Energy Efficiency and the Default Risk of Securitised Residential Mortgages

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Abstract

This study provides empirical evidence on the impact of the Green label of Residential Mortage Backed Securities (RMBS) on the quality of underlying loans in the EU. Utilising data from the new ESMA reporting template, we find that mortgages within green-labelled securitisations exhibit lower default rates. Moreover, mortgages backed by collaterals with higher EPC ratings are linked to smaller delinquency rates. This effect is particularly pronounced among low-income borrowers. Moreover, we find that this resilience becomes especially evident during energy price spikes. The results suggest that the key channel through which this occurs is lower energy bills for borrowers with high-efficiency properties, enhancing their ability to meet loan repayments. These insights underscore the benefits of integrating sustainability into financial instruments, suggesting implications for policymakers and financial institutions in enhancing economic stability and meeting EU sustainability goals.

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1 Introduction

Climate change and the intensifying geopolitical challenges stemming from energy dependence represent critical issues for the European Union (EU). Residential buildings, which account for a significant portion of energy consumption and greenhouse gas emissions, are a focal point of EU climate and energy policies. In response, the EU has prioritised energy efficiency as a pivotal tool not only for reducing greenhouse gas emissions but also for enhancing the EU's energy security by lowering its dependence on imported fuels. Moreover, by diminishing overall energy demand, the adoption of energy-efficient measures contributes to stabilising energy prices, indirectly benefitting the economy at large. The importance of these measures has been heightened by recent energy price volatility and supply chain disruptions, exacerbated by events such as the Russo-Ukrainian conflict and OPEC's supply restrictions. By promoting the adoption of energy-efficient practices, particularly in the residential sector, the EU seeks to mitigate environmental impacts while securing a stable and sustainable energy future.

In this context, the securitisation of residential mortgages through Green Residential Mortgage-Backed Securities (Green RMBS) has emerged as a critical element in the sustainable finance ecosystem. Green RMBS are differentiated by the inclusion of loans backed by energy-efficient properties, which are identified through EPC ratings. This paper leverages the European Securities and Markets Authority (ESMA)'s enhanced reporting template, which now includes EPC ratings for securitised loans, enabling a granular assessment of the impact of collaterals' energy efficiency at the loan level.

Theoretically, energy efficiency enhances the collateral value of properties by mitigating risks associated with increasing energy costs and the potential impact of future environmental regulations (transition risk). In the context of evolving climate policies, properties with poor energy performance face rising operational costs and may require significant retrofitting to meet tightening environmental standards to avoid becoming 'stranded assets' (Ferentinos et al., 2023). By contrast, energy-efficient properties not only reduce ongoing energy expenses but also offer protection against the upfront costs

of compliance with stricter regulations. This dual benefit strengthens their position as valuable collateral in financial transactions. However, there is no evidence of financial institutions actively incorporating these transition risks into their lending practices. Bell et al. (2023) note that, despite the theoretical advantages of energy efficiency, lenders do not systematically account for this form of transition risk, by not differentiating mortgage interest rates based on energy performance. This suggests a significant gap in the integration of energy transition considerations into the evaluation of credit risk, pointing to an area where both policy and market practices have room to evolve.

In our study, we identify specific channels through which energy efficiency links to credit risk. Our first contribution to the literature is to provide for the first time evidence on the performance of Green RMBS deals. Specifically, we quantify the impact of the Green RMBS label, demonstrating that this it signals better quality of the underlying assets. Our findings show that loans in Green RMBS deals exhibit significantly lower delinquency risks, with reductions of 15–20 basis points, representing approximately a 53% improvement over the mean default rate.

Second, we are the first to conduct a large-scale, EU-level study on the role of EPC ratings as predictors of default and delinquency risks. In so doing, we address the gap in existing studies, which primarily focus on single-country analyses and call for additional research (Kaza et al., 2014; Guin and Korhonen, 2020; Billio et al., 2021). To the best of our knowledge, we are also the first to harmonise EPC data across EU countries using a common metric, energy consumption per square metre per year (kWh/m^2/year), that allows for unprecedented comparability and depth of analysis.

Third, we assess the role of energy efficiency during the recent surge in energy prices, examining how EPC ratings influence loan resilience by mitigating household energy costs and preserving borrower disposable income. The recent global energy crisis (2021–2023), driven by slow supply recovery post-pandemic and compounded by geopolitical conflicts, provides a unique setting to examine how energy-efficient properties contribute to borrower and loan performance under economic stress.

These insights contribute to the broader understanding of how sustainability objectives can align with financial stability. Importantly, our study also offers valuable guidance for investors, policymakers, and financial institutions seeking to incorporate energy transition risks into their risk management frameworks and align their practices with sustainability goals.

In the subsequent sections of this paper, we provide an overview of the current regulatory background on energy efficiency and review existing studies Section 2, and develop testable hypotheses (Section 3). We will then delve into the description of our data and methodology (Section 4), the presentation of our main results results (Section 5) and the investigation of the possible channels (Section 6). Finally, we will conclude the paper by summarising the main findings and their implications (Section 7).

2 Energy Efficiency: Background and Motivation

Policy context and targets. The EU has strategically prioritised energy efficiency to address the dual challenges of climate change and energy security. Directive (EU) 2023/1791 highlights energy efficiency as a cornerstone of efforts to reduce greenhouse gas (GHG) emissions, lower energy costs, and reduce the EU's dependency on energy imports. By improving the energy performance of buildings, the directive aims to tackle energy poverty, enhance air quality, and stimulate economic activity across member states (The EU Parliament and Council, 2023a). The EU has set ambitious targets. These include achieving a minimum 55% reduction in GHG emissions by 2030 (compared to 1990 levels), fully decarbonising the building stock by 2050 and 32.5% energy efficiency improvement by 2030 (relative to the 2007 reference scenario) (European Commission, 2020a, 2020b).[1] Furthermore, all new constructions from 2021 are required to meet nearly-zero energy building (nZEB) standards, aligning with the commitments of the Paris Agreement. To support these objectives, cumulative end-use

[1]The earlier 2020 targets, including a 20% reduction in GHG emissions compared to 1990 levels and a 20% improvement in energy efficiency, were overachieved. (European Commission, 2022; European Environment Agency et al., 2021)

energy savings targets demand annual reductions of 1.9% of final energy consumption by 2030. Buildings play a central role in these efforts, as around 75% of them is energy inefficient, account for 40% of total energy use and contribute over one-third to the EU's GHG emissions (The EU Parliament and Council, 2023a). These efforts necessitate significant financial investment. Meeting the EU's 2030 energy efficiency and building renovation targets will demand over €300 billion in annual investment, with an estimated investment gap of €165 billion per year (European Investment Bank, 2023). Although public funding for energy efficiency has expanded considerably under the 2021–2027 financial framework, the majority of these investments will need to come from private sector contributions (European Commission, n.d.).

The role of EPCs. In this context, EPCs are central to the EU's strategy for promoting energy efficiency in the housing sector. These certificates provide a measure of a building's energy performance. EPC standards not only reduce emissions and energy costs but also enhance the stability of property values, reinforcing their importance in the housing market and broader economy (FitchRatings, 2023). Energy-efficient buildings yield significant economic benefits. Sanderford et al. (2015) observes that advanced building technologies increase property values by enhancing market attractiveness. Further emphasising their market appeal, Devine and McCollum (2022) find that environmentally certified buildings command higher rents, experience reduced tenant turnover, and foster greater tenant satisfaction. Beyond increased property values, energy efficiency directly reduces utility costs, as improved building materials and practices minimise the need for heating, cooling, and electricity. This results in operational cost savings that benefit both property owners and tenants. Thus, on the one hand the importance of energy efficiency is further accentuated in the *short term* by energy crises. As energy prices surge, energy-efficient homes, which require less power and thus incur lower energy bills, provide financial relief to homeowners (Bell et al., 2023). On the other hand, energy efficient buildings are also attractive as *long-term* investments due to lower maintenance and operational costs, especially in a regulatory

environment that is expected to increasingly favour environmentally friendly standard. (Lorenz and Lützkendorf, 2008; Popescu et al., 2012) By 2026, all Member States must establish or upgrade their national databases for building energy performance, ensuring interoperability with other administrative systems. Member States are required to comply with a harmonised template for EPCs and facilitate the transfer of data to the centralised EU Building Stock Observatory, ensuring consistency and facilitating cross-border comparisons. By granting lenders and investors access to EPC data, the directive highlights the pivotal role of energy efficiency in shaping the evolution of financial products to support the green energy transition (The EU Parliament and Council, 2024).

Energy efficiency and mortgage backed securities. The integration of energy efficiency into financial instruments represents a vital mechanism for addressing the substantial funding gap required to meet the EU's 2030 energy efficiency targets. By mobilising private capital, financial products such as energy-efficient mortgages can play a transformative role in accelerating the adoption of sustainable practices within the housing market (Liaw, 2024). Green RMBS, in particular, have emerged as a key instrument in this evolving landscape, aligning the credit sector with environmental goals by freeing up lenders' balance sheets to reinvest it in green lending (FitchRatings, 2022). Recent regulatory developments, such as the European Green Bond (EuGB) Regulation approved on 5 October 2023, have extended the provisions for green bonds to green securitisations and clarified important aspects on the application of the green standards (The EU Parliament and Council, 2023b). Structured finance products like securitisations are inherently more complex than traditional green bonds. In a securitisation, a financial institution (the originator) transfers a pool of loans to a securitisation special-purpose entities (SSPE), which then issues securities to investors, using the proceeds to pay the originator for the assets. This multi-entity structure created uncertainty about whether the *use-of-proceeds requirement*—i.e. the core principle mandating that funds must finance or refinance projects with

clear environmental benefits for a security to qualify as green—should apply to the originator or the issuer (SSPE). The EuGB Regulation resolves this by applying the use-of-proceeds requirement at the originator level, allowing green securitisations to align with sustainability goals even if the pool of securitised assets is *not* entirely green. This flexibility addresses the limited availability of green assets and enables proceeds to finance projects with clear environmental benefits. This alignment with sustainability objectives not only satisfies the increasing demand for green investment opportunities but also reflects broader market and regulatory trends that favour environmental sustainability. The regulatory environment has further fostered the adoption of Green RMBS by establishing transparency provisions to encourage investors' scrutiny and hinder greenwashing practices. Furthermore, the EU Securitisation Regulation mandates greater transparency regarding the environmental performance of assets underlying these securities. Article 22 specifically requires the publication of available environmental impact data for securitised assets, thereby enabling more informed investment decisions and supporting the mainstreaming of environmental, social, and governance (ESG) considerations in financial markets (The EU Parliament and Council, 2017). Green RMBS thus provide a dual benefit: they offer a scalable mechanism for private sector involvement in financing energy-efficient investments while addressing the EU's broader climate and energy security objectives. By bridging the gap between policy goals and market mechanisms, these instruments contribute significantly to the decarbonisation of the building stock and the attainment of the EU's energy efficiency targets. As such, Green RMBS exemplify how financial innovation can align capital markets with sustainability, making them instrumental in the transition to a greener economy.

3 Hypotheses Development

Given the EU's emphasis on energy efficiency as a cornerstone of climate and energy policies, understanding the financial implications of energy efficiency has become critical.

Residential buildings, which account for a substantial portion of energy consumption and greenhouse gas emissions, are pivotal to achieving these goals. This importance is underscored by recent energy price volatility and geopolitical tensions, further highlighting the role of energy-efficient financing mechanisms such as Green RMBS.

The European Green Bond (EuGB) Regulation represents a significant step toward integrating sustainability into financial markets, including the securitisation market. While the regulation allows Green RMBS to securitise non-green buildings during this transitional phase, reflecting the limited availability of taxonomy-aligned green assets, it also anticipates a stricter application of green principles in the future. Specifically, the regulation acknowledges that the current flexibility—applying the *use-of-proceeds requirement* at the originator level rather than the issuer level—will eventually evolve as the supply of green assets increases within the EU economy. As such, originators may already be adapting their practices by including a higher proportion of energy-efficient assets in Green RMBS deals, both to align with future regulatory expectations and to enhance their reputation as sustainable market participants. Moreover, the heightened transparency required——such as disclosing EPC ratings of securitised loans——pressures originators to prioritise high-quality, energy-efficient collateral to maintain credibility and avoid greenwashing. This transparency not only ensures that investors can make more informed decisions but also pressures originators to prioritise higher-quality, energy-efficient collateral in their Green RMBS structures to maintain credibility and reduce the risk of greenwashing. Given these dynamics, we test whether loans included in Green RMBS deals exhibit lower default rates. While the Green Flag does not guarantee that all underlying loans are energy-efficient, the scrutiny, transparency requirements, and potential anticipation of future regulatory changes could influence originators' practices, leading to improved loan performance. Additionally, Green RMBS align with sustainability-focused investment trends, which may attract more diligent underwriting standards and improved risk management processes. While the literature on energy efficiency and its economic impact is growing, there are no studies

about Green RMBS. Addressing this gap, we first test whether loans in Green RMBS deals exhibit superior performance compared to their non-green counterparts. This leads to our first hypothesis:

Hypothesis 1 *Loans securitised in Green RMBS deals are associated with a lower probability of delinquency compared to non-green securitised loans.*

Energy efficiency, as captured by EPC ratings, is increasingly recognised as a factor that enhances borrower resilience. Higher energy efficiency reduces household energy costs, preserving disposable income and improving borrowers' ability to meet their mortgage obligations. While studies have explored the relationship between energy efficiency and loan performance, the evidence remains fragmented and context-specific, with no comprehensive, EU-wide analysis in the securitisation market. Empirical research from various markets supports the notion that energy-efficient properties contribute to better loan performance. Kaza et al. (2014) examine ENERGY STAR-certified homes in the United States and find that these properties are associated with significantly lower default and prepayment risks. They attribute this effect to reduced energy costs or potentially better financial standing of borrowers residing in energy-efficient homes. However, they note that further research is needed to explore the exact mechanisms underlying this relationship. Similarly, Guin and Korhonen (2020) provide evidence from the UK, showing that mortgages secured by energy-efficient properties are less likely to experience payment arrears, even after accounting for borrower income. Their study also calls for additional research to better understand the channels through which energy efficiency influences loan performance. In the Netherlands, Billio et al. (2021) use provisional data derived from cadastral and housing survey information to infer the energy efficiency of residential building. They report that loans backed by properties with higher estimated energy efficiency are associated with lower probabilities of default, and underscore the importance of integrating reliable EPC data into analyses of mortgage performance. Building on these findings and leveraging harmonised, EU-level data on residential buildings' EPC ratings as retrieved from the new ESMA

template, we hypothesise that high EPC ratings are associated with lower risk of mortgage delinquency.

Hypothesis 2 *Loans backed by properties with higher EPC ratings exhibit a lower probability of delinquency.*

If the channel through which low EPC ratings affect delinquency and default probability is the one of higher running costs influencing household disposable income, we would expect this effect to be stronger for low-income households. For low-income borrowers, energy costs represent a substantial portion of household expenses. Poor energy efficiency exacerbates financial strain for these borrowers, increasing the likelihood of mortgage delinquency. Conversely, higher-income borrowers are better equipped to absorb energy-related expenses, mitigating this effect. Therefore, we propose the following hypothesis:

Hypothesis 3 *The adverse impact of poor energy efficiency on mortgage delinquency is amplified for lower-income households.*

Moreover, the recent developments in the energy markets, provide us with an exceptional circumstance to further test the channel of energy costs affecting delinquency. We hypothesise that recent events, such as the 2021–2023 energy crisis, highlight the importance of external factors in shaping the relationship between energy efficiency and loan performance. Fluctuations in energy prices can amplify the effects of energy efficiency on loan performance. Rising energy costs disproportionately impact households with less energy-efficient properties, further straining their ability to meet mortgage obligations. During periods of high energy inflation, these dynamics become particularly pronounced, motivating our fourth hypothesis:

Hypothesis 4 *The adverse impact of poor energy efficiency on mortgage delinquency is amplified during periods of high energy inflation.*

By addressing these hypotheses, our study offers novel insights into the role of energy efficiency in enhancing financial resilience, particularly in securitised portfolios, and underscores the broader implications for sustainable finance and energy policy.

4 Data and Methodology

Our dataset is retrieved from the European DataWarehouse (EDW), the repository designated by the ESMA for collecting and validating standardised loan-level data on securitised assets in Europe. The dataset complies with the updated ESMA reporting templates, introduced in 2021 and replacing the former ECB templates, which require loan-level data to be provided quarterly for asset-backed securities eligible for repurchase agreements with the European Central Bank (ECB). These templates include both mandatory and optional fields, covering detailed information on loan, borrower, and collateral characteristics, as well as performance indicators. For each loan, more than 150 variables can be reported by the originators of the securitisation, but only a subset of these is mandatory. These categories include borrowers' information, loan characteristics, information on the mortgaged property, and performance indicators. Notably, at the time we retrieved the data for our analyses, EPC rating is one of the optional fields.

4.1 Sample Overview

The full dataset comprises 28,060,021 quarterly observations spanning the period from 2021-Q1 to 2024-Q1. As shown in Table A1, the dataset includes 139 RMBS deals, 3,208,747 unique loans, and 3,529,410 associated collaterals from various countries. The majority of the deals originate from France, Spain, and the Netherlands, reflecting the dominant issuance trends in the European RMBS market during the sample period. To focus on the research objectives, we apply a series of exclusions and variable treatments to the dataset. Loans exhibiting certain characteristics are removed to focus on clear

delinquency trajectories and ensure comparability across observations. Loans are observed until the end of the sample period, unless they reach a terminal event (such as default, write-off, redemption). If a loan goes into default, it is no longer included in the analysis following the default event. Additionally, loans associated with a *release equity* purpose are excluded because these transactions, typically involving cash-out refinancing, differ significantly from standard mortgage loans. To address potential issues related to extreme values, key numeric variables are transformed into categorical bins based on quantiles.

By applying these refinements, we ensure that the dataset is tailored for investigating the risk factors associated with mortgage delinquency. Our analysis focuses on delinquency indicators as dependent variables, all of which are assessed over a 12-month horizon:

- **Default:** A dummy variable equal to 1 if the loan is two consecutive quarters in arrears within the next 12 months.
- **Material Default:** A dummy variable equal to 1 if the loan is two consecutive quarters in arrears within the next 12 months and the arrears balance exceeds 1% of the current loan balance.

In addition to the default target variables, the arrears indicators indicators are also included. This is because we hypothesise that one of the key channels through which energy efficiency impacts mortgage performance is through its effect on borrowers' utility costs.

- **Arrears:** A dummy variable equal to 1 if the loan is one quarter in arrears within the next 12 months.
- **Material Arrears:** A dummy variable equal to 1 if the loan is one quarter in arrears within the next 12 months and the arrears balance exceeds 1% of the current loan balance.

Properties with lower energy efficiency are likely to incur higher energy bills, which can strain borrowers' disposable income and lead to delays in mortgage payments, captured by the arrears indicators. Additionally, this financial strain may influence the total amount borrowers accrue in arrears. To capture this aspect, we include:

- **Arrears Balance:** A continuous variable measuring the total arrears balance for loans that are in arrears.

By incorporating arrears balance as a dependent variable, we aim to assess not only the likelihood of borrowers falling behind on payments but also the financial extent of such delinquencies, providing information on the impact of energy efficiency on mortgage performance.

To differentiate the impact on mortgage delinquencies of the Green RMBS flag from the one of the Energy Efficiency we split our sample into two distinct subsamples: (1) the Green RMBS Originator Subsample, which includes only loans from originators that have issued both green and non-green RMBS to assess the impact of the Green RMBS deal flag, and (2) the EPC Subsample, which retains only observations with populated EPC data, when we assess the impact of energy efficiency on delinquency.

The key explanatory variable in the second part of the analysis uses the Energy Efficient Tier (EE Tier), based on the EPC kWh/m^2/year measure, which quantifies the energy efficiency of the collateral. To assess the impact of energy efficiency on mortgage performance, we construct a continuous variable that represents the average energy consumption of the collaterals associated with each loan, expressed in kWh/m^2/year. The EPC ratings provided in the EDW database[2] serve as the basis for this calculation. However, as EPC rating schemes vary across countries, we harmonise these ratings by converting them into numerical values corresponding to the midpoint of the energy consumption range (in kWh/m^2/year) for each rating band in each country. This mapping, summarised in Table A4, aligns the diverse EPC scales with a unified framework. For each country, EPC ratings (e.g., A-G) are associated with specific

[2]The EPC rating variable is at the collateral level and coded as 'RREC10' in the ESMA template.

energy consumption ranges. For example, in France, an EPC A corresponds to a range of 1–50 kWh/m²/year, an EPC B corresponds to a range of 51-95, and so on. To harmonise the data, the midpoint of each range is used as the numeric value for the corresponding EPC band. The average EPC kWh/m²/year for each loan is computed as a weighted average of the numeric EPC values across all associated residential collaterals. The weights are determined by the original value of the collaterals, ensuring that higher-value collaterals exert greater influence on the average energy efficiency. Specifically, for loan l in quarter q, the weighted average is calculated as:

$$\text{EPC}_{lq} = \frac{\sum_{i=1}^{n_l} w_{iq} \cdot \text{EPC}_{iq}}{\sum_{i=1}^{n_l} w_{iq}}$$

where n_l represents the number of collaterals associated with loan l in quarter q, w_{iq} denotes the original value of collateral i, and EPC_{iq} is the numeric EPC value of collateral i. Finally, we categorise the resulting EPC values into three tiers of energy efficiency. Loans with average EPC values in the bottom third of the range (lower consumption) are classified as *high efficiency*, those in the middle third as *medium efficiency*, and those in the top third (higher consumption) as *low efficiency*.

For each loan, we retrieve a comprehensive set of control variables to account for borrower, loan, collateral and macroeconomic factors that may influence mortgage delinquency. Macroeconomic variables, including unemployment rates and house price indices, are sourced from the OECD database. For other variables, such as inflation rates and energy price indices, data is retrieved from Eurostat.[3] Table 1 provides an overview and description of the variables that have been employed in our analysis. Table 2 compares the Green RMBS Originator Subsample and the EPC Subsample in terms of sample size and key variables. The Green RMBS Originator Subsample includes

[3]It is important to note that Eurostat ceased reporting certain series for the United Kingdom following Brexit. To maintain continuity in the dataset, these series were supplemented with corresponding data from the Office for National Statistics (ONS) in the UK. For overall inflation, we use the Eurostat online data code `prc_hicp_manr - CP00`, complemented by the ONS Series ID `D7G7 (00)` for the UK. Similarly, for energy inflation, we rely on Eurostat data under the code `prc_hicp_manr - 045`, integrated with the ONS Series ID `D7GT (04.5)`.

7,704,340 observations, while the EPC Subsample comprises 4,503,026 observations. On average, delinquency rates are lower in the EPC Subsample, with arrears at 49.57 bps and default at 16.77 bps, compared to 72.27 bps and 29.57 bps, respectively, in the Green RMBS Originator Subsample. Regarding energy efficiency, 63.96% of the loans in the Green RMBS Originator Subsample have missing EPC data, whereas the EPC Subsample includes only loans with populated EPC fields. Within the EPC Subsample, 32.32% of properties are classified as high efficiency, 50.94% as medium efficiency, and 16.74% as low efficiency. The delinquency patterns are further illustrated in Figure 1 and Figure 2, which depict the cumulative arrears and default rates for loans securitised in Green and Non-Green RMBS, respectively. As shown, loans in Green RMBS consistently exhibit lower cumulative delinquency rates compared to their Non-Green counterparts. Similarly, Figure 3 and Figure 5 present the cumulative arrears and default rates by EPC rating categories. Loans backed by properties with higher energy efficiency (high EPC ratings) demonstrate lower delinquency rates over time.

4.2 Methodology

To investigate the relationship between energy efficiency, Green RMBS securitisations, and mortgage delinquency, we implement a panel logit model. This approach, commonly employed in credit risk and securitisation literature (see, for instance, Campbell et al., 2008; Chava and Jarrow, 2004; Crook, 2002), is used to estimate the likelihood of mortgage delinquency under different energy efficiency and green securitisation scenarios. Our analysis utilises two main subsamples: (1) the Green RMBS Originator Subsample and (2) the EPC Subsample.

For the Green RMBS Originator Subsample, we estimate the following baseline

model:

$$\begin{aligned} \textit{Loan Delinquency}_{i,t} = \alpha &+ \beta_1 \textit{Green RMBS}_i \\ &+ \beta_2 \textit{Interest Rate}_i + \beta_3 \textit{Time to Maturity}_{i,t} \\ &+ \gamma \textit{Loan Characteristics}_i + \delta \textit{Borrower Characteristics}_i \\ &+ \phi \textit{Collateral Characteristics}_{i,t} + \theta \textit{Macro Variables}_{i,t} \\ &+ \textit{Originator FE} + \textit{Quarter FE} + \varepsilon_{i,t}, \end{aligned} \tag{1}$$

where $\textit{Loan Delinquency}_{i,t}$ represents one of the delinquency indicators, specifically *Default* or *Material Default*. $\textit{Green RMBS}_i$ is the key explanatory variable, indicating whether loan i is securitised within a green RMBS deal. For the controls, we include variables following the existing literature. Loan characteristics include loan-to-value (LTV) ratios, interest rate at the first reporting date, interest rate type, and purpose (Ertan et al., 2017). Borrower characteristics comprise employment status and income level. Macro variables include country-specific changes in unemployment rates and house price indices, and inflation levels over the previous 12 months (Gerardi et al., 2018). Moreover, we include collateral characteristics such as property type, occupancy type, and collateral value. Including originator fixed effects[4] controls for structural features of specific RMBS deals and bank-level credit practices (and, indirectly, for country FE, as originator FE is more granular than country), while quarter fixed effects account for temporal shifts in market conditions. Standard errors are clustered at the 3-letter postcode level, following the most conservative specifications of previous papers on the topic (Billio et al., 2021; Guin and Korhonen, 2020).

For the EPC Subsample, we focus on the impact of energy efficiency on mortgage

[4]Ideally, we would control for Deal FE, as it is common in the literature, but as the variable of interest, Green Flag, is at the deal level, this would prevent us from observing its coefficient. Thus, we resort to control for Originator FE and quarter FE, and in an additional robustness test, presented in Table A3, we control for the interaction Originator × Quarter FE.

delinquency. The baseline model is specified as:

$$\begin{aligned} \textit{Loan Delinquency}_{i,t} = \alpha &+ \beta_1 \textit{EPC kWh/m}^2\textit{/year Category}_i \\ &+ \beta_2 \textit{Interest Rate}_i + \beta_3 \textit{Time to Maturity}_{i,t} \\ &+ \gamma \textit{Loan Characteristics}_i + \delta \textit{Borrower Characteristics}_i \\ &+ \phi \textit{Collateral Characteristics}_{i,t} + \theta \textit{Macro Variables}_{i,t} \\ &+ \textit{Deal FE} + \textit{Quarter FE} + \varepsilon_{i,t}, \end{aligned} \tag{2}$$

where $\textit{Loan Delinquency}_{i,t}$ represents one of the four delinquency indicators: *Arrears*, *Material Arrears*, *Default*, or *Material Default*. The key explanatory variable, *EPC kWh/m^2/year Category*, is a categorical variable dividing loans into three tiers of energy efficiency based on the average energy consumption per square metre per year of their collaterals. Loans are classified as *High Efficiency*, *Medium Efficiency*, or *Low Efficiency*.

Macro-variables include country-specific changes in unemployment rates and house price indexes (HPI) as well as inflation over the previous 12 months. These factors capture the broader economic environment's impact on delinquency rates. Borrower income and collateral value are particularly important in disentangling the effect of energy efficiency from that of borrower finances and property value. Higher energy efficiency levels may be correlated with wealthier borrowers, who typically have higher incomes and own properties with greater collateral values. These factors are themselves strong predictors of delinquency risk. Without controlling for income and collateral value, the observed relationship between energy efficiency and delinquency could be driven by these underlying borrower characteristics rather than the energy efficiency itself. By including these controls in our analysis, we ensure that the estimated impact of energy efficiency on delinquency risk reflects its unique contribution, independent of borrower wealth or property value. As in the Green RMBS model, standard errors are clustered at the 3-letter postcode level, while deal and quarter fixed effects are included to account for unobservable heterogeneity.

5 Results and discussion

5.1 The impact of the RMBS Green Flag on mortgage arrears

The results from the panel logit regressions examining the effect of the Green Flag on mortgage delinquency are shown in Table 5. The dependent variable is Default, a delinquency indicator, identifying when loans are in arrears for two consecutive quarters within the next four quarters. The Green Flag is the key explanatory variable, indicating whether the loan is part of a securitised green RMBS deal.

We gradually add sets of explanatory variables across five specifications. Across all of them, the Green Flag is negatively and significantly associated with the probability of mortgage delinquency. The marginal effects range from -19.72 to -15.25 basis points (bps), all of which are statistically significant at the 1% level. To provide an economic interpretation, we can compare the probability of default reduction from the specification with all the controls to the mean default in the sample, which is 29.6 bps. The reduction of 15.71 bps represents a decrease of approximately 53.1% relative to the average default rate. These results demonstrate that loans securitised within green RMBS deals are less likely to enter arrears compared to non-green loans.

The remaining risk drivers of the model show a relationship with default that aligns with expectations. As expected, higher LTV ratios are associated with increased delinquency risk, with the marginal effect increasing across quintiles. For example, in the fifth quintile (the highest LTV), the delinquency risk rises by approximately 40 bps, whereas the second quintile shows an increase of around 3 bps. This confirms that higher LTV loans pose a greater risk of default. In terms of interest rates, loans in the highest interest rate quintile display significantly higher delinquency rates, with a marginal effect of about 34 bps. In contrast, floating-rate loans are linked to an increased delinquency risk of approximately 25 bps compared to fixed-rate loans (baseline). This indicates that borrowers exposed to interest rate variability face a higher likelihood of financial strain, leading to arrears. Borrower characteristics, such

as employment status and income, are important predictors of delinquency. Borrowers employed in the public sector show a lower delinquency risk compared to those in the private sector, with a reduction of around 7.8 bps. Conversely, unemployed and self-employed borrowers show a significantly higher risk of delinquency, with increases of around 29 and 24 bps, respectively. Additionally, borrowers in the lowest income tertile exhibit a substantially higher delinquency risk compared to those in higher-income brackets. Finally, in specifications 4 and 5, we progressively introduce property controls and macroeconomic variables, respectively. Despite the inclusion of these additional controls, the variable of interest, the Green Flag, remains both significant and negative, reinforcing its robust association with a reduced probability of mortgage delinquency.

To further assess the robustness of our findings, we re-estimate the model using material default as the dependent variable. This indicator activates when loans are in arrears for two consecutive quarters and the arrears balance exceeds 1% of the loan balance. The results, presented in Table A2, remain consistent with the main findings. The Green Flag remains significantly associated with a reduction in delinquency risk across all five specifications. Given that the mean of the material default variable is 12.683 bps, the reduction in default probability observed in the specification with the most stringent controls (column 5) represents a decrease of approximately 43.5%, underscoring the robustness of the Green Flag's impact, even as the delinquency definition considers a materiality threshold.

We further test the robustness of our findings by introducing a more conservative fixed effects structure, capturing the interaction of Quarter and Originator Fixed Effects. The results, shown in Table A3, continue to support the main findings. The Green Flag remains negatively associated with delinquency risk, with marginal effects of -16.48 bps for default, which represents a reduction of -56.35% relative to the sample mean. For material default, the marginal effect is -5.85 bps, corresponding to a reduction of -46.14% relative to the sample mean. These results confirm that loans included in green securitisations are more resilient, even when stricter fixed effects are applied.

As reported in Table 4, properties underpinning Green RMBS generally exhibit superior energy performance. This observation holds even though the EuGB Regulation specifies that the *use-of-proceeds requirement* applies to the originator, rather than the issuer, as is the case with green bonds. The regulation does not prohibit issuers from pooling loans with energy-inefficient collateral into securitisations. However, the higher share of energy-efficient collateral in Green RMBS may be attributed to two factors:

- **Regulatory transition phase:** The EuGB Regulation takes a pragmatic approach by applying the use-of-proceeds requirement at the originator level rather than the issuer (SSPE) level. This decision addresses the limited availability of taxonomy-aligned green assets in the EU market, which would otherwise constrain the growth of green securitisations. However, the regulation suggests that this approach may shift in the future, once sufficient green assets are available. Originators may already be preparing for such regulatory changes by prioritising energy-efficient collateral to align with expected future requirements.

- **Increased scrutiny of green securitisations:** Green RMBS face stricter transparency and reporting requirements. Specifically, to ensure clarity on the environmental characteristics of the securitised exposures, the prospectus for Green RMBS deals must disclose the proportion of exposures meeting the green bond taxonomy. This encourages originators to include a higher share of energy-efficient loans, aligning with investor expectations for credibility and consistency in green financial products.

Given these dynamics, the securitisation of energy-efficient loans plays a dual role in risk management. Like all Asset-Backed Securities (ABS), RMBS distribute risk across a broad investor base, thereby reducing the concentration of risk on any single entity (Shin, 2009). Green RMBS, however, provide an additional layer of risk mitigation due to the energy-efficient nature of their underlying collateral. These properties are potentially less exposed to systematic energy price risk, which can significantly impact

borrowers' disposable income as well as their ability to meet mortgage obligations and is difficult to diversify in traditional RMBS. Furthermore, Green RMBS are better equipped to manage transition risks associated with the tightening of environmental regulations (e.g. the gradual introduction of minimum energy performance standards). In contrast, traditional RMBS backed by energy-inefficient properties face greater exposure to such risks, as these properties may become less valuable, require costly retrofits, or even risk becoming *stranded* as regulatory standards evolve. By including energy-efficient collateral, Green RMBS align more closely with these regulatory trends, offering enhanced resilience and sustainability for investors. By spreading risk across diverse investors, reducing exposure to energy cost volatility, and mitigating transition risks, Green RMBS serve as a robust and sustainable financial instrument. Moreover, they support the EU's climate objectives by reducing the green investment gap. As such, Green RMBS are well-positioned to play a critical role in the transition to a greener economy.

5.2 The Impact of EPC Rating on mortgage delinquency

The analysis of Green versus Non-Green RMBS has shown that loans securitised in Green RMBS deals tend to perform better in terms of lower delinquency rates. However, an important factor that may explain this difference is the composition of the EPC ratings of the underlying collateral in these securitised deals. Table 4 presents the distribution of EE Tiers (High, Medium, Low efficiency) across Green and Non-Green RMBS. Green RMBS not only are more likely to have the EPC certificate variable populated compared to Non-Green RMBS, but they also have a higher proportion of energy-efficient loans. As shown in Table 4, 30.69% of loans in Green RMBS are missing EPC data, compared to 65.70% in Non-Green RMBS. When excluding missing data, the difference in energy efficiency becomes more pronounced. Indeed, if we compare the distribution of the EPC ratings conditional on the EPC field being populated, Green RMBS deals tend to have a significantly higher proportion of loans with high EPC

ratings (74.82% with A/B labels) compared to Non-Green RMBS, where only 28.16% of loans fall under this category. Conversely, Non-Green RMBS have a much larger share of loans with lower EPC ratings (58.51% with C/D/E labels and 13.32% with F/G labels) compared to Green RMBS. This composition difference suggests that the energy efficiency of the collateral plays a significant role in the observed performance disparity between Green and Non-Green RMBS.

To further investigate this hypothesis, we now turn to the analysis of the energy efficiency ratings of the collateral, *EE Tier*, based on the *EPC kWh/m²/year* measure. As shown in Table A4, the meaning of these EPC labels (A, B, C, etc.) varies by country, with each label corresponding to a different range of energy consumption per square metre per year. In order to standardise these values across countries, we use the midpoint value of the energy consumption range associated with each EPC label, as specified for the country where the collateral is located.[5] We then compute the weighted average energy consumption of all the collaterals associated with a loan, where each collateral's weight is based on its proportion of the total collateral value for that loan. This results in a numerical energy consumption value for each loan, which can range from 0 to 500. Based on this value, the loan is categorised into one of three energy efficiency tiers: the highest consumption third is categorised as Low Efficiency, the middle third as Medium Efficiency, and the lowest third as High Efficiency.

Table 6 presents the results of the panel logit regressions where the *EE Tier* variable is the key explanatory factor. The analysis is conducted on the EPC-populated sample, which excludes observations without available EPC data. The table includes four specifications where the dependent variables represent different delinquency indicators: arrears, material arrears (where arrears exceed 1% of the loan balance), default, and material default (where default occurs with arrears exceeding 1% of the loan balance). The results show that EPC ratings have a significant impact on mortgage delinquency.

[5]The conversion table is floored at 0 and capped at 500. For the most efficient certificates (i.e., EPC label 'A', where the minimum consumption is ≤ 0), we use 0 as the lower bound. For the least efficient certificates (i.e., EPC label 'G', where the consumption exceeds 450), we use 500 as the upper bound. This capping ensures that we can compute a standardised midpoint for each energy consumption range, enabling consistent comparisons across efficiency bands.

In all four specifications, the loans in the Low Efficiency tier are associated with a significantly higher risk of delinquency compared to the baseline (High Efficiency). The impact of energy efficiency on mortgage delinquency is evident across all four specifications. Starting with Low Efficiency properties, the marginal effect on arrears (column 1) is 13.65 bps. When compared to the mean arrears rate of 49.57 bps, this represents approximately a 27.53% increase in the probability of arrears. For material arrears (column 2), the marginal effect is 7.06 bps, indicating a significant 56.14% increase over the mean material arrears rate of 12.58 bps. Similarly, the marginal effect of Low Efficiency on default (column 3) is 5.97 bps, translating to a 35.61% increase relative to the mean default rate of 16.77 bps. Finally, Low Efficiency properties increase the probability of material default by 3.96 bps (column 4), which is a 89.94% rise compared to the mean material default rate of 4.40 bps. Loans with Medium Efficiency also exhibit elevated delinquency risks compared to the High Efficiency baseline. In terms of arrears (column 1), Medium Efficiency increases the probability by 8.17 bps (a 16.48% rise relative to the mean arrears rate of 49.57 bps). For material arrears (column 2), the marginal effect is 2.86 bps (a 22.73% increase relative to the mean material arrears rate of 12.58 bps). For default (column 3), the marginal effect is 1.91 bps (an 11.39% increase compared to the mean default rate of 16.77 bps). Finally, Medium Efficiency increases the probability of material default by 1.00 basis point (a 22.72% rise compared to the mean material default rate of 4.40 bps). These findings remain robust even after controlling for a comprehensive set of loan, borrower, and collateral characteristics, as well as macroeconomic conditions. Fixed effects at the quarterly and deal level are also included to account for time-varying factors and deal-specific heterogeneity. The LTV ratio remains a consistent and significant predictor of delinquency. Higher LTV loans are associated with increased delinquency risks across all specifications. In particular, loans in the fifth quintile of LTV exhibit a delinquency increase of approximately 39 bps in arrears and 13.5 bps in material arrears. This confirms the critical role of LTV as a risk factor in

mortgage performance. The results for other control variables, including loan purpose, interest rate, and borrower characteristics, are in line with expectations. Floating-rate loans, for instance, continue to display a higher delinquency risk. Self-employed and unemployed borrowers also exhibit significantly higher delinquency rates. In terms of borrower income, loans extended to borrowers in the lowest income tertile (baseline) display the highest delinquency risks. The marginal effects for the second and third income tertiles show a clear improvement in loan performance as income increases, with the third tertile reducing the delinquency risk by approximately 22.71 bps in arrears and 8.24 bps in material arrears. Overall, the findings confirm that properties with lower energy efficiency, as indicated by their EPC ratings and kWh consumption, are associated with higher delinquency risk. To further strengthen the validity of these results, two additional robustness tests were conducted. The first robustness test (Table A5) incorporates an interaction between Deal and Quarter Fixed Effects (Deal x Quarter FE) to control for deal-specific time-varying factors. In this test, all the previously observed results hold true, confirming the robustness of the findings related to energy efficiency and mortgage delinquency. The second robustness test (Table A6) replaces the EE Tier variable with the direct EPC label, foregoing adjustments for country-specific variations in the meaning of each label. This approach allows for a simpler yet effective comparison of the impact of energy efficiency on mortgage delinquency. In this test, the medium efficiency tier (C/D/E labels) shows no statistical significance, but the low efficiency tier (F/G labels) remains significant when compared to the high efficiency baseline (A/B labels).

6 How Energy Efficiency affects mortgage delinquency

Having established that the energy efficiency of collaterals influences the probability of default in securitised mortgages, we now aim to investigate the channel through

which this effect occurs. Specifically, we investigate whether this effect occurs through the channel of higher utility bills due to poor energy efficiency, reducing disposable income to cover mortgage instalments. To explore this hypothesis, we conduct two sets of analyses. First, we examine the interaction between income and energy efficiency (subsection 6.1). Our expectation is that households with lower incomes are more financially constrained and thus more affected by low energy efficiency, leading to higher delinquency rates. Next, we will test whether the effect of energy efficiency on default probabilities is moderated by energy prices (subsection 6.2).

6.1 Income interaction with Energy Efficiency

We begin by exploring the interaction between energy efficiency and income. The results are presented in Table 7, where income is divided into two bands: above or below the median income. The dependent variables are arrears (column 1), material arrears (column 2), default (column 3), and material default (column 4).

The results in the table are derived from a regression model where income is simplified into a binary variable, indicating whether it is above or below the median. All other control variables are retained, including loan characteristics such as LTV and interest rates, borrower characteristics, collateral characteristics, macroeconomic variables, and fixed effects for deal and quarter. This approach allows us to isolate how the relationship between energy efficiency and delinquency varies depending on income level. By interacting the binary income variable with energy efficiency tiers, we effectively estimate separate marginal effects of energy efficiency for borrowers with above-median and below-median income. This setup reflects two distinct starting points for delinquency risk, or intercepts, corresponding to the inherent baseline differences between these two income groups. For each income group, the marginal effects of moving from high to medium or low energy efficiency are then assessed. The results show that the impact of energy efficiency is significantly larger for borrowers with below-median income. For instance, for borrowers in this group, moving from high to

low energy efficiency increases the probability of arrears by 19.70 basis points, which represents a 39.73% rise compared to the sample mean arrears rate of 49.57 basis points. Similarly, for material arrears, default, and material default, the marginal effects are 6.68 basis points, 10.45 basis points, and 4.76 basis points, respectively, representing increases of 53.12%, 62.29%, and 108.19% relative to their corresponding sample means. In contrast, for borrowers with above-median income, the effects of energy efficiency are smaller and, in some cases, not statistically significant. For instance, moving from high to low energy efficiency increases arrears by 7.06 basis points and default by 3.619 bps. However, both coefficients are non-significant. For material arrears and material default, the increases are 6.15 basis points and 3.40 basis points. To aid in the interpretation of these findings, we also present Figure 4, which shows predictive margins of the regression for each income group across the three energy efficiency tiers: high, medium, and low. The figure illustrates that borrowers with below-median income start from a higher baseline delinquency rate for high-efficiency properties, as reflected by the different intercepts for the red and blue lines. Importantly, he increase in delinquency rates when moving from high to low energy efficiency is substantially more pronounced for below-median income borrowers, as seen in the steeper gradient of the red line. For example, the difference between the points for high and low efficiency on the red line corresponds to the 19.704 bps increase in arrears (as previously reported in the Table 7), while the same difference for the blue line corresponds to the smaller increase of 7.062 basis points.

These results suggest that income plays an important role in determining how energy efficiency affects mortgage delinquency. Lower-income households are more likely to face liquidity constraints from higher energy bills, leaving them less able to meet their mortgage obligations. Higher-income households, on the other hand, are better positioned to manage these costs. Hence, their increase in delinquency risk due to low energy efficiency is mitigated. This analysis supports the hypothesis that the channel through which energy efficiency influences mortgage performance is, at least in

part, related to income constraints.

6.2 Energy inflation interaction with Energy Efficiency

This section explores whether the effect of energy efficiency on mortgage delinquency is moderated by fluctuations in energy prices. Specifically, we test the hypothesis that higher energy inflation exacerbates the impact of poor energy efficiency on mortgage delinquency, as higher energy costs reduce borrowers' disposable income for mortgage payments. Following the same econometric approach used in the above-below income analysis in the previous paragraph, we assess the additional marginal effect of moving from high to low efficiency across two distinct conditions: above-median and below-median energy inflation levels. This method allows us to quantify how the impact of energy efficiency on delinquency differs depending on the prevailing inflationary environment. Table 8 presents the results from panel logit regressions, where we interact energy inflation levels (above or below the median of 18.4%) with different energy efficiency tiers (high, medium, and low) to assess how these factors jointly influence mortgage delinquency indicators. The results show that properties with low energy efficiency are significantly more likely to experience higher delinquency rates across all four delinquency indicators, regardless of whether energy inflation is above or below the median. However, when energy inflation is above the median, low-efficiency properties are associated with an additional 16.40 bps in arrears (column 1), 6.59 bps in material arrears (column 2), 8.06 bps in default (column 3), and 4.24 bps in material default (column 4). To put these numbers into perspective, the mean arrears rate in the sample is 49.57 bps. Thus, the 16.40 bps increase in arrears for low-efficiency properties under high energy inflation represents a 33.09% rise in the probability of arrears. For material arrears, the 6.59 bps increase corresponds to a 52.41% rise compared to the sample mean of 12.58 bps. In terms of default, the 8.06 bps increase for low-efficiency properties represents a 48.06% rise relative to the mean default rate of 16.77 bps, while the 4.24 bps increase in material default represents a substantial 96.27% increase

relative to the mean material default rate of 4.40 bps. For medium-efficiency properties, the effect is more moderate but still significant when energy inflation is high. Arrears increase by 8.54 bps, which corresponds to a 17.23% rise compared to the sample mean of 49.57 bps. Material arrears rise by 2.37 bps, representing an 18.84% increase over the mean material arrears rate of 12.58 bps. Default increases by 3.60 bps, reflecting a 21.47% rise relative to the mean default rate of 16.77 bps, and material default rises by 1.33 bps, a 30.23% increase over the mean material default rate of 4.40 bps. When energy inflation is below the median, the adverse effects of low and medium efficiency on delinquency indicators are still present but are generally weaker. For low-efficiency properties, arrears increase by 8.70 bps, a 17.55% rise compared to the mean arrears rate. Material arrears rise by 4.87 bps, representing a 38.71% increase relative to the mean material arrears rate. Default increases by 5.32 bps, which corresponds to a 31.74% rise over the mean default rate, while material default increases by 3.45 bps, representing a 78.41% rise compared to the mean material default rate. For medium-efficiency properties, when energy inflation is below the median, the marginal effects are smaller but still significant for arrears (7.53 bps, a 15.19% increase over the mean arrears rate). However, the effects on material arrears (1.13 bps), default (1.67 bps) and material default (0.45 bps) are not statistically significant. In all the specifications, we control for loan, borrower, and collateral characteristics, as well as macroeconomic conditions.

Finally, given the higher proportion of high energy efficient collaterals of loans securitised in Green RMBS reported in Table 4, we also considered the differential between Green and non-Green RMBS underlying loans' delinquency over time, plotting it against the energy inflation levels, as shown in Figure 6. We notice that from 2022Q1 until 2023Q1, the differential becomes statistically significant, and this period corresponds to high energy inflation levels. During this time, the arrears rate differential between non-Green and Green RMBS widens, with Green RMBS performing better in terms of delinquency of their underlying mortgages. This indicates that Green RMBS

are more resilient to the effects of rising energy prices, supporting the hypothesis that energy-efficient loans are less vulnerable to energy price fluctuations and have a lower risk of entering arrears during inflationary periods.

Overall, these results suggest that energy inflation amplifies the negative impact of low energy efficiency on mortgage delinquency. Households with less energy-efficient properties are particularly vulnerable to rising energy costs, which increases their likelihood of falling behind on mortgage payments.

6.2.1 Continuous Energy Inflation and Energy Efficiency interaction on arrears balance

As a further robustness test, we examine the impact of energy inflation on arrears balance by interacting the continuous energy inflation variable with different energy efficiency levels. This approach allows us to test whether the relationship between energy efficiency and arrears balance holds when using a continuous measure of energy inflation rather than a binary cut-off above/below median. Table 9 presents the results from both OLS and Tobit regressions. The dependent variable is the arrears balance, and the key explanatory variables are the interactions between energy inflation and energy efficiency tiers (high, medium, and low). For medium-efficiency properties, the OLS results show a coefficient of 0.133 euros (baseline effect, i.e. when energy inflation is at 0%), which represents a 9.93% increase relative to the mean arrears balance in the sample (1.34 euros). Similarly, for low-efficiency properties, the OLS coefficient is 0.140 euros, representing a 10.45% increase over the mean. In contrast, the Tobit regression for medium efficiency shows an insignificant effect, while the interaction between energy inflation and low efficiency has a significant positive effect, with a coefficient of 1.568 euros. Given that the mean arrears balance for loans in arrears is 523.01 euros, this corresponds to a 0.30% increase.

Additionally, Table Table 10 presents the marginal effects of energy efficiency on arrears balance at different energy inflation levels, ranging from -40% to +100%. The

reason for computing the margins across such a wide range is that the distribution of energy inflation in our sample during this period, characterised by significant energy price volatility, ranged from approximately -41.1% at the 5th percentile to +129.97% at the 95th percentile. This ensures that the margins are representative of the actual conditions in the sample.

As seen before, at the 0% energy inflation level, the marginal effect for medium-efficiency properties is 0.133 euros, which represents a 9.93% increase relative to the mean arrears balance (1.34 euros). As energy inflation increases, the impact becomes stronger. For example, at +40%, the marginal effect for medium efficiency increases to 0.161 euros (12.01% increase), and for low-efficiency properties, it reaches 0.207 euros (15.45% increase). In the Tobit model, the marginal effect for low-efficiency properties rises sharply as inflation increases, reaching 183.69 euros at +100% energy inflation, corresponding to a 35.12% increase compared to the mean arrears balance when loans are in arrears (523.01 euros).

These results confirm that the interaction between energy inflation and low energy efficiency significantly affects arrears balances, with the impact becoming more pronounced as inflation levels rise. This underscores the heightened vulnerability of borrowers with energy-inefficient properties to periods of high energy price inflation.

7 Conclusion

This study provides novel insights into the role of energy efficiency in mitigating credit risk and advancing sustainability objectives in the European RMBS market. Using detailed loan-level data enriched with EPC ratings, we have shown that both Green RMBS and energy-efficient properties contribute significantly to reducing mortgage delinquency risks.

Our findings reveal that Green RMBS, which securitise loans backed by energy-efficient properties, exhibit significantly lower delinquency risks compared to their non-green counterparts. Across all model specifications, the inclusion of the Green

Flag is associated with a substantial reduction in default probabilities, ranging between 15–20 basis points, or approximately 53% relative to the mean default rate. These results underscore the potential of Green RMBS as a robust financial instrument that aligns climate objectives with credit risk mitigation. Loans included in Green RMBS are not only more resilient to default but also benefit from enhanced borrower affordability and disposable income due to reduced energy costs. Additionally, we identify the energy efficiency of collateral as a critical determinant of mortgage performance. By harmonising EPC ratings across EU countries, we quantify energy efficiency through the average energy consumption of properties (kWh/m^2/year), categorising loans into high, medium, and low-efficiency tiers. Our analysis demonstrates that loans backed by low-efficiency properties are significantly more likely to experience arrears or default. For instance, such loans are associated with a 56.14% increase in material arrears probability and an 89.94% rise in material default risk compared to high-efficiency properties. These results highlight the direct relationship between energy efficiency and credit risk, reinforcing the importance of incorporating energy metrics into financial risk assessments. Our investigation into the channels of impact reveals that the effect of energy efficiency on delinquency risk is amplified during periods of high energy inflation. Borrowers with low-efficiency properties face greater vulnerability as rising energy costs reduce disposable income, increasing the likelihood of financial strain. Furthermore, the interaction between income and energy efficiency underscores the disproportionate impact on lower-income households, who are less equipped to manage the financial burden of energy-inefficient properties. These findings suggest that energy efficiency not only serves as a transition risk mitigator but also as a tool to enhance financial resilience, particularly for economically vulnerable borrowers.

The implications of this study are far-reaching. For policymakers, our findings suggest that integrating energy efficiency metrics into credit risk evaluations and securitisation frameworks can incentivise the origination of energy-efficient mortgages and help address the significant investment gap required to meet the EU's 2030

energy efficiency and building renovation targets. This gap necessitates substantial private sector contributions to complement existing public funding. By promoting the securitisation of energy-efficient mortgages, Green RMBS could play a critical role in mobilising these investments and bridging the financing gap. For financial institutions, adopting energy efficiency metrics and incorporating them into risk assessments may enhance their ability to identify key drivers of delinquency and default. Such insights could allow institutions to adjust mortgage pricing to better reflect the underlying risk profiles, including both default and arrears probabilities. This adjustment is particularly important within the framework of credit risk management for banks, where accurate risk differentiation influences the allocation of loans to different stages under the IFRS 9 Expected Credit Loss model. In this context, loans classified in Stage 1 are performing loans with minimal credit risk, while Stage 2 and Stage 3 represent loans with significant increases in credit risk and defaulted loans, respectively. By better understanding and pricing the risks associated with energy inefficiency, financial institutions can improve both the accuracy of stage allocation and the effectiveness of their risk mitigation strategies. For investors, our findings validate the financial attractiveness of Green RMBS as an instrument that aligns credit risk mitigation with environmental sustainability.

Looking ahead, the introduction of the EuGB Regulation is expected to drive an increase in securitisation transactions labelled as green. This regulation provides a clear framework governing Green RMBS transactions, addressing a critical barrier that previously limited their growth compared to other green financial products. Originators may be incentivised to adopt the EuGB Green label to attract environmentally conscious investors and signal their commitment to financing sustainable activities. Originators that implement sustainable investment policies and disclose relevant information will be particularly well-positioned to capitalise on this framework. In conclusion, this study advances the understanding of how energy efficiency and green securitisations can align financial stability with environmental sustainability. By reducing exposure to

energy price volatility, mitigating transition risks, and supporting climate objectives, Green RMBS stand as a pivotal instrument in the EU's transition to a greener economy. Future research could explore the evolving dynamics of Green RMBS performance as energy efficiency regulations tighten and the market matures. Additionally, examining the integration of energy efficiency considerations into other asset classes could provide broader insights into the intersection of finance, energy policy, and climate resilience.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT for proofreading and to improve the flow of the text. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the manuscript.

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Figure 1. Cumulative arrears rate by Green RMBS label. This figure presents the cumulative arrears rate over time, comparing loans securitised in Green RMBS versus Non-Green RMBS. The data is based on RMBS originators with at least one Green and one Non-Green RMBS.

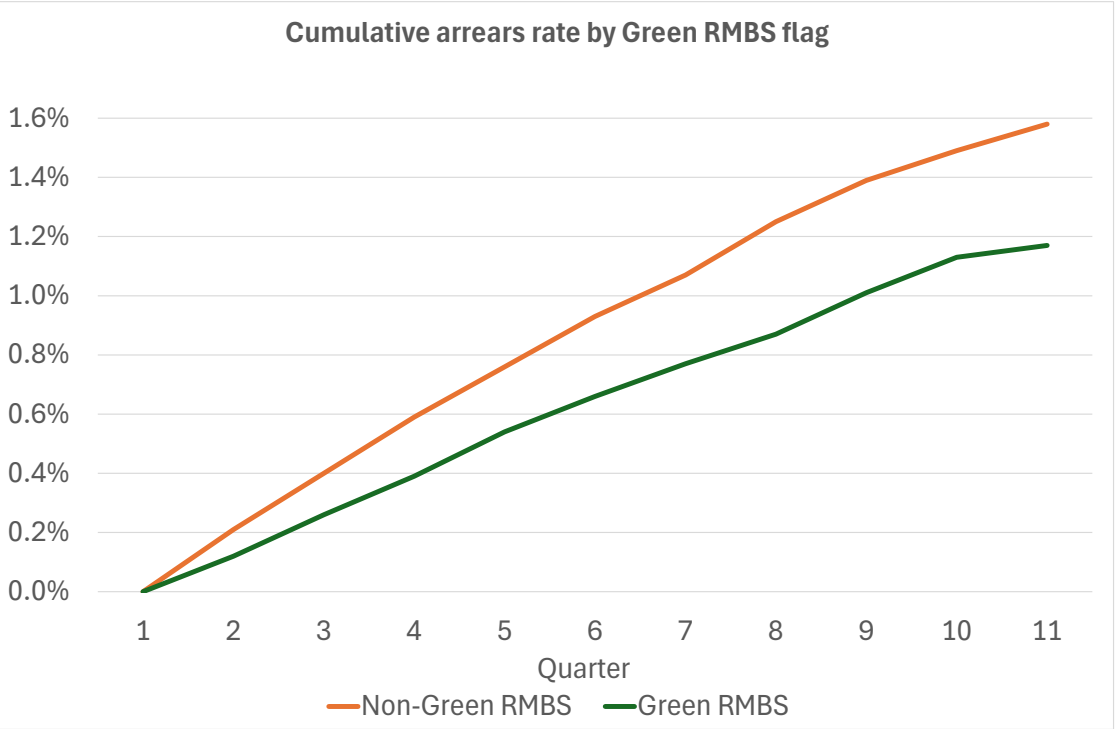


Figure 2. Cumulative default rate by Green RMBS label. This figure presents the cumulative default rate over time, comparing loans securitised in Green RMBS versus Non-Green RMBS. The data is based on RMBS originators with at least one Green and one Non-Green RMBS.

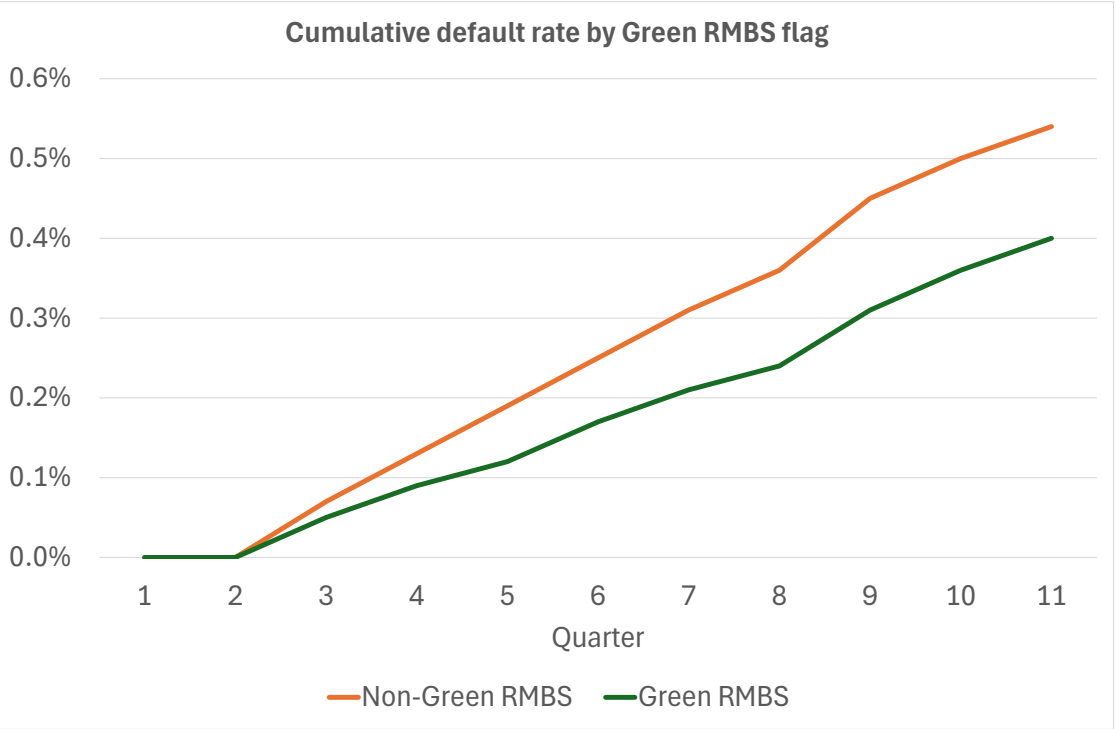


Figure 3. Cumulative arrears rate by EPC rating. This figure shows the cumulative arrears rate (arrears as a percentage of loan balance) over 12 quarters, split by EPC rating (high, medium, and low energy efficiency). The sample includes loans with EPC ratings populated at the reporting date, based on RMBS data.

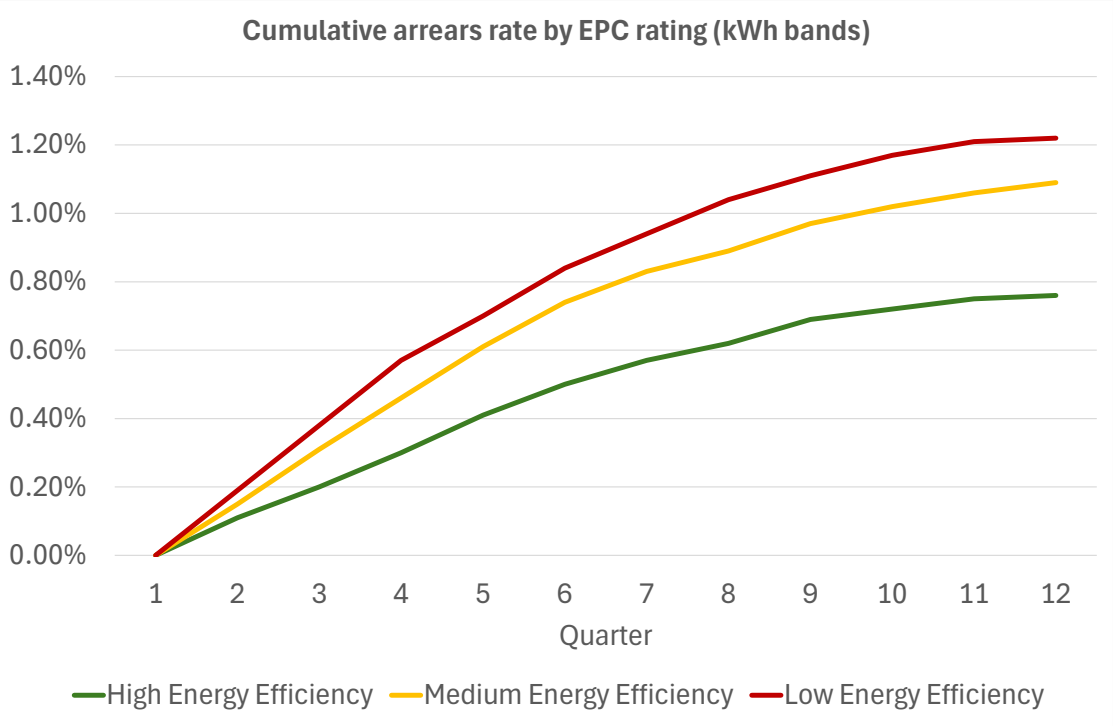


Figure 4. Predictive margins of arrears probability by income group and energy efficiency tier. This figure illustrates the predictive margins for arrears probability across three energy efficiency tiers (high, medium, and low), separately for borrowers with above-median and below-median income. The results are derived from the regression presented in Table 7, column 1. Borrowers with below-median income (red line) exhibit a steeper increase in arrears probability as energy efficiency decreases, reflecting greater sensitivity to energy efficiency tiers compared to borrowers with above-median income (blue line).

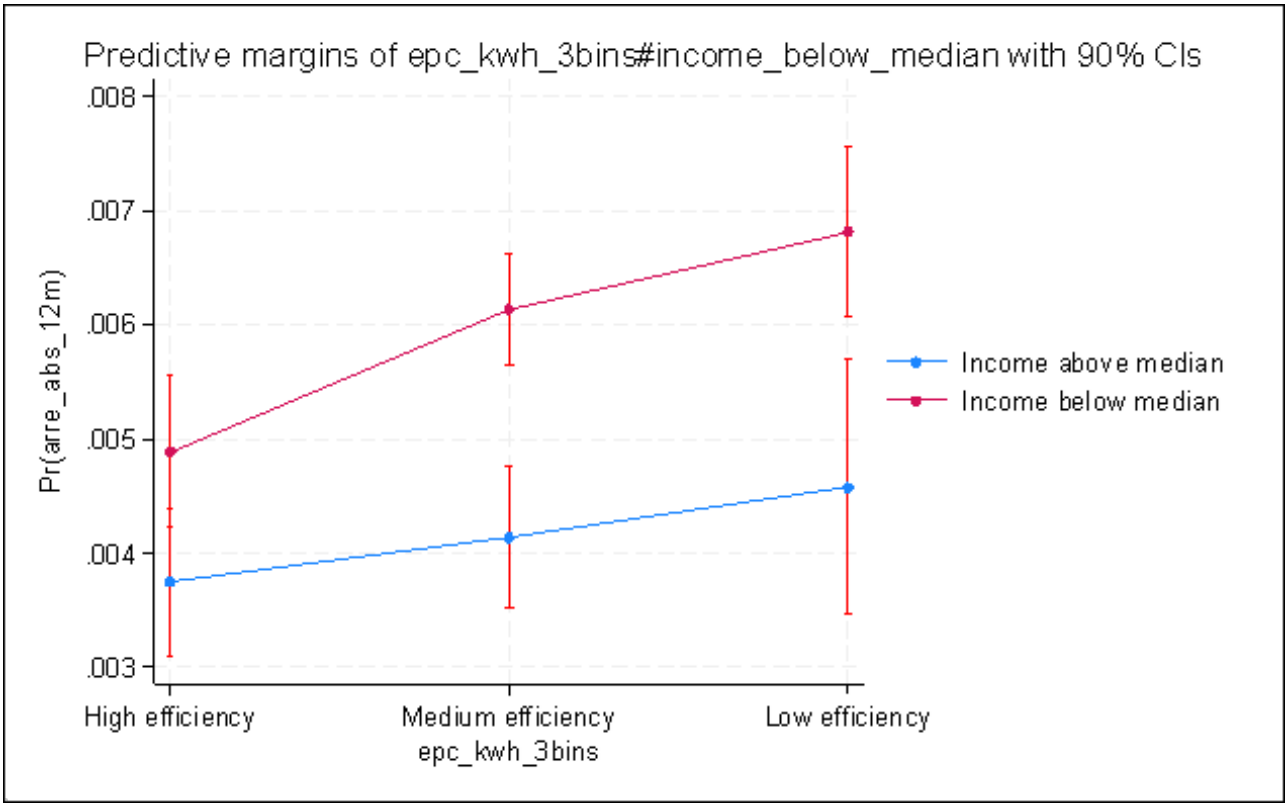


Figure 5. Cumulative default rate by EPC rating. This figure shows the cumulative default rate (defined as two consecutive quarters in arrears) over 12 quarters, split by EPC rating (high, medium, and low energy efficiency). The sample includes loans with EPC ratings populated at the reporting date, based on RMBS data.

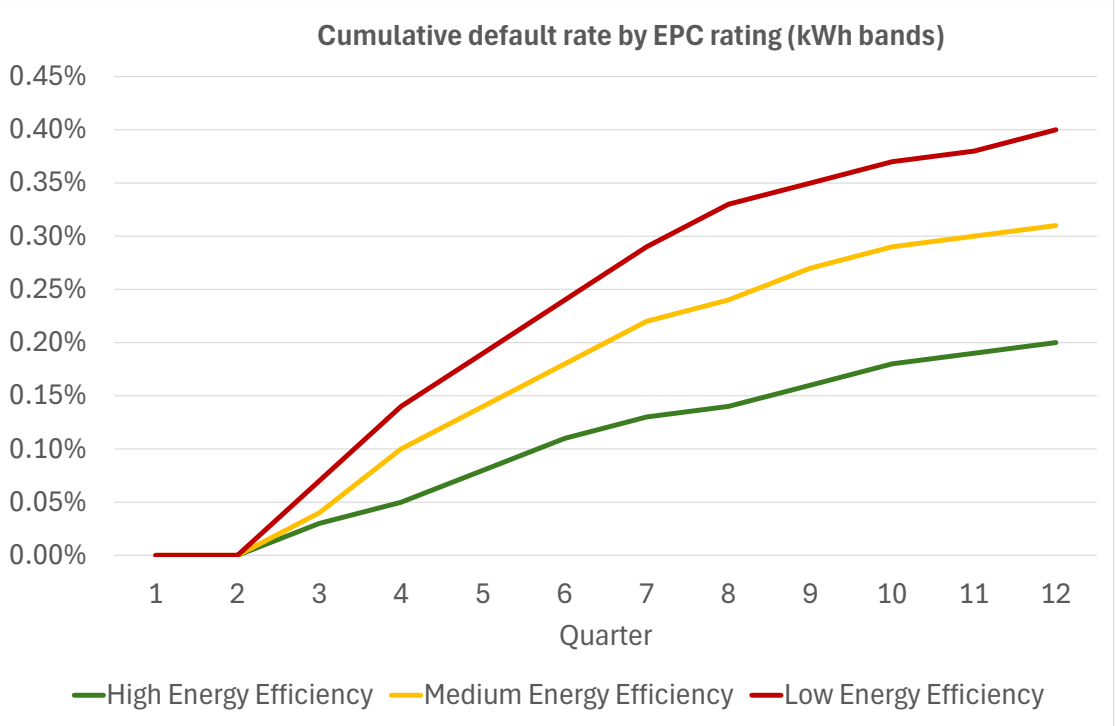


Figure 6. Green RMBS differential and energy inflation. This figure presents the difference in arrears rates (in bps) between Green and non-Green RMBS over time, plotted against the average energy inflation rate (as a percentage). The left vertical axis corresponds to the difference in arrears rates, and the right vertical axis corresponds to the energy inflation rate. Quarters where the difference is statistically significant are highlighted in green.

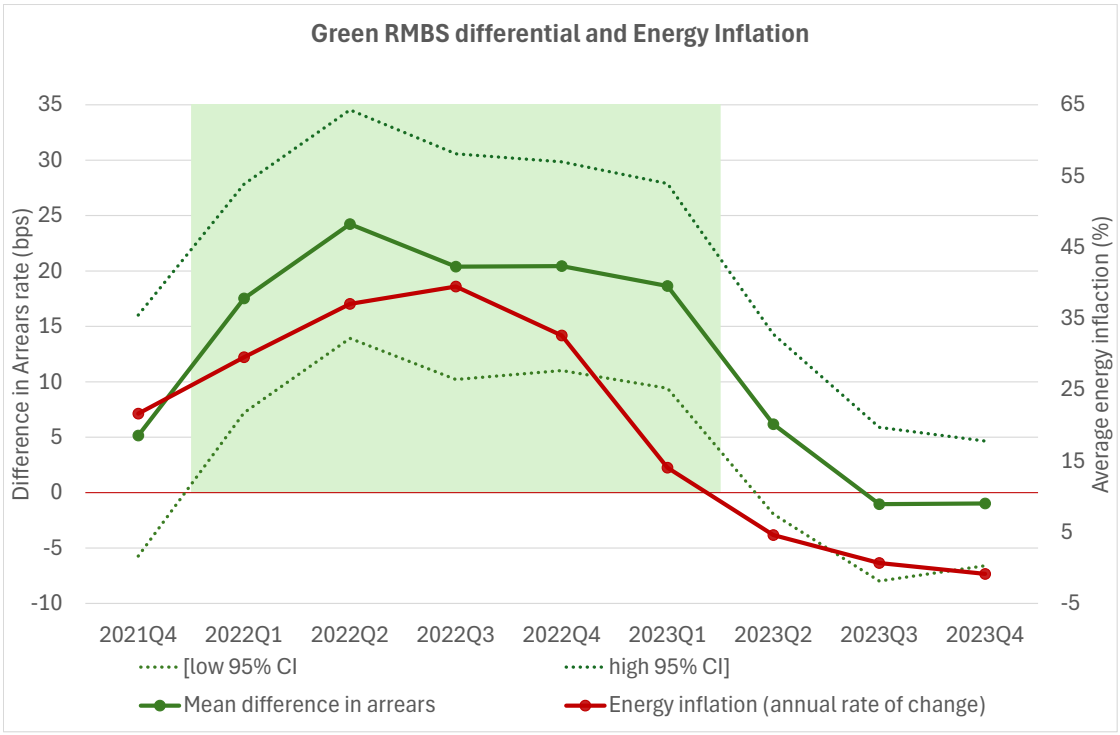


Table 1. Description of variables used in the regression analysis.

Variable	Type	Description
Delinquency		
Arrears	Dummy	A variable that takes the value of 1 if the loan is one quarter in arrears within the next 12 months, and 0 otherwise.
Material Arrears	Dummy	A variable that takes the value of 1 if the loan is one quarter in arrears within the next 12 months and the arrears balance is greater than or equal to 1% of the current loan balance, and 0 otherwise.
Default	Dummy	A variable that takes the value of 1 if the loan is two consecutive quarters in arrears within the next 12 months, and 0 otherwise.
Material Default	Dummy	A variable that takes the value of 1 if the loan is two consecutive quarters in arrears within the next 12 months and the arrears balance is greater than or equal to 1% of the current loan balance, and 0 otherwise.
Arrears balance (€)	Continuous	The arrears balance for loans in arrears.
Energy Efficiency		
Green Flag	Dummy	A binary variable indicating whether the loan is securitised in a green/energy efficiency RMBS deal, with 1 representing loans in such deals and 0 otherwise.
EE Tier	Categorical	Categorises the Energy Efficiency Tier of the loan based on the average kWh consumption per m^2 per year across all the collateral. The variable is divided into three ranges: the highest consumption third is categorised as Low Efficiency, the middle third as Medium Efficiency, and the lowest third as High Efficiency.
EPC kWh/m²/year	Numerical	Average kWh consumption per m^2 per year across all the collateral.
EPC Label	Categorical	Categorises properties based on their EPC label. Categories include EPC A/B (high), EPC C/D/E (medium), and EPC F/G (low).

Table 1 continued from previous page

Variable	Type	Description
Loan Characteristics		
Loan Purpose	Categorical	The purpose of the loan, categorised into Purchase, Construction, Remortgage, Renovation, or Other.
Interest Type	Categorical	The type of interest rate applied to the loan, which can be Fixed, Floating, or Other.
Loan-to-Value (LTV)	Continuous	The loan-to-value ratio at the time of the first reporting date.
Borrower Characteristics		
Employment	Categorical	Employment status of the borrower, which can be Employed in the private sector, public sector, or unknown sector, as well as Pensioner, Self-employed, Unemployed, or Other.
Income	Continuous	The borrower's income at the time of the first reporting date.
Collateral Characteristics		
Occupancy Type	Categorical	The type of occupancy of the property, which can be Owner Occupied, Buy to Let, Holiday, or Other.
Property Type	Categorical	The type of property, categorised as a Residential Flat, Residential House, Residential Terrace, or Other.
Property value	Continuous	The value of the property at the time of the first reporting date.
Macro Variables		
House price index change (%)	Continuous	The percentage change in the house price index over the previous 12 months.
Unemployment rate change (%)	Continuous	The percentage change in the unemployment rate over the previous 12 months.
Inflation (%)	Continuous	The inflation rate over the previous 12 months.

Table 1 continued from previous page

Variable	Type	Description
Energy inflation (%)	Continuous	The energy inflation over the previous 12 months.

Table 2. Summary statistics for categorical variables. The table reports the sample averages at the observation level for categorical variables, comparing two samples: the Green RMBS Originator Subsample and the EPC populated sample. The Green RMBS Originator Subsample includes only originators with at least one green RMBS, while the EPC populated sample excludes observations without populated EPC data.

Variable	Green RMBS Originator Subsample	EPC Subsample
Sample Size		
Observations	7,704,340	4,503,026
Delinquency		
Arrears (bps)	72.266	49.571
Material Arrears (bps)	31.190	12.576
Default (bps)	29.567	16.766
Material Default (bps)	12.683	4.404
Energy Efficiency		
Green Flag	4.792%	5.779%
EE Tier: High Efficiency	13.77%	32.318%
EE Tier: Medium Efficiency	17.90%	50.942%
EE Tier: Low Efficiency	4.37%	16.740%
EE Tier: Missing	63.96%	0.000%
Loan Characteristics		
Loan Purpose: Purchase	70.249%	78.499%
Loan Purpose: Construction	8.058%	8.611%
Loan Purpose: Remortgage	17.855%	9.958%
Loan Purpose: Renovation	3.715%	2.762%
Loan Purpose: Other	0.123%	0.169%
Int. Type: Fixed	86.830%	59.989%
Int. Type: Floating	3.718%	3.328%
Int. Type: Other	9.452%	36.683%
Borrower Characteristics		
Employment: Employed - private sector	53.467%	38.494%
Employment: Employed - public sector	20.396%	13.876%
Employment: Employed - unknown	9.052%	33.349%
Employment: Pensioner	4.912%	4.299%
Employment: Self-employed	10.074%	8.037%
Employment: Unemployed	1.876%	0.912%
Employment: Other	0.222%	1.033%
Collateral Characteristics		
Occupancy Type: Owner Occupied	86.271%	90.052%
Occupancy Type: Buy to Let	11.951%	8.125%
Occupancy Type: Holiday	1.777%	1.805%
Occupancy Type: Other	0.001%	0.018%
Property Type: Residential Flat	14.667%	27.950%
Property Type: Residential House	69.217%	69.231%
Property Type: Residential Terrace	0.758%	0.376%
Property Type: Other	15.359%	2.443%

Table 3. Summary statistics for continuous variables. The table reports the sample averages and corresponding standard deviations, minimums, and maximums for continuous variables in the Green RMBS Originator Subsample (panel A) and the EPC sample (panel B).

Variable	Mean	St. Deviation	Min.	Max.
Panel A: Green RMBS Originator Subsample				
Arrears balance (€)	3.61	117.67	0.00	9789.28
LTV at first reporting date	0.61	0.25	0.04	1.10
Time to maturity (quarters)	48.72	29.27	2.00	148.00
Interest rate (%)	2.24	0.86	0.00	5.70
Income (€)	49,621.81	29,533.80	0.00	235,741.00
Property value (€)	148,007.10	102,713.40	11,716.88	876,000.00
House price index change (%)	4.73	4.48	-4.10	19.00
Unemployment rate change (%)	7.04	1.25	3.40	8.10
Inflation (%)	4.88	2.49	-0.07	14.13
Energy inflation (%)	17.58	24.55	-47.67	152.97
Panel B: EPC Subsample				
Arrears balance (€)	1.34	49.96	0.00	9789.28
LTV at first reporting date	0.68	0.24	0.04	1.10
Time to maturity (quarters)	72.41	31.67	2.00	148.00
Interest rate (%)	2.10	0.95	0.00	5.70
Income (€)	48,668.29	31,881.81	0.00	235,741.00
Property value (€)	159,370.00	116,525.60	11,716.88	876,000.00
House price index change (%)	6.14	6.43	-4.10	19.00
Unemployment rate change (%)	6.22	2.14	3.40	15.40
Inflation (%)	5.97	3.42	-0.07	14.13
Energy inflation (%)	30.66	47.05	-47.67	152.97

Table 4. EPC rating composition of Green and Non-Green RMBS, with and without missing data. This table presents the distribution of the EPC ratings across loans securitised in Green RMBS versus Non-Green RMBS deals. The table shows the frequencies both including and excluding missing EPC ratings.

EPC Rating	Freq. including missing		Freq. excluding missing	
	Non-Green RMBS	Green RMBS	Non-Green RMBS	Green RMBS
High (A/B)	9.66%	51.86%	28.16%	74.82%
Medium (C/D/E)	20.07%	16.09%	58.51%	23.21%
Low (F/G)	4.57%	1.36%	13.32%	1.96%
N.A.	65.70%	30.69%	0%	0%

Table 5. The impact of the Green Flag on mortgage default. The table presents the marginal effects (in bps) from five specifications of panel logit regressions. The dependent variable is Default, a delinquency indicator that activates when there are two consecutive quarters in arrears (in the next four quarters). The main explanatory variable is the *Green Flag*. Other control variables include loan, borrower and collateral characteristics as well as macroeconomic variables. Robust standard errors are clustered at the regional level (3-digit postcode). The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.: Default	**Marginal Effect (bps)**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Green Flag	-19.7182***	-16.2660***	-15.8680***	-15.2478***	-15.7079***
	(4.2967)	(3.0524)	(2.9743)	(2.6499)	(2.7307)
LTV:					
1st quintile		-	-	-	-
2nd quintile		3.3413***	3.2991***	3.7476***	3.8603***
		(0.9937)	(0.9754)	(1.0400)	(1.0726)
3rd quintile		12.1317***	12.1886***	12.8559***	13.0332***
		(2.1432)	(2.1564)	(2.2589)	(2.3348)
4th quintile		17.1966***	17.7121***	19.2969***	19.5031***
		(2.8390)	(2.9256)	(3.1723)	(3.2458)
5th quintile		39.5025***	40.3957***	41.9360***	41.9934***
		(6.7367)	(6.9491)	(7.0365)	(7.0813)
Time to Maturity (quarters)		-3.313***	-3.290***	-3.600***	-3.564***
		(1.076)	(1.039)	(1.051)	(1.041)
Loan purpose:					
Purchase (baseline)		-	-	-	-
Construction		-8.3457***	-7.3663***	-8.2894***	-8.2550***
		(2.0491)	(2.0503)	(2.1146)	(2.0981)
Remortgage		-4.3620*	-4.0732*	-3.6694*	-3.4773
		(2.2921)	(2.1146)	(2.2234)	(2.2204)
Renovation		-12.9618***	-12.1586***	-10.9820***	-10.8362***
		(3.0087)	(2.9904)	(3.0146)	(2.9758)
Other		-20.6390***	-19.8547***	-20.3099***	-20.0130***
		(3.3733)	(3.4178)	(3.4276)	(3.4077)
Interest rate:					
1st quintile (baseline)		-	-	-	-
2nd quintile		-4.3211	-4.0160	-4.0965	-3.9826
		(3.1801)	(3.3019)	(3.3334)	(3.3433)
3rd quintile		0.9051	0.9449	0.6683	0.6647
		(3.3170)	(3.4080)	(3.4184)	(3.4295)
4th quintile		9.1097**	8.7832**	8.9357**	8.7993**
		(3.6196)	(3.7080)	(3.7514)	(3.7305)
5th quintile		34.2782***	31.6249***	31.8825***	31.5992***
		(5.1888)	(5.1397)	(5.2961)	(5.2345)
Interest type:					
Fixed (baseline)		-	-	-	-
Floating		25.8819***	24.5527***	25.6209***	26.5336***
		(8.6908)	(8.4343)	(8.4447)	(8.8212)
Other		115.6630**	101.5144**	102.8434**	99.3359**
		(48.6032)	(42.3801)	(42.4248)	(40.3407)
Employment:					
Employed - private sector (baseline)			-	-	-
Employed - public sector			-7.8107***	-7.6359***	-7.6339***

Table 5 continued from previous page

Dep. Var.: Default	**Marginal Effect (bps)**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
			(1.3330)	(1.3012)	(1.3002)
Employed - unknown			17.5974***	17.5189***	17.4394***
			(3.1177)	(2.9585)	(2.9337)
Pensioner			-3.9842**	-2.7746*	-2.6255*
			(1.6709)	(1.5833)	(1.5642)
Self-employed			24.1376***	24.9533***	24.9760***
			(2.7413)	(3.0475)	(3.0513)
Unemployed			29.0750***	29.4914***	29.3416***
			(4.8093)	(4.8534)	(4.8088)
Other			-10.4283	-9.4301	-9.2861
			(6.7322)	(6.9403)	(7.0250)
Income:					
1st tertile (baseline)			-	-	-
2nd tertile			-10.9341***	-12.2570***	-12.2276***
			(1.9390)	(2.1242)	(2.1158)
3rd tertile			-18.5445***	-19.6065***	-19.5755***
			(2.5415)	(2.8382)	(2.8239)
Occupancy type:					
Owner occupied (baseline)				-	-
Buy to Let				-6.9118*	-6.8048*
				(3.7911)	(3.7371)
Holiday				-12.2327**	-12.1963**
				(5.1295)	(5.1180)
Property Type:					
Residential flat (baseline)				-	-
Residential house				1.5185	1.5274
				(1.4475)	(1.4424)
Residential terrace				-2.0738	-2.0277
				(2.0496)	(2.0547)
Other				-1.0075	-1.2826
				(1.5451)	(1.5043)
Property value:					
1st tertile (baseline)				-	-
2nd tertile				3.7762**	3.7943**
				(1.4831)	(1.4848)
3rd tertile				3.8340**	3.8420**
				(1.5595)	(1.5552)
Macro variables:					
House price index					0.5554
					(0.5158)
Unemployment					11.9317**
					(5.9881)
Inflation					7.2124***
					(2.3616)
Quarter FE	Yes	Yes	Yes	Yes	Yes
Originator FE	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.104	0.127	0.135	0.136	0.139
Observations	7,693,336	7,692,758	7,692,758	7,692,664	7,692,664

Table 6. The impact of energy efficiency labels on mortgage arrears. The table presents the marginal effects (in bps) from four specifications of panel logit regressions, where the dependent variables represent different indicators of mortgage delinquency. The dependent variables are: (1) arrears, (2) material arrears (arrears exceed 1% of the loan balance), (3) default, and (4) material default (default where arrears exceed 1% of the loan balance). The key explanatory variable is *EE Tier*, categorised as high, medium, or low efficiency. Other control variables include loan, borrower and collateral characteristics as well as macroeconomic variables. Robust standard errors are clustered at the regional level (3-digit postcode). Additional macroeconomic and fixed effects are included. The symbols ***, , and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.: Delinquency indicator	**Marginal Effect (bps)**			
	(1)	**(2)**	**(3)**	**(4)**
EE Tier:				
High efficiency (baseline)	-	-	-	-
Medium efficiency	8.1734***	1.9054***	2.8572**	1.0043**
	(2.6220)	(0.6651)	(1.2106)	(0.4360)
Low efficiency	13.6520***	5.9719***	7.0612***	3.9646***
	(3.4682)	(1.3833)	(1.5068)	(0.9072)
LTV:				
1st quintile (baseline)	-	-	-	-
2nd quintile	3.6021	0.9332	1.0030	1.5323
	(2.8307)	(1.5883)	(1.7668)	(1.1776)
3rd quintile	12.1736***	5.4499**	4.0975*	1.5521
	(4.0713)	(2.4331)	(2.3371)	(1.3272)
4th quintile	24.9191***	4.2865	8.8826***	1.8264
	(4.0744)	(2.9911)	(2.3314)	(1.5820)
5th quintile	39.1576***	5.8844**	13.5089***	2.0618
	(5.4026)	(2.6311)	(2.6486)	(1.4911)
Time to Maturity (quarters)	0.2409***	-0.1089**	0.1003***	-0.0352
	(0.0549)	(0.0470)	(0.0246)	(0.0267)
Loan purpose:				
Purchase (baseline)	-	-	-	-
Construction	0.4127	1.0396	-0.8234	1.2547
	(4.4470)	(1.4386)	(2.3495)	(1.1538)
Remortgage	-1.4674	-0.9881	-1.4106	-2.6575***
	(2.9843)	(2.4347)	(2.4854)	(0.5180)
Renovation	-14.7241***	-1.8081	-6.5339***	-2.5669**
	(3.8279)	(2.4243)	(2.3416)	(1.0205)
Other	-4.2868	-4.2331	-4.7208	3.0111
	(4.2419)	(2.9445)	(4.6842)	(5.2724)
Interest rate:				
1st quintile (baseline)	-	-	-	-
2nd quintile	-1.8478	-4.7013***	-0.1195	0.8884
	(4.7097)	(1.6527)	(1.4162)	(0.7098)
3rd quintile	-1.8036	-4.2570**	0.1071	0.9211
	(5.1347)	(1.9730)	(1.3657)	(0.7111)
4th quintile	12.8930*	0.4272	7.6185***	3.1699***
	(6.7805)	(2.1064)	(2.4266)	(1.0511)
5th quintile	29.7007**	6.9427**	15.1475***	5.7459***
	(12.2376)	(3.3831)	(4.9515)	(1.7785)
Interest type:				
Fixed (baseline)	-	-	-	-

Table 6 continued from previous page

Dep. Var.: Delinquency indicator	**Marginal Effect (bps)**			
	(1)	**(2)**	**(3)**	**(4)**
Floating	2.8149	7.2156**	3.9442	1.7096
	(8.8305)	(3.0277)	(2.7990)	(1.2101)
Other	-11.9801	-7.4064**	-5.7168	-4.6169***
	(12.7278)	(3.6915)	(5.1761)	(1.6679)
Employment:				
Employed - private sector (baseline)	-	-	-	-
Employed - public sector	-19.8456***	-5.6885***	-6.1548***	-1.5226***
	(1.8758)	(0.9296)	(0.9756)	(0.5804)
Employed - unknown	-2.2475	-1.3726	-0.4808	-0.7763
	(3.0977)	(1.5341)	(4.7794)	(1.1741)
Pensioner	-6.1357	-0.2664	-2.7686	0.4088
	(4.6482)	(1.6490)	(1.8750)	(1.1859)
Self-employed	36.0157***	14.3081***	11.2418***	5.4086***
	(4.4757)	(1.9531)	(2.3083)	(1.0703)
Unemployed	48.1748***	18.6433***	20.5157***	4.2362
	(12.3727)	(4.7493)	(6.9055)	(2.8639)
Other	24.0275*	12.4234*	11.0729	12.8976
	(13.4727)	(7.3728)	(7.9888)	(8.6865)
Income:				
1st tertile (baseline)	-	-	-	-
2nd tertile	-10.2983***	-3.5999**	-3.9397**	-1.4740*
	(3.4233)	(1.5495)	(1.7473)	(0.8441)
3rd tertile	-22.7108***	-7.4994***	-8.2465***	-3.2949***
	(3.2235)	(1.9670)	(1.6632)	(1.0911)
Occupancy type:				
Owner occupied (baseline)	-	-	-	-
Buy to Let	4.6882*	0.6742	4.0718**	0.3889
	(2.4979)	(1.1724)	(1.7198)	(0.9641)
Holiday	-6.2320	-1.6186	-2.4788	-1.1687
	(7.7599)	(2.6465)	(4.5560)	(1.4125)
Property type:				
Residential flat (baseline)	-	-	-	-
Residential house	1.3169	-0.6362	1.9412	-1.1124
	(3.3134)	(1.6279)	(1.5199)	(1.0929)
Residential terrace	7.1287	8.0903**	1.0007	2.8236
	(7.0760)	(3.4212)	(1.9525)	(2.3502)
Other	7.3415	-0.9631	4.4824	1.4321
	(9.5858)	(3.0067)	(5.1645)	(2.5773)
Property value:				
1st tertile (baseline)	-	-	-	-
2nd tertile	-3.7934**	-2.9894**	-1.9275*	-1.2655**
	(1.7433)	(1.3227)	(1.1477)	(0.5916)
3rd tertile	-2.0548	-2.7984*	-0.9274	-1.6746**
	(3.2227)	(1.4605)	(1.6444)	(0.7054)
Macro variables	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Deal FE	Yes	Yes	Yes	Yes
Pseudo R2	0.0564	0.0597	0.0680	0.0606
Observations	4,471,096	4,300,723	4,412,604	4,064,874

Table 7. The impact of income and energy efficiency interactions on mortgage arrears and defaults. This table presents the marginal effects (in bps) from four specifications of panel logit regressions, where the dependent variables represent different indicators of mortgage delinquency. The dependent variables are: (1) arrears, (2) material arrears (arrears exceed 1% of the loan balance), (3) default, and (4) material default (default where arrears exceed 1% of the loan balance). We interact income bands (above or below the median) with different energy efficiency levels (high, medium, and low) to test how differently energy efficiency impacts the probability of mortgage delinquency depending on whether the household income is above or below the median. Robust standard errors are clustered at the regional level (3-digit postcode). Macroeconomic variables are included. The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.: Delinquency indicator	**Marginal Effect (bps)**			
	(1)	**(2)**	**(3)**	**(4)**
Above Median Income:				
High efficiency (baseline)	-	-	-	-
Medium efficiency	5.936*	0.998	-0.0435	0.564
	(3.057)	(1.114)	(1.559)	(0.464)
Low efficiency	7.062	6.148***	3.619	3.398***
	(4.330)	(2.229)	(2.354)	(1.348)
Below Median Income:				
High efficiency (baseline)	-	-	-	-
Medium efficiency	10.758***	2.842***	5.848***	1.471*
	(3.091)	(0.967)	(1.630)	(0.788)
Low efficiency	19.704***	6.678***	10.448***	4.756***
	(4.786)	(1.643)	(1.826)	(1.194)
Loan characteristics	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes
Collateral characteristics	Yes	Yes	Yes	Yes
Macro variables	Yes	Yes	Yes	Yes
Deal FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Pseudo R2	0.0562	0.0675	0.0597	0.0596
Observations	4,471,096	4,300,723	4,412,604	4,064,874

Table 8. The impact of energy inflation and energy efficiency interactions on mortgage arrears and defaults. This table presents the marginal effects (in bps) from four specifications of panel logit regressions, where the dependent variables represent different indicators of mortgage delinquency. The dependent variables are: (1) arrears, (2) material arrears (arrears exceed 1% of the loan balance), (3) default, and (4) material default (default where arrears exceed 1% of the loan balance). We interact energy inflation bands (below or above the median of 18.4%) with different energy efficiency levels (high, medium, and low) to test how energy inflation and energy efficiency jointly affect the probability of mortgage delinquency. Robust standard errors are clustered at the regional level (3-digit postcode). Macroeconomic variables are included. The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.: Delinquency indicator	**Marginal Effect (bps)**			
	(1)	**(2)**	**(3)**	**(4)**
Below Median Energy Inflation (median=18.4%):				
High efficiency (baseline)	-	-	-	-
Medium efficiency	7.533***	1.125	1.666	0.454
	(2.902)	(0.954)	(1.201)	(0.474)
Low efficiency	8.703***	4.871***	5.32**	3.447***
	(2.970)	(1.553)	(2.227)	(1.196)
Above Median Energy Inflation:				
High efficiency (baseline)	-	-	-	-
Medium efficiency	8.541***	2.375***	3.6**	1.325***
	(2.996)	(0.751)	(1.528)	(0.517)
Low efficiency	16.398***	6.593***	8.062***	4.241***
	(4.264)	(1.633)	(1.474)	(0.972)
Loan characteristics	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes
Collateral characteristics	Yes	Yes	Yes	Yes
Macro variables	Yes	Yes	Yes	Yes
Deal FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Pseudo R2	0.0565	0.0681	0.0598	0.0596
Observations	4,471,096	4,300,723	4,412,604	4,064,874

Table 9. The impact of energy inflation and energy efficiency on arrears balance. This table presents the coefficients (in euros) from two specifications: OLS and Tobit regressions, where the dependent variable is the arrears balance. We interact the continuous energy inflation variable with different energy efficiency levels (high, medium, and low) to investigate the effect on arrears balance. The OLS and Tobit regressions are applied to test the robustness of the findings. Robust standard errors are clustered at the regional level (3-digit postcode). Macroeconomic variables are included. The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.: Arrears balance (€)	**Coefficients (€)**	
	OLS	**Tobit**
EE Tier:		
High efficiency (baseline)	-	-
Medium efficiency	0.133***	-0.177
	(0.042)	(20.892)
Low efficiency	0.140***	26.897
	(0.047)	(24.557)
Energy Inflation	0.0004	-0.155
	(0.0008)	(0.497)
High efficiency × Energy Inflation	-	-
Medium efficiency × Energy Inflation	0.0007	1.280***
	(0.0007)	(0.498)
Low efficiency × Energy Inflation	0.0017***	1.568***
	(0.0007)	(0.446)
Loan characteristics	Yes	Yes
Borrower characteristics	Yes	Yes
Collateral characteristics	Yes	Yes
Macro variables	Yes	Yes
Deal FE	Yes	Yes
Quarter FE	Yes	Yes
R2 / Pseudo R2	0.0562	0.0675
Observations	4,486,060	4,486,060

Table 10. Marginal effects of energy efficiency levels at different energy inflation levels on arrears balance. This table presents the marginal effects (in euros) derived from Table Table 9, where the dependent variable is the arrears balance. The marginal effects are computed for different levels of energy inflation (from -40% to +100%) for medium and low energy efficiency, with the high-efficiency category as the baseline. Robust standard errors are clustered at the regional level (3-digit postcode). The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dep. Var.: Arrears balance (€)	**Coefficients (€)**	
EPC	**Energy Inflation Level**	**OLS**	**Tobit**
Medium			
	-40%	0.105*	-51.373
		(0.058)	(34.570)
	-20%	0.119**	-25.775
		(0.049)	(26.766)
	0%	0.133***	-0.177
		(0.042)	(20.892)
	20%	0.147***	25.421
		(0.038)	(18.846)
	40%	0.161***	51.019**
		(0.040)	(21.739)
	60%	0.175***	76.617***
		(0.046)	(28.083)
	80%	0.189***	102.215***
		(0.055)	(36.103)
	100%	0.204***	127.813***
		(0.066)	(44.910)
Low			
	-40%	0.072	-35.818
		(0.062)	(35.794)
	-20%	0.106**	-4.460
		(0.053)	(29.371)
	0%	0.140***	26.898
		(0.047)	(24.557)
	20%	0.173***	58.256***
		(0.046)	(22.413)
	40%	0.207***	89.613***
		(0.049)	(23.676)
	60%	0.241***	120.971***
		(0.057)	(27.887)
	80%	0.275***	152.329***
		(0.068)	(33.967)
	100%	0.308***	183.687***
		(0.080)	(41.094)
Loan characteristics		Yes	Yes
Borrower characteristics		Yes	Yes
Collateral characteristics		Yes	Yes
Macro variables		Yes	Yes
Deal FE		Yes	Yes
Quarter FE		Yes	Yes
R2/Pseudo R2		0.0563	0.0675
Observations		4,486,060	4,486,060

Appendix

Table A1. Overview of RMBS data by country. This table summarises the number of deals, loans, collaterals, and observations across various countries in the RMBS dataset. Sample period: 2021Q1—2024Q1.

Country	**N. of deals**	**N. of loans**	**N. of collaterals**	**N. of observations**
Belgium	3	371,954	461,847	2,946,420
France	20	1,129,983	1,129,990	10,695,857
Germany	5	562,297	593,236	4,117,751
Ireland	15	145,917	146,537	1,090,709
Italy	12	211,631	241,167	2,140,501
Netherlands	49	274,444	293,420	2,255,173
Portugal	3	20,047	20,541	167,056
Spain	15	419,968	565,555	4,046,088
United Kingdom	17	72,506	77,117	600,466
Total	139	3,208,747	3,529,410	28,060,021

Table A2. The impact of the Green Flag on mortgage arrears. The table presents the marginal effects (in bps) from five specifications of panel logit regressions. The dependent variable is a delinquency indicator that activates when there are two consecutive quarters in arrears (in the next four quarters) and the arrears balance is higher than 1% of the current loan balance. The main explanatory variable is the *Green Flag*. Other control variables include loan, borrower and collateral characteristics as well as macroeconomic variables. Robust standard errors are clustered at the regional level (3-digit postcode). The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.: Material Default	**Marginal Effect (bps)**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Green Flag	-9.3591***	-5.7261***	-5.5322***	-5.1373***	-5.4596***
	(2.1775)	(1.5329)	(1.5408)	(1.3590)	(1.3460)
LTV:					
1st quintile		-	-	-	-
2nd quintile		2.9162***	2.8687***	2.8897***	2.9954***
		(0.6669)	(0.6616)	(0.6644)	(0.6738)
3rd quintile		6.0373***	6.0834***	6.1415***	6.2958***
		(1.1573)	(1.1221)	(1.1519)	(1.1649)
4th quintile		3.2836***	3.5791***	3.9440***	4.0933***
		(1.0482)	(1.0246)	(0.9607)	(0.9597)
5th quintile		9.7803***	10.3239***	10.3289***	10.3531***
		(2.0247)	(2.1158)	(2.1215)	(2.1566)
Time to Maturity (quarters)		-2.446***	-2.403***	-2.419***	-2.390***
		(0.419)	(0.401)	(0.407)	(0.405)
Loan purpose:					
Purchase (baseline)		-	-	-	-
Construction		-4.2642***	-4.0651***	-4.3824***	-4.3559***
		(0.9261)	(0.9098)	(1.0149)	(1.0084)
Remortgage		-2.1823***	-1.9853**	-1.9403**	-1.8173**
		(0.7985)	(0.7823)	(0.8317)	(0.8357)
Renovation		-5.0647***	-4.9324***	-5.1227***	-5.0408***
		(1.3199)	(1.3338)	(1.3461)	(1.3358)
Other		-8.0667***	-7.5905***	-7.7646***	-7.5647***
		(1.9041)	(1.9498)	(1.9365)	(1.9535)
Interest rate:					
1st quintile (baseline)		-	-	-	-
2nd quintile		-1.3045	-1.2454	-1.1680	-1.0701
		(1.7468)	(1.8043)	(1.7816)	(1.7738)
3rd quintile		-0.7775	-0.8358	-0.7580	-0.7121
		(1.7229)	(1.7826)	(1.7642)	(1.7596)
4th quintile		3.1850*	3.0488*	3.2206*	3.2061*
		(1.6590)	(1.7039)	(1.6951)	(1.6935)
5th quintile		15.9816***	14.8815***	14.8783***	14.7417***
		(2.4570)	(2.4719)	(2.4417)	(2.4216)
Interest type:					
Fixed (baseline)		-	-	-	-
Floating		13.6050***	12.8313***	13.2038***	14.1061***
		(3.2333)	(3.1060)	(3.1625)	(3.3209)
Other		38.1054***	35.2274***	35.4516***	35.2791***
		(13.4414)	(12.1253)	(12.1161)	(12.1027)
Employment:					
Employed - private sector (baseline)			-	-	-

Table A2 continued from previous page

Dep. Var.: Material Default	**Marginal Effect (bps)**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Employed - public sector			-2.2964***	-2.2254***	-2.2273***
			(0.6437)	(0.6281)	(0.6286)
Employed - unknown			9.6281***	9.5694***	9.5146***
			(1.8984)	(1.8823)	(1.8795)
Pensioner			-0.2849	0.2203	0.3110
			(1.0176)	(1.0576)	(1.0658)
Self-employed			13.3305***	13.8977***	13.8818***
			(2.0378)	(2.2325)	(2.2286)
Unemployed			12.3818***	12.5854***	12.5025***
			(2.5046)	(2.5636)	(2.5421)
Other			-3.9555	-3.5427	-3.4721
			(4.6007)	(4.8546)	(4.9321)
Income:					
1st tertile (baseline)			-	-	-
2nd tertile			-3.3089***	-3.2935***	-3.2873***
			(1.0398)	(0.9801)	(0.9792)
3rd tertile			-5.9987***	-5.4842***	-5.4756***
			(1.1067)	(1.2354)	(1.2334)
Occupancy type:					
Owner occupied (baseline)				-	-
Buy to Let				-2.6410	-2.5914
				(1.7124)	(1.6966)
Holiday				-4.2497	-4.2421
				(2.7320)	(2.7234)
Property Type:					
Residential flat (baseline)				-	-
Residential house				0.7955	0.8058
				(0.8988)	(0.8915)
Residential terrace				-0.6000	-0.5560
				(0.8682)	(0.8595)
Other				-0.0865	-0.2750
				(0.9888)	(0.9854)
Property value:					
1st tertile (baseline)				-	-
2nd tertile				-0.4567	-0.4387
				(0.6527)	(0.6511)
3rd tertile				-0.7676	-0.7405
				(1.1652)	(1.1637)
Macro variables:					
House price index					-0.5279
					(0.3272)
Unemployment					6.0115***
					(1.8711)
Inflation					4.3675***
					(1.0006)
Quarter FE	Yes	Yes	Yes	Yes	Yes
Originator FE	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.146	0.182	0.191	0.191	0.195
Observations	7,701,026	7,700,439	7,700,439	7,700,345	7,700,345

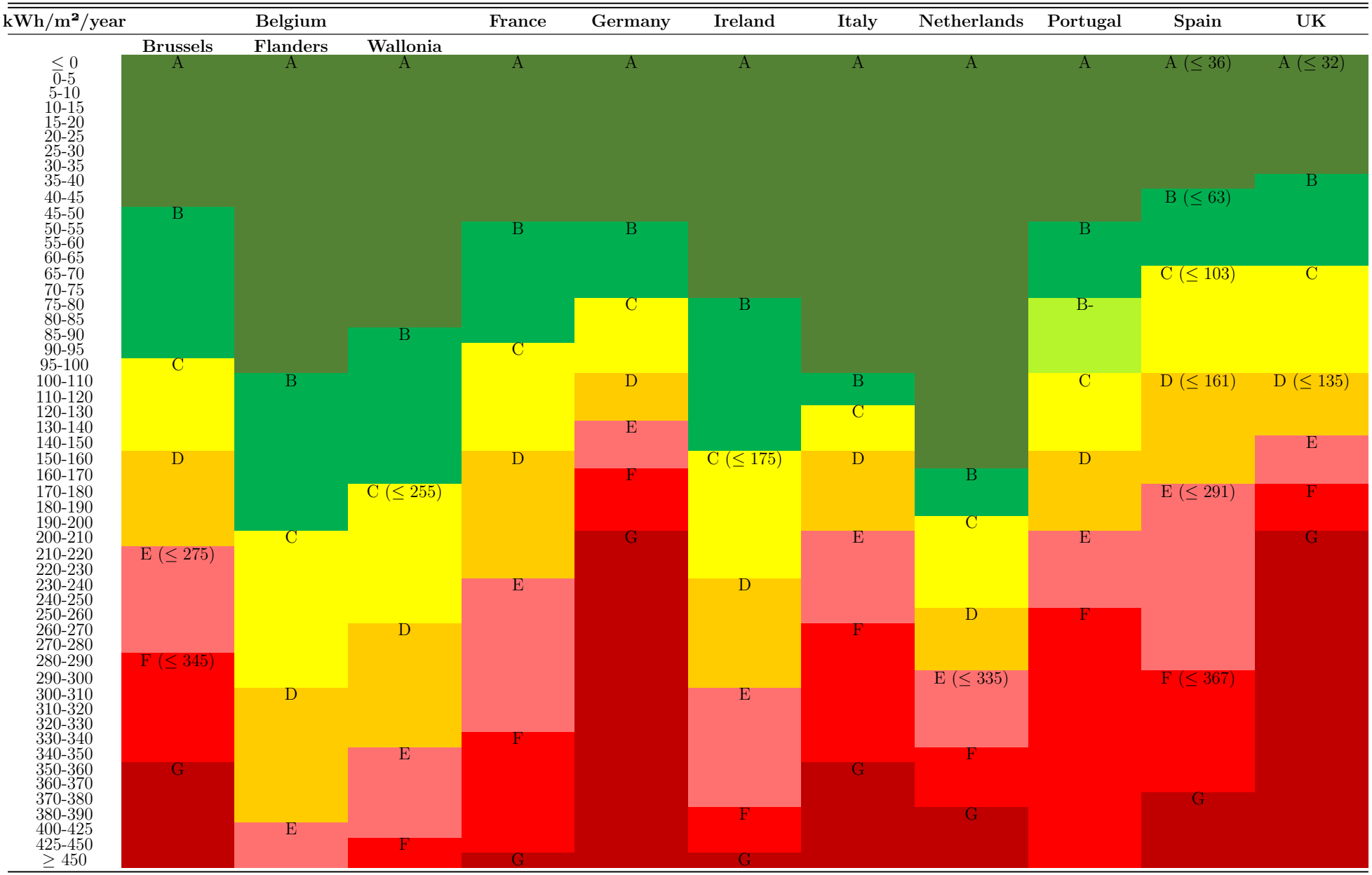
Table A3. The impact of the Green Flag on mortgage arrears with interaction of quarter and originator FE (robustness). The table presents the marginal effects (in bps) from two specifications of panel logit regressions. The dependent variable in column (1) is default (two consecutive quarters in arrears), in column (2) is material default where arrears exceed 1% of the loan balance for two consecutive quarters. The interaction of Quarter and Originator Fixed Effects (Quarter × Originator FE) is used for robustness. The main explanatory variable is the *Green Flag*. Other control variables include loan, borrower and collateral characteristics. Macroeconomic variables are omitted as they are captured by the Quarter × Originator FE. Robust standard errors are clustered at the regional level (3-digit postcode). The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.: Delinquency indicator	**Marginal Effect (bps)**	
	(1)	**(2)**
Green Flag	-16.4799***	-5.8532***
	(2.7428)	(1.4059)
LTV:		
1st quintile	-	-
2nd quintile	3.9976***	3.1621***
	(1.0714)	(0.6984)
3rd quintile	13.2458***	6.5342***
	(2.3768)	(1.1806)
4th quintile	19.6853***	4.2325***
	(3.2439)	(0.9580)
5th quintile	41.7601***	10.3923***
	(7.0978)	(2.2581)
Time to Maturity (quarters)	-3.439***	-0.2350***
	(1.027)	(0.0403)
Loan purpose:		
Purchase (baseline)	-	-
Construction	-8.2118***	-4.4146***
	(2.1002)	(1.0262)
Remortgage	-3.2740	-1.7926**
	(2.2536)	(0.8504)
Renovation	-10.6139***	-5.0548***
	(2.9655)	(1.3486)
Other	-19.4251***	-7.3513***
	(3.4837)	(2.0403)
Interest rate:		
1st quintile (baseline)	-	-
2nd quintile	-3.6457	-0.9641
	(3.2633)	(1.7832)
3rd quintile	0.8491	-0.6525
	(3.4025)	(1.7719)
4th quintile	8.8336**	3.2736*
	(3.7218)	(1.7169)
5th quintile	31.5925***	14.9648***
	(5.2878)	(2.4244)
Interest type:		
Fixed (baseline)	-	-
Floating	29.6433***	15.5630***
	(8.9615)	(3.6680)
Other	99.9530**	37.0549***
	(39.3339)	(12.6302)
Employment:		

Table A3 continued from previous page

Dep. Var.: Delinquency indicator	**Marginal Effect (bps)**	
	(1)	**(2)**
Employed - private sector (baseline)	-	-
Employed - public sector	-7.6244***	-2.2583***
	(1.2969)	(0.6378)
Employed - unknown	17.4174***	9.7053***
	(2.9459)	(1.9170)
Pensioner	-2.4387	0.4128
	(1.5765)	(1.0915)
Self-employed	25.0123***	14.1013***
	(3.0619)	(2.2827)
Unemployed	29.2204***	12.6631***
	(4.7913)	(2.5657)
Other	-8.8727	-3.3495
	(7.2328)	(5.1700)
Income:		
1st tertile (baseline)	-	-
2nd tertile	-12.0807***	-3.2886***
	(2.0984)	(0.9883)
3rd tertile	-19.3771***	-5.4749***
	(2.7921)	(1.2444)
Occupancy type:		
Owner occupied (baseline)	-	-
Buy to Let	-6.5234*	-2.5081
	(3.6612)	(1.7020)
Holiday	-12.0995**	-4.2862
	(5.1032)	(2.7630)
Property Type:		
Residential flat (baseline)	-	-
Residential house	1.5757	0.8537
	(1.4345)	(0.8997)
Residential terrace	-2.0361	-0.5645
	(2.0506)	(0.8656)
Other	-1.6474	-0.4128
	(1.4788)	(0.9949)
Property value:		
1st tertile (baseline)	-	-
2nd tertile	3.7877**	-0.4416
	(1.4785)	(0.6576)
3rd tertile	3.8192**	-0.7355
	(1.5489)	(1.1842)
Macro variables	No	No
Quarter × Originator FE	Yes	Yes
Pseudo R2	0.142	0.197
Observations	7,692,664	7,575,997

Table A4. Conversion of EPC labels to energy consumption ranges across countries. This table provides the conversion between energy efficiency labels (A-G) and energy consumption ranges (in kWh/m²/year) used across various European countries, including Belgium, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain, and the United Kingdom. Each row corresponds to a specific range of energy consumption and shows how that range is classified into energy efficiency labels for each country. This conversion helps standardise the EPC ratings used in the analysis by correlating them with energy consumption levels.



kWh/m²/year	Belgium			France	Germany	Ireland	Italy	Netherlands	Portugal	Spain	UK
	Brussels	Flanders	Wallonia								
≤ 0	A	A	A	A	A	A	A	A	A	A (≤ 36)	A (≤ 32)
0-5											
5-10											
10-15											
15-20											
20-25											
25-30											
30-35											
35-40											B
40-45										B (≤ 63)	
45-50	B										
50-55				B	B				B		
55-60											
60-65											
65-70										C (≤ 103)	C
70-75											
75-80					C	B			B-		
80-85											
85-90			B								
90-95				C							
95-100	C										
100-110		B			D		B		C	D (≤ 161)	D (≤ 135)
110-120											
120-130							C				
130-140					E						
140-150											E
150-160	D			D		C (≤ 175)	D	B	D		
160-170					F						
170-180			C (≤ 255)							E (≤ 291)	F
180-190											
190-200								C			
200-210		C			G		E		E		G
210-220	E (≤ 275)										
220-230											
230-240				E		D					
240-250											
250-260								D	F		
260-270			D				F				
270-280											
280-290	F (≤ 345)										
290-300								E (≤ 335)		F (≤ 367)	
300-310		D				E					
310-320											
320-330											
330-340				F							
340-350			E					F			
350-360	G						G				
360-370											
370-380										G	
380-390						F		G			
400-425		E									
425-450			F								
≥ 450				G		G					

Table A5. The impact of energy efficiency labels on mortgage arrears with interaction of quarter and deal FE (robustness). The table presents the marginal effects (in bps) from four specifications of panel logit regressions, where the dependent variables represent different indicators of mortgage delinquency. The dependent variables are: (1) arrears, (2) material arrears (arrears exceed 1% of the loan balance), (3) default, and (4) material default (default where arrears exceed 1% of the loan balance). The key explanatory variable is *EE Tier*, categorised as high, medium, or low efficiency. The interaction of Deal and Quarter Fixed Effects (Deal x Quarter FE) is used for robustness. Other control variables include loan, borrower, and collateral characteristics. Macroeconomic variables are omitted as they are captured by the Deal x Quarter FE. Robust standard errors are clustered at the regional level (3-digit postcode). The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.: Delinquency indicator	**Marginal Effect (bps)**			
	(1)	**(2)**	**(3)**	**(4)**
EE Tier:				
High efficiency (baseline)	-	-	-	-
Medium efficiency	8.0990***	2.0144***	2.9235**	1.1326**
	(2.6427)	(0.6928)	(1.2493)	(0.4902)
Low efficiency	13.6373***	6.3388***	7.2669***	4.4980***
	(3.4483)	(1.4251)	(1.5190)	(0.9540)
LTV:				
1st quintile (baseline)	-	-	-	-
2nd quintile	5.0296*	1.2180	1.5126	1.8239
	(2.8737)	(1.5582)	(1.7154)	(1.2277)
3rd quintile	14.1368***	6.1760***	4.8759**	1.9440
	(4.0408)	(2.3750)	(2.2891)	(1.3375)
4th quintile	27.2403***	5.0154*	9.9530***	2.2964
	(4.0177)	(3.0285)	(2.2175)	(1.6412)
5th quintile	41.9973***	6.8681***	14.8608***	2.6203*
	(5.2870)	(2.5879)	(2.5243)	(1.4999)
Time to Maturity (quarters)	0.2381***	-0.1191**	0.1016***	-0.0415
	(0.0533)	(0.0480)	(0.0244)	(0.0290)
Loan purpose:				
Purchase (baseline)	-	-	-	-
Construction	0.2735	1.0539	-0.9263	1.3999
	(4.5407)	(1.5287)	(2.4077)	(1.3113)
Remortgage	-1.5791	-1.0453	-1.4556	-3.0214***
	(2.9562)	(2.5755)	(2.5186)	(0.5226)
Renovation	-14.2283***	-1.8737	-6.5519**	-2.9277**
	(3.9655)	(2.6136)	(2.5568)	(1.1462)
Other	-4.3776	-4.5199	-4.8932	3.4264
	(4.3144)	(3.0541)	(4.8044)	(6.0888)
Interest rate:				
1st quintile (baseline)	-	-	-	-
2nd quintile	-4.1367	-5.3336***	-0.9346	0.8776
	(3.7250)	(1.7221)	(1.5567)	(0.8357)
3rd quintile	-3.9183	-4.8130**	-0.6213	0.9268
	(4.4435)	(2.1152)	(1.4222)	(0.8197)
4th quintile	11.0111*	0.2085	7.2071***	3.5048***
	(6.2063)	(2.2425)	(2.3881)	(1.0907)
5th quintile	27.8269**	7.1558**	14.9670***	6.4248***
	(11.7598)	(3.4469)	(4.8551)	(1.7523)
Interest type:				
Fixed (baseline)	-	-	-	-
Floating	2.6409	7.6396**	4.0212	1.9431
	(8.8310)	(3.1263)	(2.8769)	(1.3611)
Other	-11.6338	-7.8896**	-5.9813	-5.2666***
	(12.8184)	(3.8574)	(5.3256)	(1.8668)
Employment:				

Table A5 continued from previous page

Dep. Var.: Delinquency indicator	**Marginal Effect (bps)**			
	(1)	**(2)**	**(3)**	**(4)**
Employed - private sector (baseline)	-	-	-	-
Employed - public sector	-19.953***	-6.0513***	-6.3550***	-1.7271***
	(1.8553)	(0.8870)	(0.9645)	(0.6548)
Employed - unknown	-2.0805	-1.6263	-0.4419	-0.9247
	(3.2009)	(1.5625)	(5.1199)	(1.3296)
Pensioner	-5.3390	-0.2165	-2.6480	0.5191
	(4.6227)	(1.7711)	(1.9534)	(1.3459)
Self-employed	36.2816***	15.2549***	11.6437***	6.1722***
	(4.4962)	(1.8779)	(2.3910)	(1.1944)
Unemployed	48.5189***	19.9324***	21.2791***	4.8598
	(12.3668)	(4.7490)	(7.0297)	(3.2188)
Other	24.7145*	13.1931*	11.5205	14.8942
	(13.3574)	(7.6880)	(8.1251)	(9.7560)
Income:				
1st tertile (baseline)	-	-	-	-
2nd tertile	-10.3360***	-3.8028**	-4.0434**	-1.6569*
	(3.3936)	(1.5861)	(1.7772)	(0.9368)
3rd tertile	-22.7168***	-7.9233***	-8.4470***	-3.7139***
	(3.2459)	(1.9795)	(1.7175)	(1.1818)
Occupancy type:				
Owner occupied (baseline)	-	-	-	-
Buy to Let	4.0845	0.5944	3.9733**	0.3893
	(2.6729)	(1.2782)	(1.8657)	(1.1065)
Holiday	-6.1203	-1.6780	-2.4630	-1.3104
	(7.8284)	(2.8267)	(4.7435)	(1.6086)
Property Type:				
Residential flat (baseline)	-	-	-	-
Residential house	1.3388	-0.6683	2.0352	-1.2662
	(3.3975)	(1.7646)	(1.5874)	(1.2734)
Residential terrace	7.2899	8.6851**	1.0733	3.2404
	(7.1074)	(3.6113)	(2.0221)	(2.6720)
Other	7.4731	-1.0181	4.7079	1.6407
	(9.6680)	(3.2184)	(5.3608)	(2.9391)
Property value:				
1st tertile (baseline)	-	-	-	-
2nd tertile	-4.7130***	-3.3855**	-2.2774**	-1.5692**
	(1.5369)	(1.4479)	(1.1529)	(0.7284)
3rd tertile	-2.8379	-3.1714*	-1.2195	-2.0198**
	(3.1915)	(1.6270)	(1.6964)	(0.8773)
Macro variables	No	No	No	No
Deal x Quarter FE	Yes	Yes	Yes	Yes
Pseudo R2	0.0596	0.0649	0.0614	0.0563
Observations	4,440,249	4,037,700	4,264,802	3,568,412

Table A6. The impact of EPC labels on mortgage arrears with interaction of quarter and deal FE (robustness). The table presents the marginal effects (in bps) from four specifications of panel logit regressions, where the dependent variables represent different indicators of mortgage delinquency. The dependent variables are: (1) arrears, (2) material arrears (arrears exceed 1% of the loan balance), (3) default, and (4) material default (default where arrears exceed 1% of the loan balance). The key explanatory variable is the *EPC label*, categorized into three groups: A/B, C/D/E, and F/G. We run the regressions on a subsample where the EPC rating field is populated to ensure a fair comparison. Other control variables include loan characteristics, borrower characteristics, and collateral characteristics. Macroeconomic variables are omitted as they are captured by the Deal x Quarter FE. Robust standard errors are clustered at the regional level (3-digit postcode). The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.:	**Marginal Effect (bps)**			
	(1)	**(2)**	**(3)**	**(4)**
EPC Label:				
EPC A/B (baseline)	-	-	-	-
EPC C/D/E	4.8841	0.6359	1.4911	0.5191
	(3.2952)	(1.6882)	(1.0432)	(0.7676)
EPC F/G	11.2718***	5.2212***	5.9358***	4.0318***
	(3.3505)	(1.6473)	(1.4069)	(1.0667)
Loan characteristics	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes
Collateral characteristics	Yes	Yes	Yes	Yes
Macro variables	No	No	No	No
Deal x Quarter FE	Yes	Yes	Yes	Yes
Pseudo R2	0.0558	0.0667	0.0589	0.0574
Observations	4,440,249	4,264,802	4,037,700	3,568,412