housing upgrade loans. Public authorities and banks themselves can make customers aware of the possibilities offered by the new BBMs through marketing strategies and by providing simple tools to assess the financial viability of housing upgrade projects.

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Appendix A MNB Green programmes and regulations

As part of its green initiatives, the MNB has rolled out several green programmes and regulations, including those with a more pronounced macroprudential dimension and others that enhance green loan markets. The principle followed in any adjustments made to macroprudential regulatory policies targeting climate change-related vulnerabilities is that these modifications must reflect the effective risk difference between green and higher-risk exposures or activities. In other words, they have to be either mitigative or risk-neutral.

The Mortgage Funding Adequacy Ratio (MFAR) is a country-specific funding ratio regulation introduced to the Hungarian macroprudential toolset in April 2017, which ensures the long-term financing of residential mortgage loans through long-term mortgage bonds held outside of the issuer's group or through mortgage bank refinancing. Since July 2021, the MFAR has been modified to include preferential treatment for green mortgage bonds to support issuance.[35] The objective was to steer issuances towards green mortgage bonds and market development, which, in turn, provides a more diversified, stable funding opportunity for the banking sector and strengthens ownership diversification. This could indirectly facilitate green mortgage lending financing. Over the past years, a gradual increase was observed in both the total portfolio of mortgage bonds and the amount of green mortgage bonds outstanding (reaching 12.9% of the total stock of mortgage bonds at the end of 2024). By now, all mortgage banks have issued green mortgage bonds, five of which belong to groups that also responded to the survey conducted by this study.

The Certified Consumer-Friendly Housing Loan (CCHL) and Personal Loan (CCPL) frameworks have been established by the MNB to support financial stability and consumer protection objectives, and are continuously developed in response to evolving market trends. Since April 2023, dedicated green loan purposes have been incorporated into the program to encourage financial institutions to fund energy-efficient renovations. From April 2025, the certification process will be strengthened with additional borrower benefits, including exemptions from disbursement fees, mandatory lender coverage of Energy Efficiency Certificate costs, and interest rate discounts of 0.5 pp for housing loans and 3 pp for personal loans upon verification of the green loan purpose, with verification costs assumed by the lender. Over the last four quarters, the share of green CCHL loans has gradually increased, reaching 5.4% of total certified mortgage loan outflows, with cumulative disbursements totalling 22.5 billion HUF since Q2 2023.

Between October 2021 and September 2022, the Green Home Programme (GHP), as part of the Funding for Growth Scheme and the Green Monetary Policy Toolkit Strategy, and as one of its first steps, helped create a green housing loan market and mainstream environmental sustainability considerations in the domestic housing market by providing low-interest central bank funds with a fully exhausted budget of HUF 300 billion. Under GHP, loans of up to HUF 70 million and a maximum term of 25 years could be granted for constructions or purchases of new, highly energy-efficient[36] residential real estates, which were extended to retail clients at a maximum interest rate of 2.5%, resulting in a marked difference between the interest rates of GHL and comparable market loans during that time period.[37] So far the GHP was the only public policy intervention that could extensively increase the green share in the total housing loan outflow, as a result of the programme, the share of better-than-modern collateral in new residential mortgage lending temporarily shot up to almost 50%

[35] From 1 July 2021, green mortgage-backed funds with an original maturity of more than 5 years may be taken into account with a heightened weight of 1.5 when calculating the MFAR. With regard to the labelling of mortgage bonds as green, the MNB requires banks to follow standards that are widely accepted and employed internationally to support banks' adjustment and investor orientation.

[36] Requiring at least a 'BB' energy efficiency rating, and the upper limit for the primary energy consumption of 80 kWh/m2/year (lowered from 90 kWh/m2/year during the 2022 phase of the programme).

[37] Moreover, those households who were raising more than one child could combine the GHP with the so-called green Home Purchase Subsidy Scheme for Families (HPS) with which up to HUF 10 or 15 million the interest rate payments had been fully subsidised by the government. In nearly 60% of the contracts, the borrowers also benefited from state interest subsidies. See Komlóssy and Winkler (2022) pp. 135-136.

during the Green Home Programme's subsidy period, while it has remained low and stable, ranging from 10 to 20%, since the exhaustion of the programme.

Embedded in the microprudential Pillar 2 framework since 2020, the MNB's Green Preferential Capital Requirement Programme for Housing aims to support the construction of high-energy-quality new housing, the renovation of substandard housing, and the financing of specific energy-efficiency measures. The programme is intended to shift banks' credit portfolios to finance activities with lower transition risk, while also incentivising banks to collect and process climate risk-relevant information and, through related data reporting requirements, to support the Central Bank's risk monitoring (Kim et al., 2024). The preferential treatment reduces the Pillar 2 capital requirement for a given year under the ICAAP by 5% or 7% of the gross value, or the part of performing green loan exposures that complies with the definition of environmentally sustainable loans. The reduction cannot be used to reduce the Pillar 1 capital requirement, and the maximum discount rate is 1.5% of the total risk exposure amount. Participation is voluntary for interested credit institutions; seven banks have green loans involved in the programme, five of which also responded to the survey conducted by this study. Around 5.5% of the banking system's total housing loan portfolio at the end of 2024 could be regarded as green, and around three-quarters of these green loans are included in the preferential capital requirements programme.[38]

Indirectly, other components of the MNB's green strategy may also have supported green housing lending. The Green Mortgage Bond Purchase Programme, ongoing between August 2021 and April 2022, aimed to establish a domestic green mortgage bond market and promote best practices through targeted purchases of certified green fixed-rate HUF mortgage bonds.[39] With a focus on the primary market and complemented by transactions on the secondary market as well, altogether HUF 61 billion green mortgage bond amount was purchased, since the end of the programme, the outstanding stock of green mortgage bonds has continued to gradually grow, with its volume nearly doubling between 2022 Q1 (HUF 141 billion) and 2024 Q4 (HUF 272 billion).[40] Green aspects have also been integrated into the Central Bank's collateral management framework for liquidity-providing operations through the introduction, from September 2021, of a preferential green haircut, providing a 20% discount with a maximum value of 5 pp for green securities.[41]

[38] Other green loans are exposures that are not part of the preferential capital requirements programme for green housing financing, but green home programme loans, or taxonomy-aligned loans, or certified consumer-friendly green housing loans, or a combination of those.

[39] Eligible mortgage bonds had to comply with one of the two most used international green bond standards (CBI standards or ICMA principles), getting certification from an independent third party, initiate the listing of the mortgage bond to Budapest Stock Exchange and publishing post-issuance an annual public report on the sustainability performance of the underlying portfolio.

[40] MNB Annual Report 2022, p. 27.

[41] In addition to green securities, the MNB also introduced preferential haircuts for non-green assets if the issuer publishes relevant climate reports. To further increase transparency, the MNB has required mortgage bond issuers to supplement their quarterly transparency report with a green section, in which the relevant green parameters for the loan portfolio must be specified.

Appendix B Bank survey

The following questions have been sent to the banks participating to the survey

Green loan market and green borrower-based measures

Green loans refer to mortgages, consumer loans, and financial leases issued to purchase or build energy-efficient apartments and houses and to finance energy-efficiency-enhancing renovations.

Green loans offering

1. Which green loans does your institution offer or plan to offer?

   For each product, please specify:

   - the date at which your institution started or plans to offer it
   - the type of green loan (M: mortgage, C: consumer loan, O: other loan)
   - the criteria to be eligible for the loan, including criteria for qualifying as a green loan
   - whether your institution provides a rate or fee discount for the loan and how much it is
   - whether your institution applies specific lending standards or restrictions for these loans, which would limit its supply to specific segments of borrowers
   - whether and what kind of risk adjustments your institution applies for these loans

Product	Starting date	Type of loans	Eligibility criteria	Rate or fee discount	Specific lending standards	Risk adjustment
...						
...						
...						

Note: If one or more of the product's characteristics have changed over time, please indicate this by starting a new row with the same product name, the new characteristics, and the change date as the starting date.

Institution's practices

2. How important are green loans to your institution's business strategy?

Not important	☐
Slightly important	☐
Moderately important	☐
Very important	☐
Do not know / No opinion	☐

3. Which channels does your institution use to promote green loans?

Social Media Platforms	☐
Bank Website	☐
Partnerships with Real Estate and Energy-Efficiency Service Providers	☐
Traditional Media Outlets	☐
In-Branch Marketing and Customer Engagement	☐
Others (please specify)	☐

4. What are the key messages or value propositions that your institution emphasises when marketing green loans?

Environmental Impact	☐
Energy Cost Savings	☐
Attractive Rates and Fees	☐
Enhanced Property Value	☐
Subvention and Tax Benefits	☐
Others (please specify)	☐

5. Which systems, processes, or expertise did (or will) your institution need to implement to support green loan offerings?

Training for staff	☐
Specific internal audit	☐
Energy saving assessment tools	☐
Systems to collect, track and report data	☐
Specific platforms for application	☐
Advisory services to guide clients on technical issues	☐
Collaboration with certification bodies	☐
Other (please specify)	☐

6. How does your institution define and integrate climate- and environmental-related risks into green loan pricing and risk management? [open-ended]

Clients' feedback

7. What feedback have you received from clients regarding your institution's green loans? Which aspects of the products do clients find most attractive? What concerns or reservations have clients expressed regarding green loans? [open-ended question]

Green loan market prospects

8. How would you describe the current demand for green loans?

Very Low – Minimal customer interest or inquiries about green credit products.	☐
Low – Limited customer interest or inquiries; demand is niche or minimal.	☐
Moderate – Noticeable customer interest, with occasional inquiries and growing awareness.	☐
High – Strong and consistent customer interest; green credit products are a focus area for many customers.	☐
Do not know / No opinion	☐

9. How do you expect the demand for green loans to evolve over the next 3-5 years?

Decrease	☐
Lower growth than other loans	☐
Growth in-line with other loans	☐
faster growth than other loans	☐
Do not know / No opinion	☐

If available, please provide an empirical forecast of the evolution in green loans demand

10. How much, in your view, will the following factors drive future demand for green loans?

	No impact	Small impact	Significant Impact
Policies or subsidies promoting energy-efficient construction, renewable energy projects, or eco-friendly renovations	☐	☐	☐
Growing consumers' awareness of environmental issues and desire for eco-friendly products	☐	☐	☐
Financial savings from energy-efficient upgrades, such as reduced utility costs for energy-efficient homes	☐	☐	☐
Banks offering attractive, competitive green credit products to differentiate themselves	☐	☐	☐
Less favourable tax and financial credit conditions for non-renewable energy projects or less energy-efficient homes	☐	☐	☐
Lower interest rates or tax benefits associated with green credit products	☐	☐	☐
Worries about possible asset depreciation or difficulties to sell non energy-efficient assets	☐	☐	☐
Other (please specify)	☐	☐	☐

11. How important, in your view, are the following barriers to the growth of the green loans market?

	Not important	Moderately important	Important
Lack of consumer awareness and understanding of green loans	☐	☐	☐
Upfront expenses for green projects even with loan availability	☐	☐	☐
Lack of attractive pricing, such as reduced interest rates or fees, to motivate borrowers	☐	☐	☐
Absence of clear government support or subsidies or risk of changes in current policies	☐	☐	☐
Difficulty in defining and certifying what qualifies as a green loan or project	☐	☐	☐
Limited bank capacity and expertise	☐	☐	☐
Low supply of green projects and real estate	☐	☐	☐
Other (please specify)	☐	☐	☐

Green borrower-based measures

On [date], the [central bank name] implemented the [name of new regulation] that relaxes borrower-based requirements for green loans.

12. Has your institution observed [Hungary: Does your institution expect] changes in green loan demand since the announcement of regulatory adjustments, and to what extent do you attribute this change to the relaxed regulatory requirements?

No change in demand	☐
Increase in demand, no contribution from regulatory changes	☐
Increase in demand, marginal contribution from regulatory changes	☐
Increase in demand, significant contribution from regulatory changes	☐
Do not know / No opinion	☐

If available, please provide an empirical estimation of the increase in demand and the contribution from your institution's regulatory changes.

13. For what purpose did [Hungary: do you expect] the borrowers use the green loans made possible by the regulatory adjustments?

	Not relevant	Moderately relevant	Importantly relevant
To finance the purchase of real estate with better energy efficiency	☐	☐	☐
To finance renovation/retrofitting related to energy efficiency	☐	☐	☐
To finance real estate purchases not related to energy efficiency improvements	☐	☐	☐
To enter the credit market only due to the availability of preferential regulatory adjustments	☐	☐	☐
Other (please specify)	☐	☐	☐

14. What adjustments (if any) in terms of product offering and internal organisation has your institution made [Hungary: is your institution planning] to take advantage of or address the challenges of the new regulatory requirements?

15. How do you anticipate the net impact of the relaxed borrower-based requirements on the credit risk profile of green loans in your portfolio?

Significantly increase risk	☐
Moderately increase risk	☐
No impact on risk	☐
Moderately decrease risk	☐
Significantly decrease risk	☐
Do not know / No opinion	☐

16. Which areas do you perceive as potentially risk decreasing, and which are risk increasing under the new green loan requirements? [open-ended]

17. How do you evaluate the probability of default (PD) and the loss given default (LGD) levels for green loans compared with similar other loans?

	Probabilty of default for green loans	Loss given default for green loans
Lower than for other loans	☐	☐
Similar to other loans	☐	☐
Higher than for other loans	☐	☐
Do not know / no opinion	☐	☐

If available, please provide an empirical estimation of the increase or decrease in PD and LGD of green loans compared to other loans estimated by your institution.

18. What further adjustments to the new prudential regulatory measures - regarding borrower-based measures, capital and liquidity requirements, or other macroprudential measures - would your institution find helpful to support sustained growth in green lending? [open-ended]