Green Mortgages*

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Abstract

We study contractual features and lenders' motivations for *offering* Green mortgages, used to finance energy-efficient properties, in the United Kingdom. There is significant heterogeneity in benefits: preferential-rate mortgages offer 9bp discounts, while the benefits are substantially lower for products with upfront cashback. Our evidence shows that the green label functions as a tool for product differentiation and customer acquisition, with lenders tailoring product features around borrower heterogeneity. In particular, we show that they use upfront cashback as a salient pricing feature of credit contracts to target liquidity-constrained homebuyers. We find no evidence that the financial benefits reflect lower credit risk.

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1 Introduction

Banks play a central role in capital allocation within the economy. Among the assets they finance, residential real estate is particularly relevant for the transition to a net-zero economy, as the operation of residential buildings is responsible for roughly 22% of global energy consumption and 17% of CO_2 emissions (Programme, 2020).[1] However, significant barriers to financing energy-efficient assets persist (Giglio et al., 2021; Berkouwer and Dean, 2022; Lanteri and Rampini, 2025; Hovekamp and Wagner, 2023), which have motivated the provision of public finance.[2] By contrast, there remains a limited understanding of the role of market-based initiatives, particularly in household credit markets.

In this paper, we study the supply of "Green mortgages" used to finance energy-efficient properties in the United Kingdom (UK).[3] Despite the absence of government subsidies or regulatory mandates, green mortgages constitute a significant share of the market, accounting for 10% to 15% of mortgages on offer.[4] Their prevalence motivates our two central questions: (i) what are the contractual features of green mortgages; and (ii) why lenders offer them. We address these questions using granular data on the universe of roughly four million daily product offerings.

Our first contribution is to estimate the financial benefits of green mortgages. There is significant heterogeneity in the nature of these benefits across market segments: in the owner-occupied segment, the predominant benefit is upfront cashback; by contrast, in the investor segment, green mortgages primarily offer preferential interest rates. We estimate their magnitude by comparing green to conventional (non-green) mortgages with identical contractual features, offered to similar borrowers by the same lender on the same day using a saturated fixed-effects model. This granular comparison allows us to address product heterogeneity and precisely identify the incremental financial benefit associated with the green label.

[1] Achieving reductions in CO_2 emissions in the residential sector to meet the 2015 Paris Agreement targets requires substantial investments in carbon-reducing retrofits (Buchner et al., 2013; International Energy Agency, 2023).

[2] Government interventions often take the form of subsidies (Hahn and Metcalfe, 2021) or regulations (Hausman and Joskow, 1982; Allcott and Greenstone, 2017).

[3] In the United States (US), green mortgages are commonly known as energy-efficient mortgages (EEMs) (Palmer et al., 2012; Bardhan et al., 2014). There are cross-country differences, but in general they may be used to: (i) finance the acquisition of properties with an efficiency rating above a given threshold or refinance the existing loans on those properties; and/or (ii) finance energy efficiency improvements.

[4] These values refer to our sample period, May 2022 to September 2023.

In the owner-occupied segment, cashback-based green products offer £211 (*within* lenders) to £241 (*across* lenders) higher cashback amount than comparable non-green products. These differences translate into annual equivalent gains of £49-56 for a typical loan. Green mortgages with preferential rates offer average interest rate discounts of 35 basis points *across* lenders; *within*-lender discounts are smaller but remain economically and statistically significant at 9 and 11 basis points, for the owner-occupier and investor segments, respectively. The 9 basis points discount implies annual gains of roughly £180. Thus, cashback products provide annual benefits of about one quarter of those of preferential-rate ones. We find no evidence of the benefits being offset by adjustments in other contractual terms, such as higher fees.

Our analysis identifies upfront cashback as a contractual feature in household credit markets. Prior literature has primarily focused on the interest rate and fees pricing dimensions. For instance, fees can be used to screen for prepayment risk (Brueckner, 1994; Stanton and Wallace, 1998; Buchak and Jørring, 2025), target inattentive or unsophisticated borrowers (Stango and Zinman, 2014; Ru and Schoar, 2016), or facilitate credit in segmented markets (Cocco et al., 2025).[5] In contrast, much less is known about the use of upfront cashback as a salient pricing feature of credit contracts.

Our second contribution is to study why lenders offer green mortgages, in particular those with upfront cashback. One explanation is that lenders use these products to attract new customers. In a competitive market, green mortgages may serve as a product differentiation mechanism and cater to an increasingly large proportion of environmentally conscientious households.[6] Although testing this hypothesis is challenging, we provide evidence of its relevance.

In the first set of tests, we exploit features of the UK mortgage market, where most mortgages include an initial discounted-rate period, after which borrowers typically refinance. Often, borrowers refinance with their current lender, as switching lenders requires a full property valuation and affordability assessment (Benetton, 2021; Belgibayeva et al., 2025). In contrast, borrowers are much more likely to search across different lenders when purchasing a property. Since we observe whether products are specifically offered to homebuyers and/or remortgagors, we test whether green mortgages are being offered to attract new business.

Consistent with this hypothesis, on the extensive margin, we find that green mortgages in the owner-occupied segment are significantly more likely to be available only to homebuyers

[5]Products with non-standard features may also be used by high-income households (Amromin et al., 2018).

[6]Figure A1 provides illustrative examples of how lenders advertise green mortgages, emphasizing their sustainability features and associated financial benefits.

and significantly less likely to be available to remortgagors. These effects hold even when we include lender fixed effects, and are economically large: green products are 22% *more* likely to be offered only to homebuyers than comparable non-green products, while remortgagors are 10% *less* likely to be offered a green mortgage. These effects are driven by products offering cashback benefits.

In the second set of tests, we examine whether the use of upfront cashback reflects targeting by lenders based on borrowers' financial conditions. The prevalence of cashback in the owner-occupied sector and preferential rates in the investor segment is consistent with this interpretation: the typical household faces tighter borrowing constraints than the typical investor, and a lower discount factor makes upfront cash relatively more valuable than a reduced interest rate over time.[7] We provide more direct evidence by showing that green cashback products are systematically more likely to be offered under shared ownership schemes that are designed to improve housing access for financially constrained borrowers. These findings indicate that banks use upfront cashback as a salient instrument to target liquidity constrained homebuyers and as a customer acquisition tool.

A second explanation for why lenders offer green mortgages is credit risk based. Their financial benefits may reflect lower default risk due to the "cash-flow channel": energy-efficient homes reduce utility costs, leaving borrowers with more disposable income to service debt. At the same time, more energy efficient properties may retain higher values or be less exposed to "brown discounts" in markets that penalize less sustainable buildings, a mechanism we refer to as the "collateral value channel."[8]

To test for the cash-flow channel, we exploit sharp increases in energy prices during our sample period. Rising energy costs put more financial pressure on owners of less energy-efficient properties making it more difficult to service debt. Thus, we would expect the incremental financial benefits of green mortgages to grow as energy prices rise, reflecting a wider credit risk gap driven by energy costs. However, inconsistent with the cash-flow channel, we do not find a relation between the financial benefits of green products and energy prices.

To test the collateral value channel, we examine whether the benefits of green mortgages are

[7] The high transaction costs and down-payment requirements of a house purchase involve significant financial outlays, which likely heighten the appeal of upfront cash for liquidity constrained borrowers.

[8] Ortega and Taspinar (2018); Bernstein et al. (2019); Baldauf et al. (2020); Murfin and Spiegel (2020); Giglio et al. (2021); Keys and Mulder (2022) show that climate risk impacts the value of real estate assets. Giglio et al. (2021) provides a literature review on climate finance.

larger for products with higher maximum loan-to-value (LTV) ratios. Ceteris paribus, higher LTV loans have higher default risk, and in the event of a default, lenders are concerned with the property's ability to maintain its value as collateral. Under this channel, one would expect the benefits of green mortgages to increase with LTV ratios. However, we find no association between the magnitude of the benefits and the maximum LTV ratio.

In the last part of the paper, we examine other non-mutually exclusive explanations for why lenders offer green mortgages, namely lower cost of capital and reputation considerations. Although we cannot study these mechanisms with the same granularity as the customer acquisition and credit risk channels, we assess their relevance in our setting. First, green mortgages may be bundled to back the issuance of green bonds. However, using data on green bond issuance by lenders in our sample, we find no significant relationship with green mortgage offerings. Second, green mortgages may enhance lenders' reputation, which has become increasingly important as stakeholders scrutinize banks' sustainability practices. This strategic positioning may be reinforced by the adoption of sustainability targets. We find that banks voluntarily adopting green commitments are also more likely to offer green mortgage products. Although correlated with lender size, green commitments account for substantially more of the variation in green mortgage offerings.

Overall, our findings show that lenders exploit borrower heterogeneity and use product design to target liquidity savings for households and wealth savings for investors. By combining green labels with upfront cashback offers, they aim to segment the market and attract new business in competitive mortgage markets.

Related Literature. Our study provides the first large-sample characterization of green mortgages *on offer* available to both homeowners and investors. The findings complement the literature on debt contracts aimed at tackling climate change that has focused on firms — such as corporate green bonds (Flammer, 2021; Baker et al., 2022), sustainability-linked loans (Kim et al., 2022; Du et al., 2023; Feldhütter et al., 2024), and blended financing structures (Flammer et al., 2024). There also is a growing literature on bank lending to firms for climate transition, including Kacperczyk and Peydró (2022); Houston and Shan (2022); Sachdeva et al. (2024); Green and Vallee (2025); Ivanov et al. (2024). Compared to these studies, our focus is on the *menu* of green mortgage contracts offered to households and real estate investors and in our ability to characterize their features and benefits.

In its focus on mortgages, our paper is more closely related to the recent papers that study how the realization of climate change related natural disasters such as wildfires and hurricanes impact mortgage markets (Issler et al., 2020; Gete and Tsouderou, 2021). In addition, our focus on credit is particularly important since the literature has identified an energy efficiency gap in the residential sector (Allcott and Greenstone, 2012), and the work of Berkouwer and Dean (2022) suggests that credit availability can facilitate the adoption of energy savings technologies.[9] This is behind government interventions in loan provision for energy retrofits (Bellon et al., 2024). In contrast, we study the provision of credit by the private sector in the absence of regulatory mandates and loan features offered by lenders in competitive mortgage markets.

There is a literature that has studied the motivations of banks to originate green lending (Giannetti et al., 2023; Haushalter et al., 2023).[10] We contribute to this literature by showing that lenders are increasingly offering products that reward the ownership of green homes and of significant heterogeneity in the nature and magnitude of their benefits. Products with upfront cashback have much lower benefits and additional features so as to attract new customers.[11] In this regard, our paper is related to the literature that studies advertising as a mechanism to attract customers. Prior work has documented this channel in mortgage markets (Gurun et al., 2016; Chen et al., 2025), as well as in other financial products, including credit cards (Bertrand et al., 2010) and the mutual fund industry (Roussanov et al., 2021). This work is part of a broader literature that emphasizes customer capital as a key component of firms' intangible capital (see, Dou and Ji, 2021; Belo et al., 2022; He et al., 2024).

Finally, our study provides the first empirical estimates of green premiums on offer for households, using granular variation in mortgage pricing. Prior work reports a wide range of *greenium* estimates across asset classes and finds mixed evidence. In equities, studies document negative, zero, and positive premia depending on how greenness is measured (Bolton and Kacperczyk, 2021; Pástor et al., 2022; Bolton and Kacperczyk, 2023; Aswani et al., 2024; Eskildsen et al., 2024; Zhang, 2025). For corporate bonds, the literature again reports a range of estimates varying from zero to −14 basis points (Hachenberg and Schiereck, 2018; Zerbib, 2019;

[9] This contrasts, albeit in a different setting, with the limited success of subsidies (e.g. Fowlie et al. (2018)). At the same time, regulations can trigger energy efficiency investments (Clara et al., 2026). On the other hand, Adelino and Robinson (2023) study how enhancing credit availability can lead to the purchase of larger houses which consume more energy.

[10] See, De Haas (2024); Morse and Sastry (2024); de Bandt et al. (2023) for recent reviews of the literature.

[11] Loans focusing on customer acquisition may have limited effectiveness for decarbonizing the real estate sector (see Berk and van Binsbergen (2025); Hartzmark and Shue (2023) in the context of firms).

Larcker and Watts, 2020; Tang and Zhang, 2020; Flammer, 2021; Baker et al., 2022; Feldhütter et al., 2024; Caramichael and Rapp, 2024). Lastly, for sovereign bonds, research finds a small negative *greenium* of 1–2 basis points (D'Amico et al., 2023; Feldhütter and Pedersen, 2025). In comparison to these studies, we estimate a substantial *within* lender discount of 9 basis points.

2 The institutional setting and data

2.1 Energy efficiency measurement and product eligibility

The "green" label in mortgages refers to the energy efficiency of the residential property that is being financed, as measured by its Energy Performance Certificate (EPC). In England and Wales, EPCs have been legally required for selling or renting a home since 1 October 2008.[12] EPCs are generated using an assessment procedure: an accredited assessor visits the property to gather information on its characteristics (property type, size, insulation, heating system, etc.) and its energy sources. The information is then entered into a government-approved software that generates the EPC.[13] Certificates typically cost between £60 and £120, remain valid for ten years, but may be updated earlier (see Clara et al. (2026) for further details).

EPCs measure the overall energy efficiency of the property on a numerical scale of 1 to 100 (SAP points), that reflects its estimated energy running costs. These SAP point scores are grouped into bands and converted into letter ratings ranging from A (the most efficient, 92 points or above) to G (the least efficient, 1–20 points). Most green mortgages rely on these letter ratings—typically A/B or A/B/C—to determine product eligibility.

Residential buildings in the UK rank among the least energy-efficient in Europe (Fetzer et al., 2023). Panel A of Table 1 reports the distribution of energy efficiency ratings by construction year, using data from the 2022 English Housing Survey. Older properties are significantly less energy efficient than newer ones. For instance, among pre-1919 properties, 79% have an energy efficiency rating of D or below. The comparable figure for those constructed after 1990 is only 17%, meaning that 83% fall in the A/B/C categories. The last four columns of Panel A show energy use, cost, emissions and number of properties, by property construction year. Newer,

[12] Listed homes and residential properties that are used for less than four months of the year are exempt.

[13] The software is based on an engineering model. EPCs for existing homes are generated using a Reduced data Standard Assessment Procedure (RdSAP) while for newly built properties, a more comprehensive Standard Assessment Procedure (SAP) is used. Measurement is one of the crucial bottlenecks discussed by Bardhan et al. (2014) for energy efficiency retrofits.

more energy efficient homes use less energy, are cheaper to operate, and generate fewer CO_2 emissions. Their lower energy costs increase homeowners' available cash flow, thereby improving their capacity to service mortgage debt.

[Insert Table 1 here]

Panel B.1 of Table 1 reports statistics based on EPC register data that includes all certificates issued in England and Wales since 2008 (see Appendix B for details). The panel confirms that higher-rated properties are, on average, newer. Roughly 3/4 of those in the A and B categories are new builds, whereas the share of new builds is much lower in the remaining categories. There is a U-shaped relationship between energy efficiency and floor area, with properties at both the high and low ends of the efficiency distribution being larger, on average, than those in the middle. The last row of Panel B.1 reports the average value of the Index of Multiple Deprivation (IMD) for the local area where the properties are located. The IMD ranks neighborhoods (LSOAs) in England on a relative scale, from 1 (most deprived) to 32,844 (least deprived).[14] Higher-rated properties tend to be located in less deprived areas.

We merge the EPC dataset with the Land Registry Price Paid Data, which records the near-universe of property transactions in England and Wales. The transaction data include sale price, date, and full address, along with several property characteristics. Appendix B provides further details on the data sources and the merging procedure. Panel B.2 of Table 1 focuses on the universe of properties *transacted* during the period covered by our mortgage data (i.e., between May 2022 and September 2023, see Section 2.3). Collectively, properties rated A or B account for approximately 20% (233,812) of the transactions in this sample— a measure of the potential size of the green loan market for property acquisitions. This further increases to 49% when properties rated C are also included.

On average, A/B properties are significantly more likely to be newly built. The share of newly-built properties is 56% for A-rated and 57% for B-rated homes compared to just 2% for C-rated properties. In addition, transaction prices are significantly higher for A/B rated properties than C-rated ones (£496k/£404k for the former compared to £350k for the latter, which are the most affordable). This relatively larger preponderance of newly-built properties— which tend to be more expensive and less affordable— in the A/B segment provides a useful

[14]This index is created by the Department for Communities and Local Government (DCLG). It combines 39 indicators across seven weighted domains—including income, employment, health, education, crime, housing, and living environment—to construct the ranking.

lens to understand motivations of lenders to offer certain financial benefits to finance more energy-efficient properties.

2.2 The UK mortgage market

The UK mortgage market has several distinctive features that make it particularly useful for our analysis. The dominant UK mortgage is a "dual-rate" mortgage contract where most products have an initial period of discounted and fixed interest rate (the most common periods are 2- and 5-years), at the end of which the interest rate reverts to a typically much higher variable reversion rate. Most borrowers refinance their loans when this period of discounted rate ends, a process which is much simpler for same lender refinances without equity extraction since it does not require a full property valuation nor an affordability assessment.

There are many different products on offer, by different lenders, and with different characteristics, such as fixed versus variable rate, fixation term, maximum LTV, borrower type (e.g., first time buyer, remortgagors), initial interest rate, fees, green or not, among others. As part of the underwriting, for loans for property acquisition and for equity extraction, lenders carry out income checks and an affordability assessment. These checks determine whether borrowers qualify for a loan, but conditional on approval, they do not influence the loan's interest rate. Thus, pricing depends only on product features, and the UK mortgage market operates like a "mortgage supermarket" (Benetton, 2021).[15]

There are two distinct segments of the mortgage market, depending on whether the loan is for the financing of an owner-occupied or a rental property (Buy-to-Let sector). Lenders offer loans specifically for each of the segments. Those to owner-occupiers and to 'accidental landlords' in the investor sector are regulated by the Financial Conduct Authority (FCA).[16] The remaining investor loans are regulated by the Prudential Regulation Authority (PRA) of the Bank of England. During the period of analysis, there are no regulations requiring lenders to offer green mortgages.

There are many different lenders in the market, including banks of varying sizes, building

[15]Since loan pricing depends only on product features, before the introduction of the green label, banks did not differentiate interest rates between energy-efficient and non-energy-efficient properties (see, Bell et al. (2023)). They could, however, differentiate in terms of loan approval likelihood or pricing on other products related to the green label (e.g., new versus old properties).

[16]Accidental landlords are individuals who became landlords by 'accident.' They or a member of their family have previously lived in the rental property. See, Cocco et al. (2025) for more details.

societies (mutual organizations) and other non-bank lenders (shadow banks). Lenders have a differential presence in the owner-occupied and investor segments of the mortgage market. For most of our analysis, we distinguish between these two segments and include lender fixed effects, but we also study how green mortgages offerings vary across lender types.

2.3 Data sources

Our main data source is Moneyfacts Group plc, an independent data provider that collects information on the products *on offer* in the UK retail financial industry, including mortgages, insurance, credit cards, etc. The data are widely used by consumers, lenders, and regulators, and have previously been used in academic research (e.g., Benetton et al., 2025; Coen et al., 2023). It is important to emphasize that the data covers the loans *on offer* on each day, i.e., the menu of contracts from which borrowers can choose, and not loan originations.[17]

We use daily mortgage data from May 27, 2022 to September 30, 2023. The starting date is the day when the green information (the green status and associated qualifying criteria and benefits) was added to the dataset. The data provides comprehensive information on mortgages available in the market, namely daily product-level information on: (i) market segment (owner-occupied or investor); (ii) product characteristics such as maximum LTV, interest rate, fees, market segment, interest rate fixation period, borrowers for whom the product is available, green status, green requirements, financial benefits (incentives), indicator for whether the product is available for newly built properties; and (iii) lender identity. The data comprises various numerical variables along with textual descriptions. Appendix C includes variable definitions and describes the process of extracting numerical information from the textual descriptions.

Over the sample period, the dataset contains approximately 4 million daily product entries corresponding to about 190,000 unique mortgages (23,680 green and 164,759 non-green products), of which nearly 137,000 (73%) are offered in the owner-occupied segment. On average, on each day, there are around 5,700 (2,300) different products on offer in the owner-occupied (investor) segment. A product is defined as the unique combination of all mortgage characteristics recorded by the data provider, including those described above and additional attributes such as eligible borrower types. Whenever any characteristic of an existing product changes, Moneyfacts records it as a new product with a unique identifier.

[17]For owner-occupied mortgages, origination information is available in the Product Sales Data, an administrative dataset collected by the FCA. However, the origination data does not contain a green loan identifier.

Figure 1a plots the daily share of green products on offer in the owner-occupied and investor segments. Over the sample period, green products account for a growing share of the market in the owner-occupied segment — rising from below 10% at the start of the period to around 15% by the end. In contrast, the share of green products in the investor segment remains relatively more stable, averaging around 11% throughout.

[Insert Figure 1 here]

Figure 1b plots the daily proportion of lenders offering green mortgages across both the owner-occupied and investor segments. On average, around 22% (19%) of lenders offer green products in the owner-occupied (investor) segment. In the owner-occupied segment, this proportion varied between 18% and 25%, whereas the investor segment shows greater time-series variation, with the share falling from around 20% at the start of the sample to roughly 14–15% by the end. Appendix Figure A2 replicates this analysis using the consolidated lender classification that accounts for lenders being part of a larger banking group, finding similar patterns.

2.4 Summary statistics

Table 2 presents information on *unique* green products in our sample, focusing on product eligibility. Strikingly, the vast majority of mortgages are offered to finance properties that currently have a given (high) level of energy efficiency (97%), and not for improving the energy efficiency of an existing property (3%). Therefore, most loans do not directly provide funds to owners to improve their properties. Their effects are likely to work through the demand for greener properties — compensation for purchasing and owning energy efficient homes. In terms of the energy-efficiency rating, roughly 64% of the green products are for A/B-rated properties and 33% for A/B/C-rated properties. However, the distribution of EPC ratings differs sharply across segments. In the owner-occupied market, 80% of green products target A/B-rated properties. In the investor segment, just 19% of products target A/B properties.

[Insert Table 2 here]

Table 3 presents summary statistics for product characteristics, comparing green with non-green products. The unit of analysis is product-day, so that products that are offered for longer periods have more observations and a larger weight in the summary statistics.

Panel A focuses on the owner-occupied segment. The fixation term and maximum LTV is similar for green and non-green products, as is their availability to first time buyers (FTBs). However, green products are less frequently available for remortgagors (36% of the product-day observations for green products compared to 60% for non-green) and are much more likely to be available for new builds (41% versus 18%), which also tend to be more energy efficient. Green products also carry lower average initial interest rates (5.26% versus 5.51%) and are far more likely to include cashback features (73% versus 29%) as well as larger average cashback amounts—approximately £334 for green products compared with £122 for non-green ones.[18]

[Insert Table 3 here]

Thus, green products appear to offer financial advantages, including lower interest rates and larger cashback benefits. Figure 2 confirms that, within each segment, the interest rate tends to be lower for green products when compared to other non-green products throughout our sample period. It also shows that offered interest rates are on average higher in the investor segment than in the homeowner segment. While these averages are informative, they do not account for the potentially systematic differences between the two types of loans on offer.[19] Also shown in the figure is a vertical line marking the mini-budget announcement of 23 September 2022, an unexpected announcement that triggered a large increase in swap and mortgage rates. We exploit this event in Section 4.2.

[Insert Figure 2 here]

One possibility we investigate is whether lenders offset some of these financial benefits by increasing follow-on interest rates or by charging higher fees. Panel A of Table 3 shows that reversion rates are, on average, higher for green mortgages than for non-green ones, whereas the opposite holds for fees.

The variables in the bottom four rows of Panel A capture the financial benefits that lenders explicitly associate with their green products. These variables are extracted from the green

[18]The variables $\mathbb{1}$(Cashback) and Cashback Amount (£) are available for all products and are provided directly by the data source.

[19]In Appendix Figure A3, we show that the difference in the probability of cashback between green and non-green products is persistent over time. For the cashback amount, we observe a gradual decline in the average amount offered by green products, particularly in the owner-occupied market, while the average amount for non-green products shows little variation over time.

product descriptions, as detailed in Appendix C, and are therefore available only for green mortgages. Most green products list only cashback as a financial benefit (0.61), and a substantial share offers only preferential rate (0.24), with some stating both benefits (0.15). Only a very small fraction indicate other benefits such as reduced fees.

Panel B presents statistics for the investor segment. There are significant differences compared to the owner-occupied sector. A much larger proportion of the green mortgages state preferential rate (0.79) than cashback (0.15) as a benefit. Another important difference is that for investor loans, the proportion of mortgages that are available to remortgagors is similar between green (0.80) and non-green (0.81) products, and neither is available for new builds (roughly 1% of all products).[20]

In the UK mortgage market, it is common to distinguish between the largest 7 lenders, who typically have a high-street branch presence, and are known as high-street banks, and the remainder (Coen et al., 2023). Table 4 presents product characteristics split by lender category.[21] In the owner-occupied segment, the proportion of green product-day observations varies significantly across lender types, with 21% among lenders in the top 7 banking groups compared to only 7% among other lenders. Green product characteristics also differ across lender types. The top 7 lenders tend to offer products with longer fixation periods, that are less frequently available for remortgagors, and that are more likely to include cashback.

[Insert Table 4 here]

In the investor segment, the proportion of green observations is similar across lender types, at roughly 12%. Product features exhibit much smaller variation in this segment, and preferential rates are the most commonly stated financial benefit for all lender types. Finally, the top 7

[20] Appendix Table A1 shows summary statistics by the energy efficiency requirement of the properties eligible for green mortgages. In the owner-occupied segment, products targeting A or B-rated properties are much less frequently available to remortgagors (0.24 versus 0.64) and are much more likely to include cashback (0.90 versus 0.30). In contrast, in the investor segment, a much larger share of green mortgages target properties with A/B/C ratings and tend to offer preferential rates rather than cashback.

[21] The top 7 lenders in the UK, as measured by the value of mortgages outstanding in 2023, are Lloyds Banking Group, Nationwide Building Society, Natwest Group, Santander UK, Barclays, HSBC, Virgin Money. After the end of our sample period Virgin Money was acquired by Nationwide, with the acquisition completed on October 1, 2024. Among the top 7 lenders, and during our sample period, Santander UK and HSBC did not offer green mortgages. HSBC introduced the Energy Efficient Home Cashback mortgage on March/27/2024. Santander UK launched green mortgages on September/24/2024. We distinguish between high-street and non-high street lenders at the financial group level. For example, both Halifax and Lloyds Bank belong to the Lloyds Banking group and both are included in the top 7 lenders.

lenders have a relatively larger presence in the owner-occupied than the investor segment of the market, as measured by the fraction of products they offer in each.

3 Financial benefits of green mortgages

In this section, we characterize the nature and estimate the magnitude of the financial benefits of green mortgages.

3.1 Types of benefits

The summary statistics showed significant differences in targeted properties and financial benefits across the owner-occupied and investor segments. The same patterns hold when the unit of observation is unique products. Figure 3a shows that, in the owner-occupied segment, the vast majority of products for A/B-rated properties provide cashback to borrowers (around 88%). For products offered to A/B/C-rated properties, the most commonly stated benefit is preferential rate. A smaller, residual category of products offers reduced fees.

[Insert Figure 3 here]

In the investor segment (Figure 3b), in stark contrast to the owner-occupied segment, loans offering preferential rate are much more common, as are those targeting A/B/C-rated properties. In this market segment, there are few unique products (444 in total) offering cashback.

The prevalence of cashback in the owner-occupied sector and preferential rate in the investor sector may be due to the differential situation of borrowers. The typical household has lower wealth and is more borrowing constrained than the typical investor, more so for those households purchasing a house. Chen et al. (2020) develop a model of home equity extraction by constrained borrowers. More constrained borrowers have a lower discount factor and, as a result, value upfront cash relatively more than lower loan interest rate over time. The next section estimates the financial benefits of green mortgages.

3.2 Magnitude of benefits

In estimating the financial benefits of green mortgages, and for the remainder of the analysis, we focus on the largest categories of loans available in the market. Specifically, for the

owner-occupied segment, we estimate the benefits in terms of both the initial interest rate and cashback. For the investor segment, we concentrate on the initial interest rate.

3.2.1 Empirical specification

To estimate the magnitude of the financial incentive associated with green mortgages, we estimate the following model:

$$y_{ijblt} = \alpha + \beta \cdot \text{Green}_{it} + \lambda_{jblt} + \epsilon_{ijblt}, \tag{1}$$

where i and t are product and day indexes, respectively. The subscripts j, b and l refer to product characteristics, borrower types, and the lender offering the product.

As outcomes y_{ijblt}, the key variables we focus are: initial interest rate, probability of cashback, and cashback amount. The independent variable of interest, Green_{it} is an indicator variable that takes the value of one if the product corresponds to a green mortgage and zero otherwise. The term λ_{jblt} corresponds to product type (j) $\times$ borrower type (b) $\times$ lender (l) $\times$ day (t) fixed effects. Product types are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period (typically 2 or 5 years), and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types.

By saturating the model with these fixed effects, the coefficient β, compares outcomes using daily variation across green and non-green products of the same type, offered to similar borrowers, on the same day, and in the most stringent specifications, by the same lender. We cluster standard errors by lender, allowing errors to be correlated across products and over time within each lender (Roberts and Whited, 2013; Abadie et al., 2023).

3.2.2 Results

Initial interest rate. Panel A of Table 5 shows the results of estimating Equation (1) for the initial rate as dependent variable, incrementally adding fixed effects. In this panel, we consider all green products available in the market on each day. The initial rate is one of the primary factors borrowers consider when selecting mortgage products and is also a frequently

highlighted benefit of green mortgages. Columns (1) to (3) refer to the owner-occupied market, and columns (4) to (6) to the investor segment, which are estimated separately.

[Insert Table 5 here]

In column (1), where we include only product × day fixed effects, the estimated coefficient is −0.39. This means that within the same product type on the same day, green products offer an initial rate that is, on average, 39 basis points lower than non-green products. In column (2), we additionally include an interaction with borrower type to ensure that we compare products offered to the same pool of potential borrowers. Under this specification, the average discount lowers to 24 basis points. In column (3), we add the interaction with lender fixed effects, which significantly increases the explanatory power of the empirical model, as noted by the increase in the Adjusted-R^2. When conditioning on similar products offered on a given day to the same pool of potential borrowers by the *same* lender, we document a considerably smaller discount on green products, of approximately 4 basis points. The decrease in the magnitude of the estimated coefficient from column (2) to column (3) shows that lenders who offer green mortgages tend to be cheaper, on average.

In the investor segment, we observe a similar decrease in estimated benefits as we saturate the specification with fixed effects, with estimates ranging from -18 to -5 basis points, but not statistically different from zero. We return to the question of why lenders offer different incentives across market segments in Section 4.2.

Note that our empirical specifications include all green products in the market and may therefore underestimate the financial benefits of products that offer a specific benefit. To assess the extent of the underestimation, we re-estimate the initial rate discount for green products that explicitly state "preferential rate" as a benefit, compared to all non-green products.[22] Panel B of Table 5 reports the results. In the owner-occupied market, the estimates are generally larger than those in Panel A, with green products offering a statistically significant reduction of 35 basis points *across lenders* and 9 basis points *within lender*. In the investor segment, when controlling for lender fixed effects, the estimated discount of 11 basis points closely aligns with that observed in the owner-occupied segment.

Upfront cashback. Table 6 focuses on cashback. Panel A considers all green products. Columns (1) to (3) report estimates from a linear probability model in which the outcome

[22]We also include those that state preferential rate and cashback.

variable is an indicator equal to one if the product offers cashback and zero otherwise. In columns (1) and (2), we find that green products are 34–42% more likely to offer cashback than comparable non-green products. When including lender fixed effects in column (3), the estimated coefficient remains similar at 39% and statistically significant at the 5% confidence level.

[Insert Table 6 here]

In columns (4) to (6), the dependent variable is the cashback amount.[23] For products that offer cashback, this variable is set to the corresponding pound amount; for products without cashback, it is set to zero. It therefore captures both the extensive and intensive margins of cashback provision. Green products offer, on average, £158-206 higher cashback than comparable non-green products (columns (4) and (5)). When controlling for lender fixed effects (column (6)), the estimated effect remains economically and statistically significant, at £145.[24]

Panel B of Table 6 restricts the sample to green products that explicitly state cashback as a benefit. The estimates for the probability of cashback are larger than before, ranging between 0.52 and 0.62. A similar conclusion holds for the cashback amount, with green products offering between £295 and £211 more than non-green products. Overall, and as expected, conditioning on products that state specific financial benefits increases the economic magnitudes of our estimates.

Lastly, some borrowers, especially in the owner-occupied segment, may consider loans exclusively from these top 7 lenders, which are the focus of Coen et al. (2023). In Table 7 we report results when we restrict the sample to contracts offered only by these lenders. We focus on green products stating "preferential rate" for the initial rate discount and "cashback" for cashback-related outcomes (as in Panel B of Tables 5 and 6).

[Insert Table 7 here]

[23] In Appendix Figure A4, we compare the distribution of cashback amount across green and non-green products. We find that both across and within lenders there is substantial variation in the amount offered, with the variation being larger for non-green products than for green mortgages.

[24] Appendix Table A2 replicates columns (3) to (6) of Panel A of Table 6 conditioning only on products that offer positive cashback. We do not find a statistically significant difference in cashback amount between green and non-green products, indicating that the results in Table 6 are mainly driven by the extensive margin. Appendix Table A3 repeats the analysis in Table 6 (Panel A) for the investor segment and finds no statistically significant differences in either cashback likelihood or amount.

Both across lenders and within lenders, we estimate a similar initial rate discount of approximately 20 basis points (columns (2) and (3)), with the within-lender discount being twice our baseline estimate. In the investor segment, the across-lender estimates are now statistically significant, ranging from 17 to 19 basis points, while the within-lender discount remains in line with the baseline estimate (10 basis points). For cashback, when restricting the sample to the top 7 lenders, both the likelihood of green products offering cashback and the corresponding cashback amounts remain consistent with our baseline estimates in Panel B of Table 6.[25]

3.2.3 Other contractual features

This section studies whether the estimated financial benefits of green mortgages are offset by other contractual features, including higher product fees or follow-on interest rates. We also study initial interest rates for green products offering cashback and cashback offers for green products offering preferential rate. Table 8 reports the results for the owner-occupied segment. The estimated coefficients on the green indicator are statistically insignificant, except for column (3) where the estimated coefficient is economically insignificant.[26]

[Insert Table 8 here]

Overall, we conclude that green mortgages provide lower initial rates and higher cashback compared to similar non-green products on the market, without adjusting other contractual features.

3.3 Back-of-the-envelope calculations

We use our estimates to calculate the financial benefits of green mortgages for qualifying borrowers, distinguishing between products offering preferential rates and those offering cashback. Cashback benefits are received as a lump sum at origination, whereas preferential rate benefits are realized through a lower initial interest rate over the introductory period of the loan. Therefore, to compare the benefits, we convert the cashback amount into an annual equivalent value (annualized £s), using the average interest rate for the conversion. Since most UK borrowers

[25] Appendix Table A4 repeats our main analysis replacing lender fixed effects by financial group fixed effects. The estimated coefficients are virtually unchanged.

[26] Appendix Table A5 shows results for the investor segment, with similar conclusions.

refinance at the end of the introductory period, our calculations focus on this time frame. We focus on a 5-year fixed loan. We calculate: (i) across lender; and (ii) within lender benefits.

For owner-occupied loans with preferential rates, the estimated benefits correspond to the values in columns (2) and (3) of Panel B of Table 5, amounting to 35 and 9 basis points, respectively. Given that the average mortgage loan amount in the UK is approximately £200,000, the resulting annual benefits are £700 and £180, respectively.[27] For owner-occupied loans with cashback, the estimated benefits are £241 and £211, as shown in columns (5) and (6) of Panel B of Table 6. Converting them into annual equivalent figures yields £56 and £49, respectively. Panel (a) of Figure 4 plots these values.

[Insert Figure 4 here]

We perform similar calculations while restricting the sample to loans offered by the top 7 lenders, using the estimates in Table 7, and plot the resulting values in Panel (b).[28] The patterns are similar: green mortgage products with preferential rates provide significant financial benefits relative to comparable non-green products, both across the market and within the same lender, but Green cashback products offer significantly smaller financial gains.

4 Why do lenders offer green mortgages?

In this section, we conduct several tests to shed light on the lenders' motives for offering these products. This analysis is particularly useful for understanding private market motivations, given that there are no regulatory requirements or government subsidies for lenders to offer green mortgages.

4.1 Customer acquisition

Our first hypothesis is that lenders offer green mortgages to attract new customers. In a competitive market, green products may serve as a mechanism for lenders to differentiate themselves

[27] See, Average mortgage values in the UK.

[28] For owner-occupied mortgage loans, the estimated green discounts are 21 and 20 basis points, depending on whether we consider across-lender variation or within-lender variation, respectively. The corresponding cashback estimates range between £187 and £215 (columns (5) and (6) of Panel B of Table 7).

and cater to an increasingly large proportion of environmentally conscientious borrowers. Although empirically testing this mechanism is challenging, we present evidence that suggests that this is an important determinant of at least some lenders' choice to offer green mortgages.

4.1.1 Product availability: Home Buyers versus remortgagors

We leverage the unique features of the UK mortgage market. As explained in Section 2.2, UK mortgages tend to have an initial period of fixed discounted rate, at the end of which it reverts to a significantly higher variable reversion rate. At this point, most borrowers refinance their loans. There are significant differences in the process of refinancing, depending on whether borrowers refinance with their current lender or a different one, and whether they wish to extract home equity in the process.

Loans for property acquisition require a full property valuation and affordability assessment. The same is true for borrowers refinancing a previous loan (without property acquisition) from a *new* lender, and for those refinancing a previous loan with their current lender while extracting equity. In contrast, refinancing an existing loan with the same lender without equity extraction is much simpler and less costly. It does not require a full property valuation (lenders update the value of the house using the evolution of local house price indices) nor does it involve an affordability assessment or proof of income. This simpler process is often known as "product transfer," as borrowers are simply transferred to a new product offered by the same lender.

Because of the significantly lower requirements, most borrowers refinancing a loan do so with their existing lender (see Belgibayeva et al. (2025) and Appendix Figure A5 that illustrates the life cycle of a typical UK mortgage). By contrast, borrowers are much more likely to search offers from multiple lenders when purchasing a property, increasing competition at this stage. As loans on offer are differentially available to buyers and remortgagors, we can test the hypothesis that green loans are used to attract *new* business. Under this hypothesis, the availability of green loans should be greater for homebuyers than for remortgagors.

Loans may be available for first-time buyers, second-time buyers, remortgagors or combinations of these borrower types. We construct a binary variable that takes the value of one if the product is available to homebuyers only (and zero otherwise). In addition, we construct a dummy variable if the product is available to remortgagors (and zero otherwise). We then estimate an equation similar to Equation (1) with these indicator variables as outcomes excluding the interaction with borrower-type fixed effects as its inclusion would prevent estimation, but

including an interaction between the green indicator and an indicator for whether the product offers cashback:

$$y_{ijblt} = \alpha + \beta_0 \cdot \text{Green}_{it} + \beta_1 \cdot \mathbb{1}(\text{Cashback}_{it}) + \beta_2 \cdot \text{Green}_{it} \cdot \mathbb{1}(\text{Cashback}_{it}) + \lambda_{jlt} + \epsilon_{ijblt} \quad (2)$$

Table 9 shows the results for these product availability outcomes. Panel A focuses on the owner-occupied segment. In column (1), the estimated coefficient of 0.31 on Green_{it} shows that green products are much more likely to be offered exclusively to buyers. This effect remains both economically and statistically significant in column (2), where, after controlling for within-lender variation, green products are 22% more likely to be offered only to buyers.

[Insert Table 9 here]

Columns (4) and (5) report results for the corresponding specifications with the $\mathbb{1}$(Available to remortgagors) indicator as dependent variable. Green products are significantly less likely to be available to remortgagors, both compared to the market as a whole and when considering within-lender variation. The estimates are economically large: green mortgages are 10-23% less likely to be available to remortgagors.

We investigate whether the increased availability of green products for buyers only - and their decreased availability for remortgagors — varies with the type of financial benefit offered, following equation (2). The coefficient β_2 captures how green products that offer cashback differ from green products that do not, most of which instead provide a preferential rate.

Columns (3) and (6) of Panel A in Table 9 show that the previously estimated effects are driven by green products offering cashback. The probability that such products are offered to buyers only is 23% higher (0.35-0.12) than for green products without cashback. In addition, the probability that green cashback loans are available to remortgagors is 12% lower (-0.40+0.28) than green loans without cashback. In both cases, the sum of the relevant estimated coefficients is statistically different from zero, with p-values of 0.03 and 0.02, respectively. Interestingly, as our back-of-the-envelope calculations have shown, green cashback products offer considerably smaller financial benefits than those providing preferential rates.

Panel B shows the results for the investor segment. In contrast to the owner-occupied segment, most coefficients are statistically insignificant. These results suggest that lenders use green cashback loans to attract new business in the owner-occupied sector of the market, but

are less keen on offering such loans for those seeking to remortgage, which typically constitute a disproportionate number of their existing customers.

The evidence that cashback offers on green mortgages are used to attract new customers raises the question of whether the use of cashback is specific to green loans or instead reflects a broader customer acquisition strategy. To address this question, we study the relationship between cashback offers on green and non-green products by the same lender. For each lender–day pair in the owner-occupied segment, we compute the share of green and non-green products offering cashback. We then group the non-green cashback share into equal-sized bins, calculate the mean for each variable within each bin, and in Figure 5a plot these data points, residualized by day fixed effects. Figure 5b applies the same procedure to average cashback amounts.

[Insert Figure 5]

These figures show a strong positive relationship: lenders that frequently offer cashback on non-green products (x-axis) are also more likely to provide cashback on green products (y-axis), with a best-fit slope 0.83. Similarly, the relationship between the average cashback amount on green and non-green products is positive and significant. This evidence strongly supports the view that cashback offers on green mortgages form part of a broader customer acquisition strategy that lenders apply across both green and non-green products.

4.1.2 Targeting financially constrained homebuyers

Given the limited financial benefits of cashback offers on green products, we turn to the question of which types of customers lenders target with these offers. We present evidence that cashback-based green mortgages are directed toward financially constrained households purchasing more expensive properties.

We focus on the owner-occupied segment and consider product availability for newly built properties. On average, new builds are more expensive than existing resale homes. For example, in October 2023, the average transaction price for new builds in England was £415,000 compared with £299,000 for existing properties.[29] Moreover, new builds tend to be less affordable: in 2023, the affordability ratio, defined as average house price divided by average annual disposable household income, was 10.3 for new builds and 8.0 for existing homes across England and Wales (Office for National Statistics, 2024). These figures suggest that buyers of new-build

[29]Source: UK House Price Index for December 2023.

properties are, on average, more financially constrained than buyers of existing properties at the time of buying a property.

We estimate Equation (2) with an indicator for product availability for new builds as the outcome variable. Table 10 shows the results. The positive coefficient on $\mathbb{1}$(Cashback) is consistent with earlier evidence that upfront cashback is part of a lender's general acquisition strategy. Notably, on average, green mortgage products with cashback are 16 percentage points more likely to be available for new builds than comparable green products without cashback (column 1). This difference increases to 27 percentage points when the analysis is restricted to the top 7 lenders (column 3). This targeting strategy suggests that lenders are using cashback features within green mortgage products to attract financially constrained borrowers purchasing newly built properties. Supporting this interpretation, we find that nearly all green products with cashback are limited to properties with energy-efficiency ratings of A or B (Figure 3a), among which a substantial share of properties are newly built (Panel B of Table 1).

[Insert Table 10]

Second, to provide more direct evidence on the role of financial constraints, we examine product eligibility for shared ownership or shared equity schemes — programs aimed at improving housing affordability and expanding access to homeownership for financially constrained households. Under shared ownership, households purchase a partial stake in a property and pay rent on the remaining share held by a housing association. Shared equity schemes provide buyers with an equity loan (often government-backed) that reduces the required mortgage size. We construct a *Shared ownership* variable equal to one if the product is available under either scheme and zero otherwise. Columns (2) and (4) of Table 10 show that green products with cashback are significantly more likely to be offered under these schemes than comparable green products without cashback.

Finally, we study the heterogeneity in financial incentives offered across the owner-occupied and investor segments of the market. We focus on all green products, including those in the owner-occupied and in the investor segments of the market, and use as outcome an indicator variable equal to one for green mortgages offering cashback and zero otherwise. The explanatory variable of interest is a dummy equal to one if the product is offered in the owner-occupied segment of the market, and zero if it is offered in the investor segment. The estimates in Appendix Table A6 show that lenders are relatively more likely to offer cashback in the owner-

occupied segment, where borrowers tend to be more financially constrained than those in the investor segment.

Taken together, the results in this section show that lenders use upfront cashback on green mortgages to segment the market and attract new financially constrained homebuyers. These borrowers are likely to place greater value on upfront cash when taking out a mortgage. One might ask why lenders focus on cashback rather than reduced fees, and whether the two are equivalent. In the UK mortgage market, origination fees can be added to the outstanding loan balance without affecting the interest rate, even when doing so pushes the LTV above the maximum threshold. In this setting, upfront cashback is more valuable than reduced fees for financially constrained borrowers.

4.2 Credit risk

A second explanation we explore for why lenders offer green mortgages is that they have lower default risk than non-green mortgages. More energy-efficient properties are less expensive to run, and lower energy bills leave borrowers with more cash-flow available to service their debt — a mechanism we refer to as the cash-flow channel. At the same time, greener buildings are thought to have an increased value — known as "green premium," compared to an equivalent non-green property — or be more resilient to any "brown discount" in markets where less energy efficient properties are becoming increasingly unattractive.[30] We refer to this second mechanism as the collateral value channel.

All else equal, borrowers seeking mortgages for green properties may have lower default risk due to both the cash-flow and collateral value channels, which may be reflected in the benefits provided on the loans on offer. We exploit two sources of variation in our main analysis: (i) sharp changes in energy prices over our sample period, and (ii) differences in the maximum LTV ratios of loans on offer.[31]

[30] There is a large literature documenting that, globally including the UK, buyers and sellers pay attention to energy efficiency of their homes (see, Eichholtz et al. (2010); Myers et al. (2022); Lu and Spaenjers (2023); Sejas-Portillo et al. (2025) and cites therein).

[31] Unfortunately, existing loan performance data do not identify which products are green, limiting our ability to compare default outcomes directly.

4.2.1 Cash-flow channel

Energy prices. In our first test, we exploit the sharp and sudden changes in energy prices over our sample period as a shock to households' ability to service their debt. All else equal, rising energy prices widen the credit risk gap between more and less energy-efficient properties. Consequently, under the cash-flow channel, one would expect an increase in the financial advantages of green products relative to comparable non-green products following an increase in energy prices. To test this hypothesis, we obtain energy price data from the Office of Gas and Electricity Markets (Ofgem), focusing on weekly wholesale forward delivery contract prices for electricity and gas.[32] Appendix Figure A6 shows the fluctuation of these prices over our sample period, peaking in August 2022 and declining thereafter.

We exploit the time-series variation in energy prices by estimating Equation (1), interacting the Green_{it} indicator with weekly electricity and gas prices. To account for lenders potentially anticipating future energy price movements, we also estimate specifications that interact the Green_{i} indicator variable with energy prices at two- and four-week leads. Table 11 shows the results.

[Insert Table 11 here]

The estimated coefficients on the interaction terms are small in magnitude and statistically insignificant, both when using the initial interest rate and the cashback amount as outcome variables. These results show that lenders do not adjust the financial benefits associated with green mortgages in response to energy price movements, which does not align with the predictions of the cash-flow channel.

Interest rate shock. In a second test of the cash-flow channel, we exploit the large unexpected interest rate rise following the UK mini-budget announcement of 23 September 2022. The UK chancellor unexpectedly announced large unfunded tax cuts, an announcement that was received with skepticism by markets and triggered large increases in swap rates, used by lenders for the pricing of mortgages. The mortgage market effects were significant with a sudden and large rise in mortgage rates (Figure 2), raising debt service requirements for new borrowers and remortgagors.

[32] These prices reflect the rates suppliers typically pay when purchasing energy to supply their customers and represent the largest component of retail energy bills.

Owners of energy-efficient properties, facing lower energy bills, may have had greater capacity to manage the higher debt repayments. Consequently, the relative benefits of green mortgages should widen after the shock. We formally test this prediction, leveraging the unexpected nature of this shock combined with our high-frequency data. We summarize our empirical specification and results in Appendix D. Overall, the findings align with our earlier evidence based on energy price variation and do not support the cash-flow channel.

4.2.2 Collateral value channel

Higher LTV loans carry greater default risk, and in the event of default, lenders are more exposed to the property's ability to retain its value in order to avoid collateral losses. Therefore, under the collateral value channel, we would expect the benefits associated with green mortgages to increase as the product's maximum LTV ratio rises. We test this hypothesis by estimating Equation (1) with the green indicator interacted with maximum product LTV dummies. We use different LTV cutoffs for the owner-occupied and the investor segments, as the distribution of maximum LTV ratios for green products differs substantially across these two markets (Appendix Figure A7).

The first six columns of Table 12 show the results for the owner-occupied sector. The last two columns refer to the investor segment. For both segments, the omitted category is maximum LTV$\leq$65. The estimated coefficients on the interactions are always statistically insignificant in the owner-occupied segment. A similar conclusion holds for the investor market. The only exceptions are in columns (5) and (6) for the green products in the highest LTV bracket. The estimated positive coefficients are the opposite of what the collateral value channel would predict. Nonetheless, one should be careful in reading too much from the large estimate coefficient for loans with LTV>75 since 75 is the typical maximum considered by the vast majority of lenders.

[Insert Table 12 here]

Overall, the results in this section do not support the hypothesis that the benefits of green mortgages are due to the lower default risk of the loans.

5 Other mechanisms

In this section we consider alternative non-mutually exclusive explanations for why lenders, absent regulation, offer green mortgages. Although we cannot analyze these alternative mechanisms with the same granularity as the customer-acquisition and credit-risk channels, we discuss and assess their relevance in our context. These alternative mechanisms, namely cost of capital and reputation, may be more relevant for larger lenders.

5.1 Green bond issuance

By originating mortgages that meet environmental standards, lenders can bundle these loans and issue green bonds backed by them, potentially lowering their funding costs. To provide evidence on this mechanism, we construct a dataset covering the universe of bonds — both green and conventional — issued by the lenders in our sample using Bloomberg's fixed income database (e.g., Zerbib, 2019; Flammer, 2021). For each lender in our sample, we manually search the database and extract all bond issuances, recording the issue date, amount issued, and a green bond indicator. For the subset of green corporate bonds, we also rely on the *Use of Proceeds* section (as reported by Bloomberg) and construct an indicator equal to one if the bond specifies "Green Buildings" as an eligible use of proceeds.[33] We focus on the time-period 2016-2024. In our sample, 27 financial groups issued bonds during this time, of which 9 issued green bonds.

Appendix Figure A8 shows some stylized facts on green bond issuance among the lenders in our sample. Panel (a) shows that the volume of green bond issuance has increased since 2016, exceeding £5 billion in 2023. Panel (b), however, indicates that green bonds have consistently represented only a small share of overall issuance, never exceeding 5%. These aggregate statistics reflect the fact that, for the vast majority of lenders in our sample, green bonds account for only a small share of total issuance (Panel (c)).

Using these data, we study the relationship between green bond issuance and green mortgages on offer. More precisely, we exploit cross-sectional variation across financial groups in our sample and relate the overall share of green mortgages offered during our sample period

[33] Nearly all green bonds mention "Green Buildings" as an eligible use of proceeds. However, in most cases, lenders list multiple eligible uses, including Renewable Energy, Electric Vehicles, Green Buildings, Circular Economy, among others.

with the share of of green bond issuance during the same years (2022 and 2023). In addition, we relate the share of green mortgages offered to the extensive margin of green bond issuance.

Figure 6 shows the results. We do not find a systematic association between the offering of green mortgages and green bond issuance. As Panel (a) shows, many lenders offer green mortgages without issuing any green bonds. In Figure 6b, the average share of green mortgages is higher among lenders that issue green bonds, but the confidence intervals are wide and overlap substantially. Given the small number of observations these results should be viewed as suggestive. This evidence, together with the overall limited role of green bond issuance, suggests that the cost of capital channel is unlikely to be the primary determinant of the supply of green mortgages.

[Insert Figure 6]

Another factor reinforcing this argument is that the financing benefits from issuing green bonds— the so-called *green premium*— are typically small or even negligible, as documented in the literature (Hachenberg and Schiereck, 2018; Zerbib, 2019; Larcker and Watts, 2020; Baker et al., 2022; Eskildsen et al., 2024). By contrast, our estimates show that some lenders, particularly those offering preferential rates on their green mortgages, provide borrowers with much larger discounts of at least 10 basis points. This gap points to motives other than the issuance of green bonds against green mortgages as explanations for the supply of the latter.

5.2 Green commitments

Another potentially important factor is reputational and strategic positioning. By offering green mortgage products, banks can enhance their reputational capital at a time when investors, customers, supervisors, and regulators are increasingly scrutinizing sustainability practices. This strategic positioning may be reinforced by banks signing green commitments and adopting explicit sustainability targets (Giannetti et al., 2023).

We test whether the supply of green mortgages is associated with lenders' commitments under the Net-Zero Banking Alliance (NZBA) initiative. Launched in 2021 by the United Nations Environment Programme Finance Initiative (UNEP-FI), the NZBA aims to align banking activities with the climate objectives of the Paris Agreement. NZBA members commit to setting and publishing individual science-based targets that promote the transition to a low-carbon economy, and to regularly disclosing progress toward these targets. As of 2025, the NZBA

comprises 145 banks across 44 countries, representing approximately US$74 trillion in assets, which is equivalent to 41% of the global banking assets.[34]

The NZBA initiative publicly discloses its membership. From the official NZBA website we obtain the list of member banks and their signing dates, and manually match bank names to the lenders in our sample. In total, we identify 25 member banks in our sample, belonging to 13 financial groups. NZBA membership is correlated with lender size, with larger lenders more likely to be signatories. We create the *NZBA Member* variable that takes the value of one if the financial group was a NZBA member at the beginning of our sample period and zero otherwise.[35] We estimate the following model at the financial group-day level, separately by market segment:

$$y_{gt} = \alpha + \beta \cdot \text{NZBA Member}_g + \lambda_t + \epsilon_{gt}, \tag{3}$$

where g and t refer to financial group and day indexes, respectively. We focus on two outcome variables y_{gt}: (i) a binary variable taking the value of one if the financial group offers any green mortgage in a given day, and zero otherwise; (ii) the daily share of green mortgages in the group's total mortgage offerings. We include day fixed effects (λ_t) and cluster the standard errors at the financial group level. We also estimate this model replacing NZBA Member$_g$ with an indicator for whether the financial group is among the top 7 lenders (Top 7 Lender$_g$). Some NZBA members are not part of the top 7 group, which helps distinguish the association between green commitments and green mortgage supply from the effects of lender size.

Table 13 presents the results. In the owner-occupied segment, both top 7 lenders and NZBA members are roughly 50% more likely to offer at least one green mortgage on a given day. However, NZBA membership provides substantially greater explanatory power, with an adjusted-R^2 of 20% compared with 13% for the top 7 indicator. Moreover, while the difference in the daily share of green mortgages between top 7 lenders and others is not statistically significant, we find that this share is 19% higher among NZBA members. By contrast, in the investor segment, we do not find any statistically significant difference between the top 7 group and others, or between NZBA members and non-members. This evidence suggests that banks' green commitments are associated with a greater propensity to supply green mortgage products, particularly in the owner-occupied market.

[34] Sustainability Magazine.

[35] All but one of the lenders in our sample who are NBZA members signed the NZBA membership prior to the beginning of our sample period. The results are robust to including all NZBA members, including the single lender that joined the initiative during our sample period.

[Insert Table 13]

An important caveat to this analysis is that, while it shows green commitments are correlated with green mortgage offerings, it does not address why lenders choose to make such commitments in the first place. Positioning as a 'green lender' allows banks to differentiate themselves from competitors and attract sustainability-conscious investors and borrowers. This interpretation is consistent with earlier evidence that green mortgages can serve as a tool for market segmentation and customer acquisition.

Positioning as a 'green lender' may also reflect regulatory and supervisory pressures. Although explicit capital requirements for green lending have not yet been implemented in the UK, banks may anticipate such measures or respond to the growing emphasis regulators place on climate-related financial risks.[36] In this context, offering green mortgages may help banks align with evolving regulatory expectations and prepare for potential future policy changes.[37]

6 Conclusion

We conclude by summarizing and interpreting our findings with a focus on borrower characteristics, lender incentives, and the role of product differentiation. Mortgage borrowers are heterogeneous in the degree to which they are liquidity constrained. Products offering upfront cashback cater to liquidity needs and are more likely to be preferred by constrained homebuyers *vis-à-vis* unconstrained landlords. This is consistent with our finding that green cashback products are more prevalent in the owner-occupied segment, while green preferential rate ones are more common in the investor segment. Many homebuyers, particularly first-time buyers and those making use of shared ownership schemes, face liquidity constraints at the time of house purchase due to the downpayment requirement and housing acquisition–related expenses.

Relatedly, borrowers may find it easier to evaluate a salient, one-time cashback amount than to translate an interest-rate reduction into intertemporal savings, particularly when shopping in

[36]For example, the Sustainable Finance Disclosure Regulation (SFDR) requires banks to classify and disclose their green activities, while the European Central Bank has placed increasing emphasis on climate-related risk management in supervisory assessments.

[37]Future work could examine this mechanism more directly by studying banks' responses to regulatory or supervisory announcements related to green finance. An event-study design around key policy communications—such as the introduction of disclosure requirements, climate stress-testing guidance, or discussions of green capital frameworks—could test whether lenders expand green mortgage offerings or adjust the associated benefits.

a complex product space. In this context, upfront cashback serves as a salient instrument that caters to the liquidity needs of homebuyers and acts as a marketing and customer-acquisition tool. The evidence on the use of upfront cashback as a contractual feature is an important contribution of our paper.

While not all lenders offer green mortgages, those that do, offer genuine financial benefits relative to otherwise comparable traditional mortgages. From lenders' perspective, offering such benefits is costly. By revealed preference, the net gain of supplying a green mortgage must be weakly positive. Our evidence does not support lower credit risk as an explanation. Instead, it supports reputational benefits: by offering green mortgages, lenders may signal sustainability commitments to investors, regulators, and customers. Such reputational returns are likely to be more valuable for large lenders, whose actions are more visible and more closely scrutinized, particularly in the owner-occupied segment. Consistent with this interpretation, we find that large lenders are significantly more likely to offer green mortgages in this segment.

Taken together, our evidence shows that the green label serves as an instrument of product differentiation. While lenders offer green mortgages with genuine financial benefits, they tailor product design around borrower heterogeneity, using salient cashback incentives to cater to liquidity-constrained homebuyers. In doing so, lenders segment the market and leverage the green label so as to attract new customers.

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Figures

Figure 1. Daily Green Mortgage Shares in the UK

(a) Share of Green Mortgages

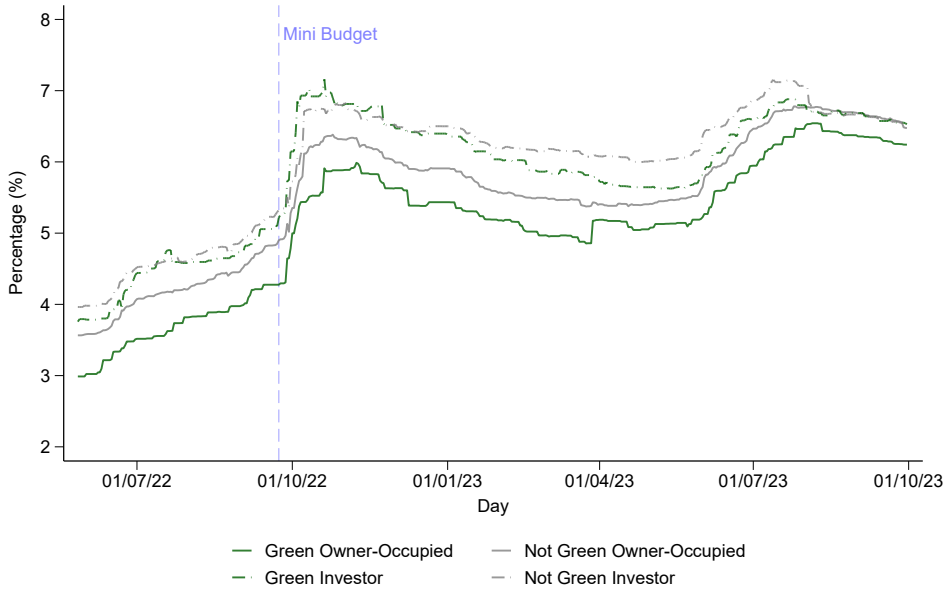


(b) Share of Lenders Offering Green Mortgages



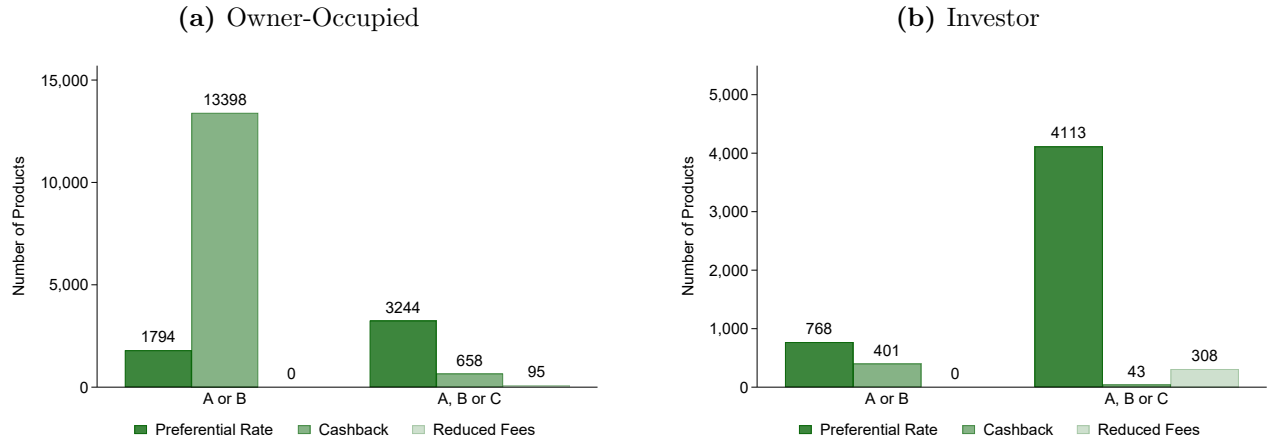
Notes: This figure presents the daily time series of (i) the share of green mortgage products available in the market (Figure 1a) and (ii) the share of lenders offering green mortgages (Figure 1b). Both figures display results separately for the owner-occupied and investor segments. Appendix C provides a detailed description of the variables.

Figure 2. Average Initial Rate



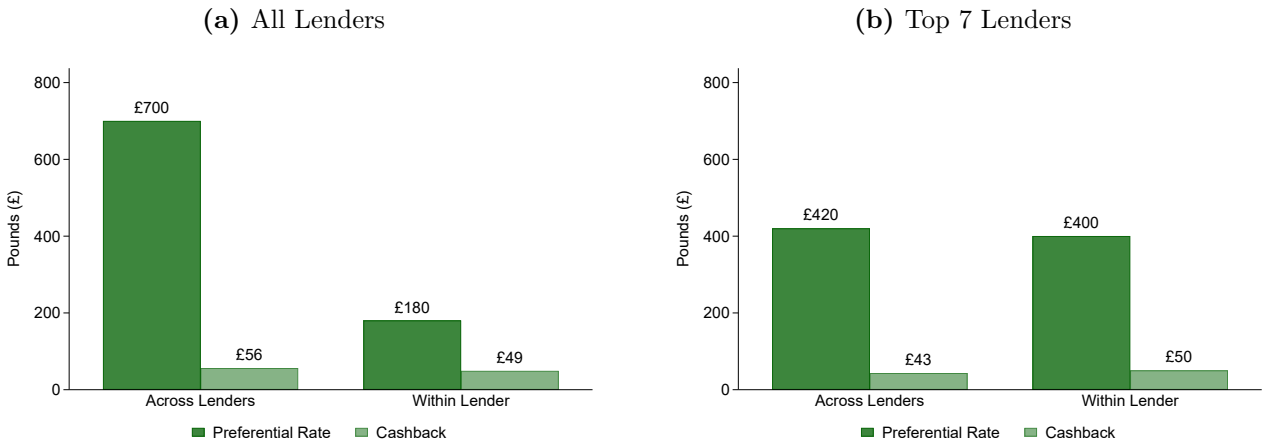
Notes: This figure shows the daily time-series of the average initial rate for non-green and green products for the owner-occupied and investor segments. The vertical line identifies the mini-budget announcement of 23 September 2022. Appendix C provides a detailed description of the variables.

Figure 3. Stated Benefits of Green Mortgages



Notes: This figure provides the count of unique green products that state "Preferential Rate", "Cashback" or "Reduced Fees" in their green description. The benefits are not mutually exclusive, as a product may list more than one benefit. Figure 3a refers to the owner-occupied market, while Figure 3b refers to the investor segment. For both segments, we show the count of products separately for EPC ratings "A or B" and "A, B or C". Appendix C provides a detailed description of the variables.

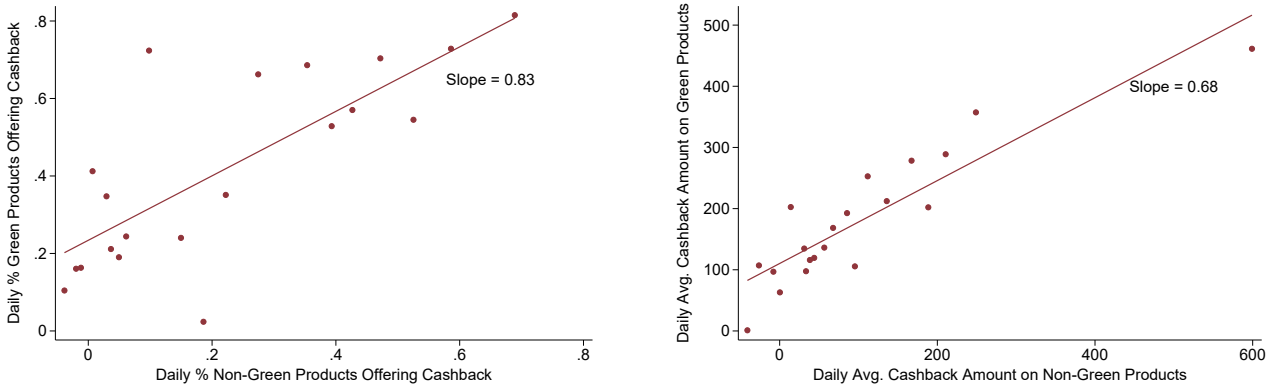
Figure 4. Back-of-The-Envelope Calculations: Equivalent Annualized Benefits



Notes: This figure presents the equivalent annualized benefits of green mortgage products that offer preferential rates or cashback, calculated in Section 3.3. Figure 4a reports results using estimates for all lenders, whereas Figure 4b restricts the analysis to the top seven lenders.

Figure 5. Relationship Between Daily Green and Non-Green Cashback Shares by Lender

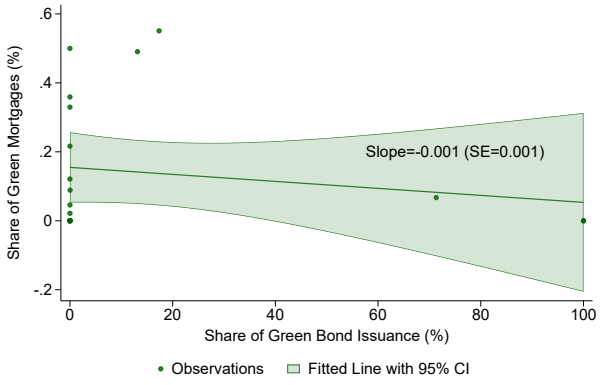
(a) 𝟙(Cashback) **(b)** Cashback Amount (£)



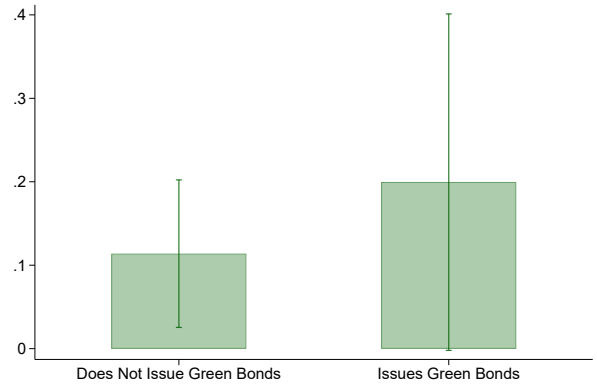
Notes: These figures present bin-scatter plots illustrating the relationship between the daily share of green products (y-axis) and non-green products (x-axis) offering cashback (Figure 5a), as well as the corresponding cashback amount (Figure 5b). In Figure 5a, we calculate the share of both green and non-green products offering cashback for each lender-day pair. We then group the non-green cashback share into equal-sized bins, compute the mean for each variable within each bin, and plot these data points, residualized by day fixed effects. Figure 5b follows the same procedure, but for the average cashback amount. Both plots focus on the owner-occupied segment. Appendix C provides a detailed description of the variables.

Figure 6. Green Bond Issuance and the Supply of Green Mortgages

(a) Share of Green Mortgages and Share of Green Bond Issuance



(b) Share of Green Mortgages and Green Bond Issuance (Binary)



Notes: These figures show the relationship between issuing green bonds and green mortgage supply during our sample period. Panel (a) plots the cross-sectional relationship between the share of green mortgages supplied and the share of green bond issuance across financial groups, together with the fitted line. Panel (b) relates the share of green mortgages supplied with the extensive margin of issuing green bonds.

Tables

Table 1. Energy Performance and Property Characteristics

Panel A: Energy Performance of Dwellings in the UK, 2022

Dwelling Age	% of Properties Within Energy Efficiency Rating				Energy Use (KWh/m^2/year)	Energy Cost (£/year)	CO_2 Emissions Tonnes/Year	Nr. of Dwellings (000s)
	A/B	C	D	E/F/G				
Pre-1919		21	56	23	275	1,894	5.7	5,099
1919-44		28	63	9	247	1,592	4.4	3,801
1945-64	1	47	45	6	231	1,370	3.7	4,550
1965-80	1	49	43	7	235	1,346	3.7	4,674
1981-90	3	57	34	6	227	1,251	3.4	1,660
Post-1990	13	70	15	2	176	1,074	2.8	5,376

Panel B: Market Characteristics by EPC Rating

	EPC Rating				
	A	B	C	D	E/F/G
Panel B.1: EPC Data (Full Sample)					
Nr. of Certificates	89,822	3,142,365	8,156,028	9,728,846	4,952,041
Property Construction Year	2006	2005	1971	1950	1935
New Build (Binary)	0.76	0.75	0.07	0.01	0.01
Owner-Occupied (Binary)	0.69	0.58	0.44	0.60	0.67
Total Floor Area (m^2)	114	87	78	87	99
Index of Multiple Deprivation Rank (where 1 is most deprived)	17,254	16,206	14,258	15,445	15,735
Panel B.2: Price Paid - EPC Merged Data (27/05/2022 - 30/09/2023)					
Nr. of Transactions	6,056	227,756	337,014	436,762	149,475
Property Construction Year	2016	2017	1973	1948	1935
Transaction Price (£)	495,629	403,729	349,682	366,001	414,241
New Build (Binary)	0.56	0.57	0.02	0.00	0.00
Total Floor Area (m^2)	125	97	90	94	105
Index of Multiple Deprivation Rank (where 1 is most deprived)	19,831	18,481	17,413	17,248	16,977

Notes: Panel A shows the energy performance of the stock of dwellings in the UK in 2022, by dwelling age. It also presents estimates of the energy use, associated cost and CO_2 emissions. Energy costs are at constant 2012 prices. Source: Energy Housing Survey 2022-23. For details: 2022 English Housing Survey. Panel B presents average property characteristics by EPC rating. Panel B.1 considers all entries in the EPC data. Panel B.2 considers the universe of properties transacted during our sample period (27/05/2022 - 30/09/2023). Appendix B provides further details on the data sources and the merging procedure.

Table 2. Green Mortgages Requirements

EPC Rating	Owner-Occupied		Investor		Total
	Current EPC	Improving EPC	Current EPC	Improving EPC	
Not Reported	0	228	0	384	612
A	4	0	0	0	4
A or B	13,929	55	1,168	1	15,153
A, B or C	3,244	0	4,613	43	7,900
E or Above	0	10	0	0	10
Total	17,177	293	5,781	428	23,679

Notes: This table presents the number of unique green products by EPC rating requirement, in each market segment. We also categorize each product based on whether it targets properties with a current required EPC rating or if it allows for future energy improvements. We extract both variables from the green description. Appendix C provides a detailed description of the variables. The 612 cases for which the EPC rating is not reported have the following description: "Cashback for the purchase or remortgage of a property when the energy efficiency rating is improved by 10 or more SAP points within 12 months of completion." One additional product lacks information on its green characteristics, preventing us from identifying its requirements. Overall, the dataset contains 23,680 unique green mortgages.

Table 3. Summary Statistics: Green and Not Green Mortgages

	Panel A: Owner-Occupied							
	Green ($n = 346,777$)				Not Green ($n = 2,464,183$)			
	Mean	Std. Dev.	p25	p75	Mean	Std. Dev.	p25	p75
Fixation Term (Years)	3.75	2.28	2.00	5.00	3.43	2.08	2.00	5.00
Maximum LTV Ratio (%)	78.43	10.62	75.00	85.00	77.86	11.89	70.00	85.00
𝟙(Available to First Time Buyers)	0.69	0.46	0.00	1.00	0.66	0.47	0.00	1.00
𝟙(Available to Remortgagors)	0.36	0.48	0.00	1.00	0.60	0.49	0.00	1.00
𝟙(Available for New Builds)	0.41	0.49	0.00	1.00	0.18	0.38	0.00	0.00
Initial Rate (%)	5.26	1.18	4.43	6.14	5.51	1.52	4.48	6.37
𝟙(Cashback)	0.73	0.45	0.00	1.00	0.29	0.45	0.00	1.00
Cashback Amount (£)	333.91	317.11	0.00	500.00	121.55	241.75	0.00	250.00
Reversion Rate (%)	7.18	1.43	6.20	7.99	6.86	1.44	5.74	7.87
Total Flat Fees (£)	517.34	523.32	0.00	999.00	626.91	613.89	0.00	999.00
Total Percent Fees (%)	0.00	0.04	0.00	0.00	0.02	0.13	0.00	0.00
Stated Benefits (Green):								
𝟙(Preferential Rate Only)	0.24	0.43	0.00	0.00				
𝟙(Cashback Only)	0.61	0.49	0.00	1.00				
𝟙(Both)	0.15	0.35	0.00	0.00				
𝟙(Others)	0.01	0.08	0.00	0.00				

	Panel B: Investor							
	Green ($n = 129,365$)				Not Green ($n = 1,010,984$)			
	Mean	Std. Dev.	p25	p75	Mean	Std. Dev.	p25	p75
Fixation Term (Years)	3.97	1.81	2.00	5.00	3.33	1.77	2.00	5.00
Maximum LTV Ratio (%)	70.65	7.32	65.00	75.00	71.18	7.25	65.00	75.00
𝟙(Available to First Time Buyers)	0.10	0.30	0.00	0.00	0.18	0.39	0.00	0.00
𝟙(Available to Remortgagors)	0.80	0.40	1.00	1.00	0.81	0.39	1.00	1.00
𝟙(Available for New Builds)	0.01	0.08	0.00	0.00	0.01	0.10	0.00	0.00
Initial Rate (%)	5.70	1.30	4.84	6.65	5.91	1.69	4.84	6.75
𝟙(Cashback)	0.27	0.44	0.00	1.00	0.15	0.36	0.00	0.00
Cashback Amount (£)	147.10	286.61	0.00	300.00	51.92	128.93	0.00	0.00
Reversion Rate (%)	7.51	1.51	6.24	8.59	7.55	1.56	6.25	8.74
Total Flat Fees (£)	731.81	1,173.26	0.00	995.00	842.62	907.12	0.00	1,495.00
Total Percent Fees (%)	1.51	1.23	0.00	2.00	1.64	1.33	0.00	2.00
Stated Benefits (Green):								
𝟙(Preferential Rate Only)	0.79	0.40	1.00	1.00				
𝟙(Cashback Only)	0.15	0.35	0.00	0.00				
𝟙(Both)	0.00	0.00	0.00	0.00				
𝟙(Others)	0.06	0.24	0.00	0.00				

Notes: This table shows summary statistics for the main variables used in the paper, separately for green and non-green mortgage products. These statistics are calculated using the full dataset at the product-day level. Panel A covers the owner-occupied segment, while Panel B refers to the investor segment. Appendix C provides a detailed description of the variables.

Table 4. Average Product Characteristics, For Top 7 Lenders and Others

	Owner-Occupied				Investor			
	Top 7 Lenders		Others		Top 7 Lenders		Others	
Number of Green Observations	226,266		120,511		30,936		98,429	
Number of Non-Green Observations	826,948		1,637,235		223,841		787,143	
Share of Green	0.21		0.07		0.12		0.11	
	Green	Non-Green	Green	Non-Green	Green	Non-Green	Green	Non-Green
Fixation Term (Years)	4.07	3.76	3.15	3.26	3.56	3.43	4.10	3.30
Maximum LTV Ratio (%)	78.36	78.73	78.54	77.43	67.00	67.80	71.80	72.15
$\mathbb{1}$(Available to First Time Buyers)	0.61	0.47	0.82	0.76	0.20	0.12	0.06	0.20
$\mathbb{1}$(Available to Remortgagors)	0.22	0.41	0.63	0.70	0.65	0.61	0.85	0.87
$\mathbb{1}$(Available for New Builds)	0.57	0.26	0.10	0.14	0.00	0.00	0.01	0.01
Initial Rate (%)	5.00	4.90	5.77	5.81	5.04	5.04	5.91	6.16
$\mathbb{1}$(Cashback)	0.92	0.30	0.37	0.28	0.33	0.33	0.25	0.10
Cashback Amount (£)	366.76	116.08	272.19	124.32	98.37	122.53	162.42	31.84
Reversion Rate (%)	7.03	6.66	7.49	6.96	7.44	7.27	7.54	7.64
Total Flat Fees (£)	550.72	586.16	454.67	647.86	1,471.05	940.84	270.25	804.89
Total Percent Fees (%)	0.00	0.00	0.01	0.03	0.00	0.89	1.65	1.79
Stated Benefits (Green):								
$\mathbb{1}$(Preferential Rate Only)	0.03		0.63		1.00		0.73	
$\mathbb{1}$(Cashback Only)	0.89		0.09		0.00		0.19	
$\mathbb{1}$(Both)	0.08		0.27		0.00		0.00	
$\mathbb{1}$(Others)	0.00		0.02		0.00		0.08	

Notes: This table shows average product characteristics for the main variables used in the paper, separately for the top seven lenders and all other lenders. The averages are calculated using the full dataset at the product-day level. The definition of "top seven lender" is based on consolidated lender groups identified through ultimate ownership. Appendix C provides a detailed description of the variables.

Table 5. Incentives: Interest Rate on Products Offered

	Panel A: All Green Products					
Dependent Variable:	Initial Rate (%)					
Segment:	Owner-Occupied			Investor		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.39**	-0.24*	-0.04**	-0.18	-0.13	-0.05
	(0.18)	(0.14)	(0.02)	(0.23)	(0.19)	(0.05)
Constant	5.53***	5.51***	5.52***	5.91***	5.92***	5.96***
	(0.17)	(0.13)	(0.00)	(0.19)	(0.15)	(0.01)
Observations	2,802,916	2,775,739	2,555,194	1,138,870	1,126,318	1,062,067
Adjusted R-Squared	0.54	0.65	0.95	0.53	0.62	0.94
Mean Dep. Variable	5.48	5.48	5.51	5.89	5.90	5.95
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

	Panel B: Green Products Stating "Preferential Rate" as a Benefit					
Dependent Variable:	Initial Rate (%)					
Segment:	Owner-Occupied			Investor		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.35	-0.35*	-0.09**	-0.36	-0.30	-0.11***
	(0.30)	(0.19)	(0.04)	(0.23)	(0.18)	(0.01)
Constant	5.53***	5.53***	5.56***	5.90***	5.91***	5.94***
	(0.17)	(0.13)	(0.00)	(0.19)	(0.15)	(0.00)
Observations	2,591,029	2,563,852	2,344,562	1,110,279	1,097,708	1,033,411
Adjusted R-Squared	0.53	0.64	0.95	0.53	0.62	0.94
Mean Dep. Variable	5.51	5.52	5.55	5.87	5.88	5.93
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

Notes: This table presents estimates of the difference in the initial rate between green and non-green products, based on the model specified in Equation 1. Panel A considers all green products, whereas Panel B focus exclusively on green products that state "preferential rate" as a financial benefit in the green description. For both panels, columns (1)-(3) refer to the owner-occupied segment, while columns (4)-(6) refer to the investor segment. These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Incentives: Cashback Offered on Mortgages in the Owner-Occupied Segment

	Panel A: All Green Products					
Dependent Variable:	𝟙(Cashback)			Cashback Amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.42***	0.34***	0.39**	206.17***	158.60***	145.24**
	(0.13)	(0.13)	(0.15)	(52.85)	(41.50)	(65.51)
Constant	0.29***	0.30***	0.30***	122.50***	128.96***	133.55***
	(0.03)	(0.03)	(0.02)	(16.39)	(15.96)	(8.75)
Observations	2,802,916	2,775,739	2,555,194	2,802,812	2,775,635	2,555,174
Adjusted R-Squared	0.13	0.26	0.60	0.11	0.24	0.63
Mean Dep. Variable	0.34	0.34	0.35	147.98	148.71	152.95
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

	Panel B: Green Products Stating "Cashback" as a Benefit					
Dependent Variable:	𝟙(Cashback)			Cashback Amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.62***	0.53***	0.52***	295.98***	241.76***	211.25***
	(0.06)	(0.08)	(0.14)	(55.79)	(43.64)	(43.75)
Constant	0.29***	0.30***	0.31***	123.20***	128.95***	135.22***
	(0.03)	(0.03)	(0.01)	(16.74)	(16.22)	(4.61)
Observations	2,718,053	2,691,805	2,469,256	2,717,949	2,691,701	2,469,236
Adjusted R-Squared	0.19	0.30	0.63	0.15	0.27	0.67
Mean Dep. Variable	0.35	0.35	0.36	151.74	152.49	157.48
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

Notes: This table presents estimates of the difference in the probability of cashback and the cashback amount between green and non-green products, based on the model specified in Equation 1. Panel A considers all green products, whereas Panel B focus exclusively on green products that state "cashback" as a financial benefit in the green description. These estimates refer to the owner-occupied segment and are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7. Incentives: Interest Rate and Cashback on Products Offered, by Top Seven Lenders Only

	Panel A: Green Products Stating "Preferential Rate" as a Benefit					
Dependent Variable:	Initial Rate (%)					
Segment:	Owner-Occupied			Investor		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.19***	-0.21***	-0.20***	-0.19**	-0.17***	-0.10***
	(0.03)	(0.04)	(0.01)	(0.07)	(0.05)	(0.03)
Constant	4.90***	4.90***	4.90***	5.06***	5.06***	5.04***
	(0.02)	(0.02)	(0.00)	(0.03)	(0.02)	(0.00)
Observations	849,468	845,059	822,738	254,006	246,977	230,450
Adjusted R-Squared	0.90	0.91	0.96	0.84	0.85	0.85
Mean Dep. Variable	4.90	4.90	4.89	5.04	5.04	5.03
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

	Panel B: Green Products Stating "Cashback" as a Benefit					
Dependent Variable:	𝟙(Cashback)			Cashback Amount (£)		
Segment:	Owner-Occupied					
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.61***	0.50***	0.55***	249.04***	187.33***	214.76***
	(0.08)	(0.14)	(0.16)	(47.35)	(29.39)	(31.83)
Constant	0.30***	0.33***	0.31***	117.05***	129.52***	122.25***
	(0.05)	(0.05)	(0.03)	(22.58)	(16.79)	(6.86)
Observations	1,042,996	1,038,697	1,015,759	1,042,996	1,038,697	1,015,759
Adjusted R-Squared	0.27	0.44	0.60	0.23	0.61	0.80
Mean Dep. Variable	0.43	0.43	0.43	169.36	169.03	168.56
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

Notes: This table presents estimates of the difference in the initial rate, probability of cashback and the cashback amount between green and non-green products, based on the model specified in Equation 1. We restrict the sample to the top seven lenders. In Panel A, columns (1)-(3) refer to the owner-occupied segment, while columns (4)-(6) refer to the investor segment. In Panel B, all columns refer to the owner-occupied segment. These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8. Other Contractual Features in the Owner-Occupied Segment

Dependent Variable:	Green Products Stating "Preferential Rate"				Green Products Stating "Cashback"		
	𝟙(Cashback)	Cashback Amount (£)	Reversion Rate (%)	Flat Fees (£)	Initial Rate (%)	Reversion Rate (%)	Flat Fees (£)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Green	-0.00	-54.67	0.00*	103.88	-0.00	-0.00	10.76
	(0.03)	(37.23)	(0.00)	(65.98)	(0.03)	(0.00)	(37.21)
Constant	0.29***	132.39***	6.92***	621.48***	5.50***	6.90***	611.08***
	(0.00)	(2.09)	(0.00)	(3.74)	(0.00)	(0.00)	(3.96)
Observations	2,344,562	2,344,542	2,218,348	2,321,088	2,469,256	2,346,386	2,445,865
Adjusted R-Squared	0.61	0.61	0.99	0.23	0.95	0.99	0.21
Mean Dep. Variable	0.29	129.32	6.92	627.36	5.50	6.90	612.23
Fixed Effects:							
Product × Borrower × Day × Lender	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents estimates of the difference in contractual features between green and non-green products in the owner-occupied segment, based on the model specified in Equation 1. Columns (1)-(4) focus on products that state "preferential rate" as financial benefit, while Columns (5)-(7) focus on products that state "cashback" as the financial benefit. These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9. Customer Acquisition: Products Offered by Borrower Types

	Panel A: Owner-Occupied					
Dependent Variable:	𝟙(Buyers Only)			𝟙(Available to Remortgagors)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.31***	0.22**	0.02	-0.23***	-0.10***	0.07*
	(0.10)	(0.10)	(0.03)	(0.07)	(0.04)	(0.04)
𝟙(Cashback) [β_1]			-0.12			0.28***
			(0.13)			(0.10)
Green × 𝟙(Cashback) [β_2]			0.35***			-0.40***
			(0.12)			(0.10)
Constant	0.32***	0.34***	0.38***	0.60***	0.58***	0.50***
	(0.03)	(0.01)	(0.04)	(0.04)	(0.00)	(0.03)
Observations	2,802,916	2,681,817	2,681,817	2,802,916	2,681,817	2,681,817
Adjusted R-Squared	0.10	0.25	0.27	0.11	0.33	0.37
Mean Dep. Variable	0.36	0.37	0.37	0.57	0.57	0.57
P-value $\beta_1 + \beta_2$			0.03			0.02
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Day × Lender		Yes	Yes		Yes	Yes

	Panel B: Investor					
Dependent Variable:	𝟙(Buyers Only)			𝟙(Available to Remortgagors)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.03	0.10	0.07*	-0.03	-0.09	-0.05
	(0.07)	(0.08)	(0.04)	(0.07)	(0.08)	(0.04)
𝟙(Cashback) [β_1]			-0.10			0.10
			(0.08)			(0.08)
Green × 𝟙(Cashback) [β_2]			0.16			-0.16
			(0.22)			(0.22)
Constant	0.14***	0.14***	0.15***	0.81***	0.82***	0.80***
	(0.03)	(0.01)	(0.02)	(0.03)	(0.01)	(0.02)
Observations	1,138,870	1,111,509	1,111,509	1,138,870	1,111,509	1,111,509
Adjusted R-Squared	0.11	0.35	0.35	0.11	0.34	0.34
Mean Dep. Variable	0.15	0.15	0.15	0.81	0.81	0.81
P-value $\beta_1 + \beta_2$			0.81			0.82
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Day × Lender		Yes	Yes		Yes	Yes

Notes: This table presents estimates of the probability of green products being offered to different borrowers types, namely buyers only (columns (1)-(3)), and remortgagors (columns (4)-(6)). Panel A covers the owner-occupied segment, while Panel B refers to the investor segment. Columns (3) and (6) include the interaction terms with 𝟙(Cashback). These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 10. Customer Acquisition: Products Offered to New Builds and Under Shared Ownership Schemes

Sample:	All Lenders		Top 7 Lenders Only	
Dependent Variable:	Available to New Builds (Binary)	Shared Ownership (Binary)	Available to New Builds (Binary)	Shared Ownership (Binary)
	(1)	(2)	(3)	(4)
Green	0.01	-0.08**	-0.04	-0.19***
	(0.03)	(0.04)	(0.09)	(0.02)
$\mathbb{1}$(Cashback) [β_1]	0.07	0.12**	0.18*	0.22***
	(0.06)	(0.06)	(0.10)	(0.07)
Green $\times$ $\mathbb{1}$(Cashback) [β_2]	0.09**	0.08*	0.09	0.13***
	(0.05)	(0.05)	(0.09)	(0.04)
Constant	0.18***	0.15***	0.24***	0.27***
	(0.02)	(0.02)	(0.04)	(0.03)
Observations	2,681,817	2,681,817	1,038,145	1,038,145
Adjusted R-Squared	0.57	0.57	0.37	0.59
Mean Dep. Variable	0.21	0.19	0.33	0.35
P-value $\beta_1 + \beta_2$	0.02	0.00	0.03	0.00
Fixed Effects:				
Product $\times$ Day $\times$ Lender	Yes	Yes	Yes	Yes

Notes: This table presents estimates of the probability of green products being offered to new builds and under shared ownership schemes in the owner-occupied segment. In columns (1)-(2), we include all green products. In columns (3)-(4), we restrict the sample to top seven lenders. *Available to New Builds (Binary)* takes the value of one if the product is available to new builds and zero otherwise. *Shared Ownership (Binary)* takes the value of one if the product is offered under shared ownership or shared equity schemes, and zero otherwise. Columns (2) and (4) include the interaction terms with $\mathbb{1}$(Cashback). These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 11. Screening on Default Risk in the Owner-Occupied Segment: Interaction with Energy Prices

	Panel A: Electricity					
Dependent Variable:	Initial Rate (%)			Cashback amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.0817***	-0.0768***	-0.0739***	285.2859***	287.5036***	286.7157***
	(0.0099)	(0.0106)	(0.0116)	(32.6096)	(34.5314)	(34.5834)
Green × Weekly Electricity Price	-0.0001			-0.3567		
	(0.0002)			(0.2566)		
Green × Weekly Electricity Price (2-Weeks Lead)		-0.0001			-0.3722	
		(0.0002)			(0.2707)	
Green × Weekly Electricity Price (4-Weeks Lead)			-0.0001			-0.3733
			(0.0002)			(0.2747)
Constant	5.5565***	5.5565***	5.5565***	135.1765***	135.1771***	135.1798***
	(0.0020)	(0.0020)	(0.0021)	(4.3449)	(4.3321)	(4.3351)
Observations	2,344,562	2,344,562	2,344,562	2,469,236	2,469,236	2,469,236
Adjusted R-Squared	0.95	0.95	0.95	0.67	0.67	0.67
Mean Dep. Variable	5.55	5.55	5.55	157.48	157.48	157.48
Fixed Effects:						
Product × Borrower × Day × Lender	Yes	Yes	Yes	Yes	Yes	Yes

	Panel B: Gas					
Dependent Variable:	Initial Rate (%)			Cashback amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.0786***	-0.0748***	-0.0733***	279.6319***	279.8198***	278.9698***
	(0.0112)	(0.0118)	(0.0126)	(30.1707)	(30.7353)	(30.6376)
Green × Weekly Gas Price	-0.0001			-0.3165		
	(0.0001)			(0.2267)		
Green × Weekly Gas Price (2-Weeks Lead)		-0.0001			-0.3209	
		(0.0001)			(0.2325)	
Green × Weekly Gas Price (4-Weeks Lead)			-0.0001			-0.3212
			(0.0001)			(0.2346)
Constant	5.5565***	5.5565***	5.5565***	135.1797***	135.1816***	135.1845***
	(0.0020)	(0.0021)	(0.0021)	(4.3574)	(4.3569)	(4.3629)
Observations	2,344,562	2,344,562	2,344,562	2,469,236	2,469,236	2,469,236
Adjusted R-Squared	0.95	0.95	0.95	0.67	0.67	0.67
Mean Dep. Variable	5.55	5.55	5.55	157.48	157.48	157.48
Fixed Effects:						
Product × Borrower × Day × Lender	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents estimates of the difference in the financial benefits between green and non-green mortgages in the owner-occupied segment, interacted with energy price measures. Panel A uses the weekly wholesale forward contract price for electricity, while Panel B uses the corresponding measure for gas. In both panels, we interact the green mortgage indicator with the contemporaneous energy price, as well as its 2-week and 4-week leads, to capture potential anticipation of changes in energy prices by lenders. Columns (1)–(3) focus on green mortgages offering "Preferential Rate" and compare them to all non-green mortgages. Columns (4)–(6) repeat the analysis for green mortgages offering a "Cashback" benefit. These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12. Screening on Default Risk: Heterogeneity by Loan-to-Value Ratios

Segment:	Owner-Occupied						Investor	
Dependent Variable:	Initial Rate (%)		𝟙(Cashback)		Cashback Amount (£)		Initial Rate (%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Green	-0.39	-0.05*	0.40***	0.39**	168.57***	131.84**	-0.17	-0.10***
	(0.24)	(0.02)	(0.13)	(0.17)	(34.06)	(65.85)	(0.19)	(0.01)
Green ×	-0.01	-0.02	-0.11	-0.09	-19.51	-14.54		
65 < LTV Ratio ≤ 75	(0.12)	(0.01)	(0.09)	(0.06)	(46.30)	(38.36)		
Green ×	0.23	0.01	-0.09	-0.01	-12.61	26.37		
75 < LTV Ratio ≤ 85	(0.19)	(0.02)	(0.08)	(0.07)	(46.74)	(42.69)		
Green ×	0.36	0.03	-0.01	0.12	-1.15	41.74		
LTV Ratio > 85	(0.25)	(0.02)	(0.07)	(0.08)	(28.33)	(29.55)		
Green ×							-0.33	0.00
LTV Ratio = 70							(0.22)	(0.01)
Green ×							0.09	0.05
LTV Ratio = 75							(0.19)	(0.06)
Green ×							0.45***	0.35***
LTV Ratio > 75							(0.17)	(0.10)
Constant	5.51***	5.52***	0.30***	0.30***	128.94***	133.48***	5.92***	5.96***
	(0.13)	(0.00)	(0.03)	(0.02)	(15.96)	(8.65)	(0.15)	(0.00)
Observations	2,775,739	2,555,194	2,775,739	2,555,194	2,775,635	2,555,174	1,126,318	1,062,067
Adjusted R-Squared	0.65	0.95	0.26	0.60	0.24	0.63	0.62	0.94
Mean Dep. Variable	5.48	5.51	0.34	0.35	148.71	152.95	5.90	5.95
Fixed Effects:								
Product × Borrower × Day	Yes		Yes		Yes		Yes	
Product × Borrower × Day × Lender		Yes		Yes		Yes		Yes

Notes: This table presents estimates of the heterogeneous green product characteristics along different maximum LTV ratios. The first six columns show the results for the owner-occupied segment. The last two columns refer to the investor segment. These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 13. Alternative Mechanisms: Green Commitment

Dependent Variable:	Offers Green (Binary)				Share Green Products (%)			
Segment:	Owner-Occupied		Investor		Owner-Occupied		Investor	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Top 7 Lender	0.53***		0.23		0.08		0.05	
	(0.18)		(0.19)		(0.05)		(0.06)	
NZBA Member		0.51***		0.06		0.19***		0.01
		(0.14)		(0.14)		(0.07)		(0.04)
Constant	0.19***	0.15***	0.19***	0.20***	0.04**	0.01***	0.06***	0.07***
	(0.05)	(0.04)	(0.05)	(0.05)	(0.02)	(0.01)	(0.02)	(0.02)
Observations	33,378	33,378	31,723	31,723	33,378	33,378	31,723	31,723
Adjusted R-Squared	0.13	0.20	0.02	-0.01	0.02	0.28	-0.00	-0.01
Mean Dep. Variable	0.24	0.24	0.21	0.21	0.05	0.05	0.07	0.07
Fixed Effects:								
Day	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports estimates of the differences in (i) the daily probability of offering green mortgages and (ii) the share of green mortgages between top-seven lenders and all other lenders, and between NZBA members and non-members, as specified in Equation 3. NZBA members are defined as lenders that joined NZBA prior to the beginning of our sample. *Offers Green (Binary)* is a binary variable taking the value of one if the lender offers any green mortgage in a given day, and zero otherwise. *Share Green Products (%)* refers to the daily share of green mortgages in the lender's total mortgage offerings. These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Appendix

Table of Contents

A Appendix: Figures and Tables **57**

B Appendix: Price Paid and EPC Data **71**

B.1 Energy Performance Certificates data 71

B.2 Index of Multiple Deprivation (IMD) 71

B.3 Land Registry Price Paid Data 71

C Appendix: Moneyfacts data **73**

C.1 Data cleaning 73

C.2 Variables 74

D Appendix: Credit Risk using Interest Rate Shock **79**

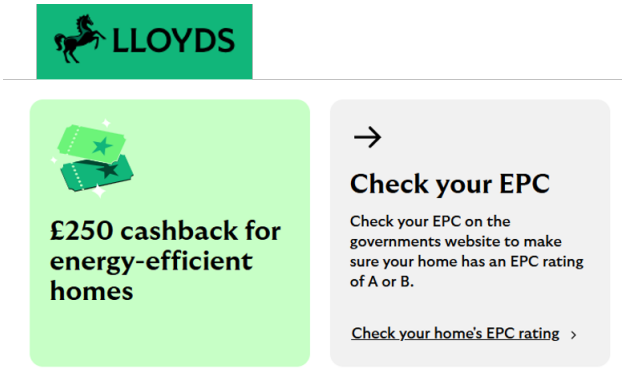
A Appendix: Figures and Tables

Figure A1. Examples of Green Mortgage Advertising

(a)



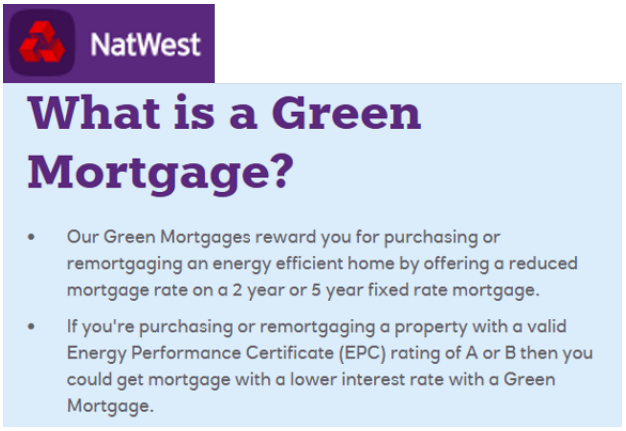
(b)



(c)

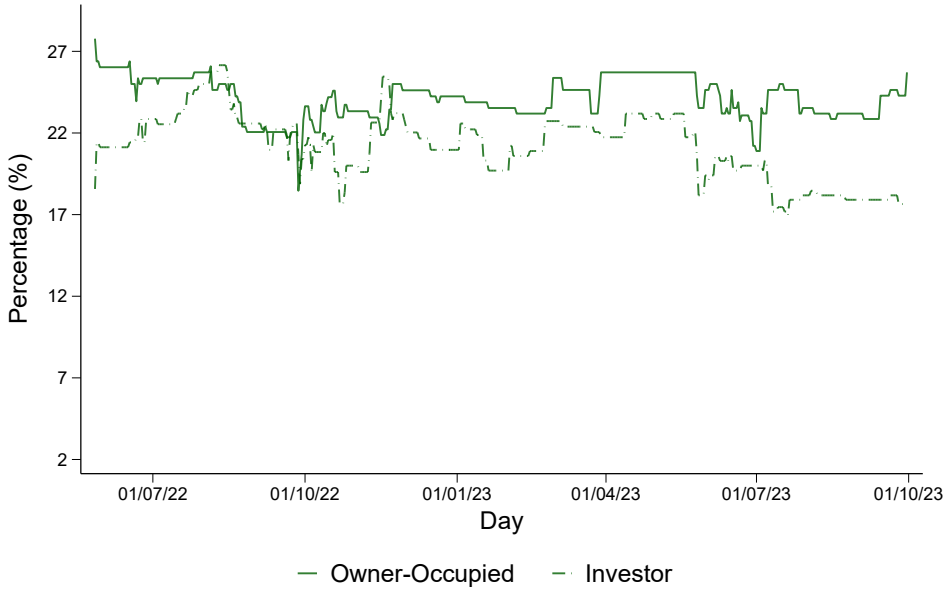


(d)



Notes: This figure shows examples of green mortgage advertising by selected lenders in our sample. Source: Banks' websites.

Figure A2. Daily Share of Lenders Offering Green Mortgages

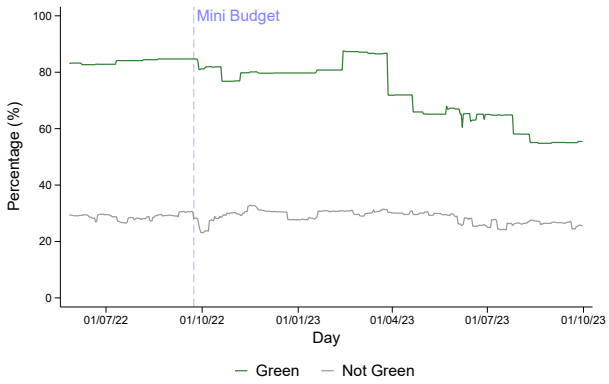


Notes: This figure shows the time-series of the share of lenders offering green mortgages, based on the consolidated lender classification. We distinguish between the owner-occupied and the investor segments. Appendix C provides a detailed description of the variables.

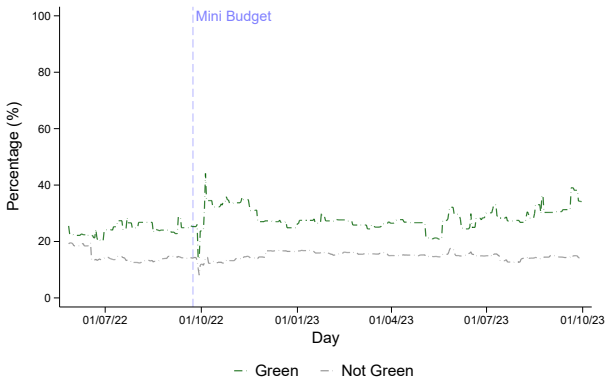
Figure A3. Time-series of Probability of Offering Cashback and Cashback Amount

Panel A: Probability of Cashback

(a) Owner-Occupied

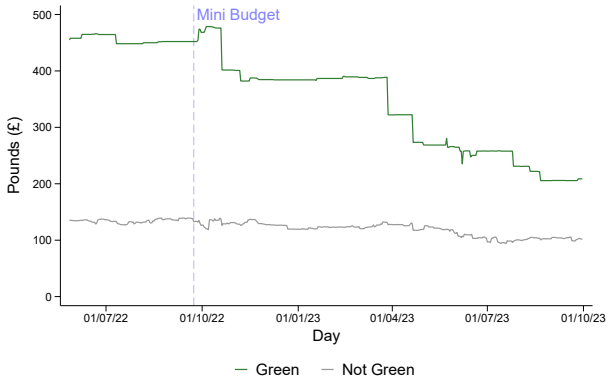


(b) Investor

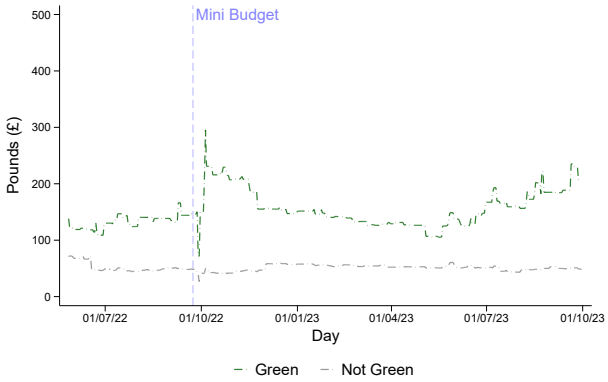


Panel B: Cashback Amount

(c) Owner-Occupied



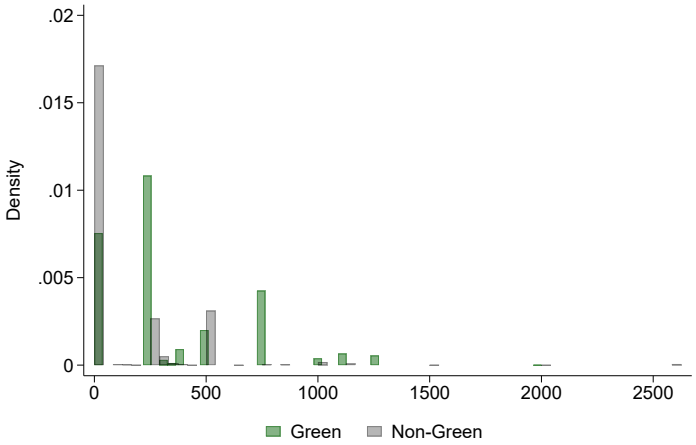
(d) Investor



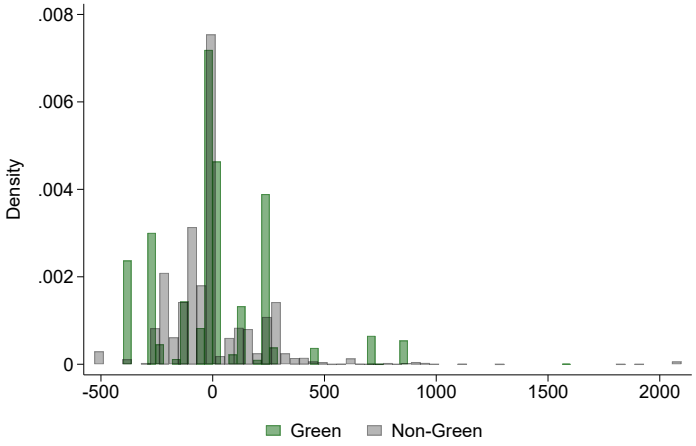
Notes: This figure shows the daily time-series of the share of products offering cashback (Panel A), and the average cashback amount (Panel B). Figures A3a and A3c refer to the owner-occupied market. Figure A3b and A3d refer to the investor market. The vertical line identifies the mini-budget announcement of 23 September 2022. Appendix C provides a detailed description of the variables.

Figure A4. Distribution of Cashback Amount in the Owner-Occupied Segment

(a) Not residualized

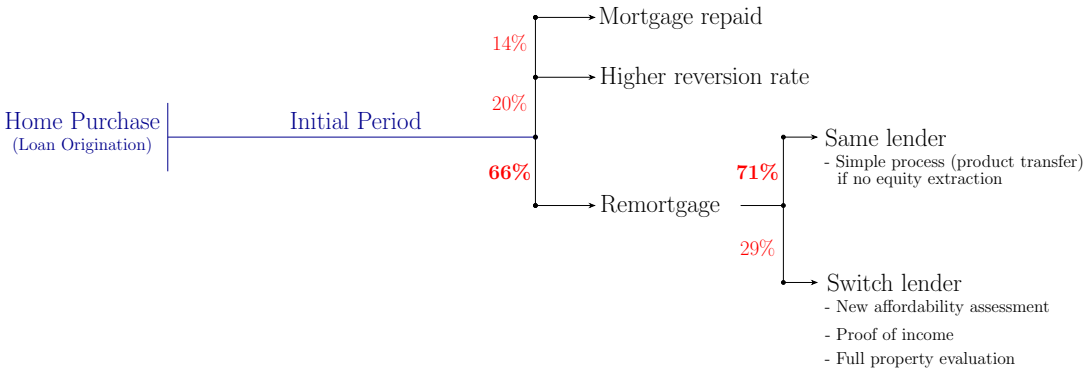


(b) Residualized by Lender Fixed Effects



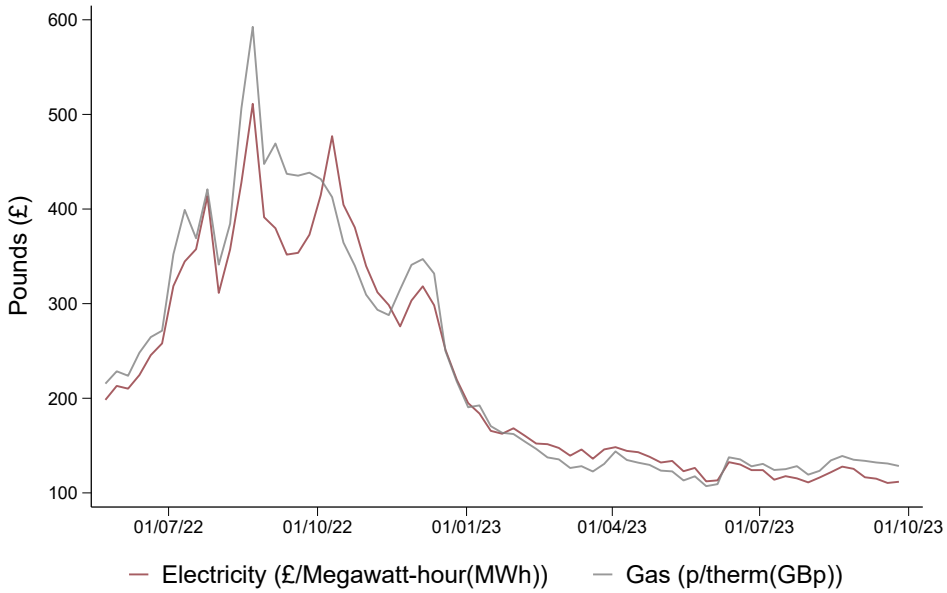
Notes: This figure shows the distribution of cashback amount for the owner-occupied segment. Figure A4b shows the distribution of cashback amount after residualizing by lender fixed effects. Appendix C provides a detailed description of the variables.

Figure A5. Life cycle of a Typical UK Mortgage Contract



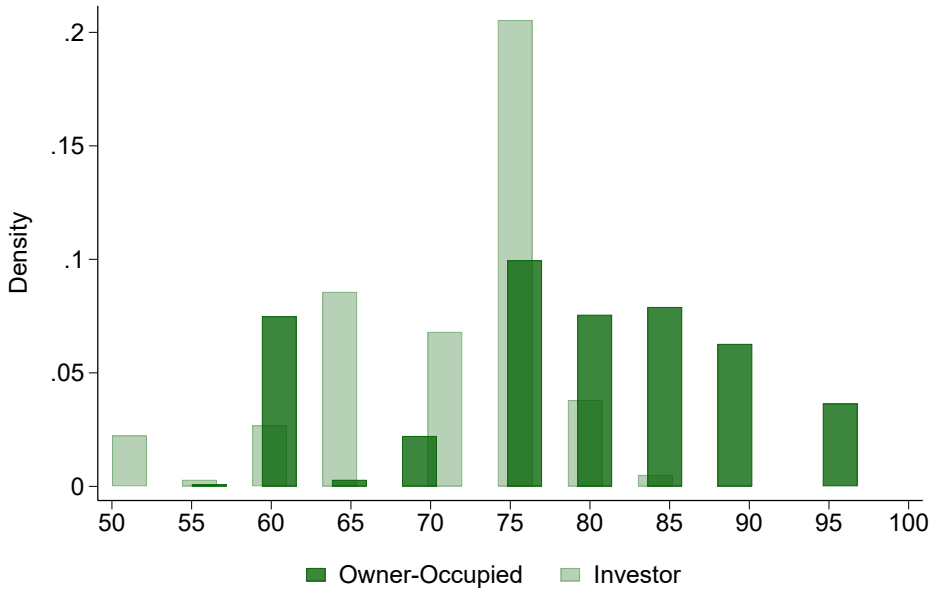
Notes: This figure illustrates the lifecycle of a UK mortgage contract with an initial fixed rate period of 2-years. The percentages associated with each outcome are sourced from Belgibayeva et al. (2025).

Figure A6. Energy prices: Weekly wholesale forward delivery contracts prices



Notes: This figure shows the weekly evolution of wholesale forward delivery contracts prices during our sample period, for electricity (measured in £/Megawatt-hour(MWh)) and gas (measured in p/therm(GBp)). These indicators represent the wholesale prices that suppliers typically face when buying gas or electricity to supply their customers. Source: Ofgem.

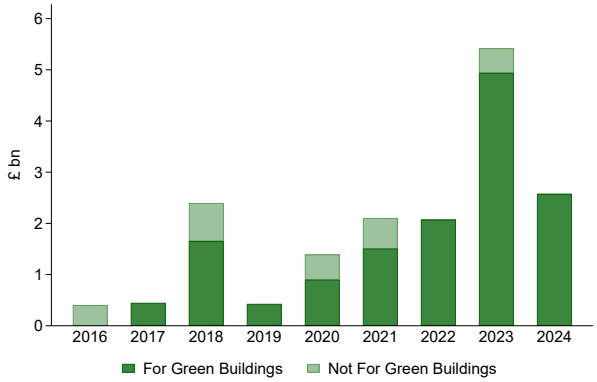
Figure A7. Distribution of Maximum Product LTV for Green Products



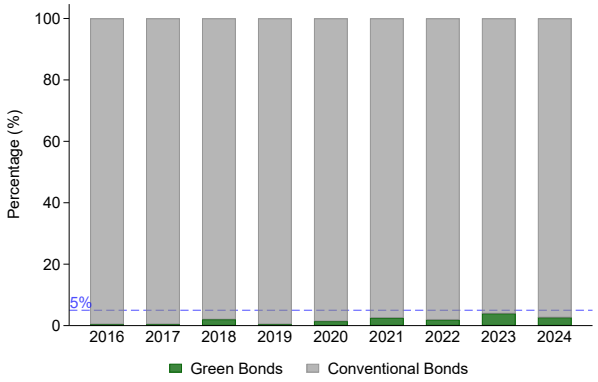
Notes: This figure shows the distribution of the maximum product LTV for green products, both in the owner-occupied and in the investor segments. Appendix C provides a detailed description of the variables.

Figure A8. Green Bond Issuance

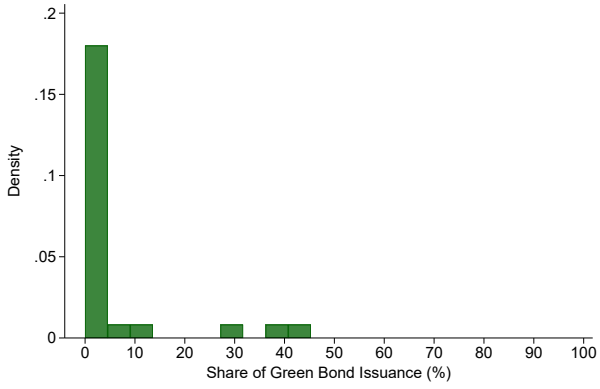
(a) Aggregate Time Series Of Green Bond Issuance



(b) Share of Green Bond Issuance



(c) Distribution of Share of Green Bond Issuance



Notes: This figure presents descriptive evidence on green bond issuance by the lenders in our sample. Panel (a) plots the aggregate time series of green bond issuance amounts, measured in billions of £. Panel (b) shows the evolution of the share of green versus conventional bond issuance over time. Panel (c) displays the cross-sectional distribution of the share of green bond issuance by lender. The sample period covers 2016–2024, and the data are sourced from Bloomberg's Fixed Income database.

Table A1. Summary Statistics: Green Mortgages, by EPC Rating

	Panel A: Owner-Occupied							
	EPC Rating: A or B ($n = 242,947$)				EPC Rating: A, B or C ($n = 98,566$)			
	Mean	Std. Dev.	p25	p75	Mean	Std. Dev.	p25	p75
Fixation Term (Years)	3.98	2.45	2.00	5.00	3.20	1.70	2.00	5.00
Maximum LTV Ratio (%)	78.62	11.25	75.00	85.00	77.88	9.11	70.00	85.00
𝟙(Available to First Time Buyers)	0.64	0.48	0.00	1.00	0.78	0.41	1.00	1.00
𝟙(Available to Remortgagors)	0.24	0.42	0.00	0.00	0.64	0.48	0.00	1.00
𝟙(Available for New Builds)	0.56	0.50	0.00	1.00	0.00	0.00	0.00	0.00
Initial Rate (%)	5.03	1.01	4.37	5.79	5.80	1.36	4.61	6.84
𝟙(Cashback)	0.90	0.31	1.00	1.00	0.30	0.46	0.00	1.00
Cashback Amount (£)	361.64	239.19	250.00	500.00	234.94	423.08	0.00	400.00
Reversion Rate (%)	7.02	1.30	5.99	7.99	7.59	1.66	6.70	9.20
Total Flat Fees (£)	525.59	519.88	0.00	999.00	519.81	531.78	0.00	995.00
Total Percent Fees (%)	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Stated Benefits (Green):								
𝟙(Preferential Rate Only)	0.06	0.24	0.00	0.00	0.68	0.47	0.00	1.00
𝟙(Cashback Only)	0.85	0.35	1.00	1.00	0.00	0.00	0.00	0.00
𝟙(Both)	0.09	0.28	0.00	0.00	0.30	0.46	0.00	1.00
𝟙(Others)	0.00	0.00	0.00	0.00	0.02	0.14	0.00	0.00

	Panel B: Investor							
	EPC Rating: A or B ($n = 26,692$)				EPC Rating: A, B or C ($n = 94,179$)			
	Mean	Std. Dev.	p25	p75	Mean	Std. Dev.	p25	p75
Fixation Term (Years)	3.66	1.49	2.00	5.00	4.10	1.90	2.00	5.00
Maximum LTV Ratio (%)	72.75	5.90	65.00	75.00	69.38	7.40	65.00	75.00
𝟙(Available to First Time Buyers)	0.35	0.48	0.00	1.00	0.02	0.15	0.00	0.00
𝟙(Available to Remortgagors)	0.40	0.49	0.00	1.00	0.89	0.31	1.00	1.00
𝟙(Available for New Builds)	0.00	0.00	0.00	0.00	0.01	0.09	0.00	0.00
Initial Rate (%)	5.87	1.52	4.77	7.14	5.54	1.17	4.75	6.29
𝟙(Cashback)	0.35	0.48	0.00	1.00	0.18	0.38	0.00	0.00
Cashback Amount (£)	166.79	231.89	0.00	500.00	64.63	158.33	0.00	0.00
Reversion Rate (%)	6.99	1.31	6.00	8.00	7.69	1.55	6.24	9.09
Total Flat Fees (£)	511.80	480.68	0.00	995.00	988.92	1,441.00	199.00	1,495.00
Total Percent Fees (%)	0.51	0.62	0.00	1.00	1.86	1.15	1.25	2.00
Stated Benefits (Green):								
𝟙(Preferential Rate Only)	0.68	0.47	0.00	1.00	0.90	0.30	1.00	1.00
𝟙(Cashback Only)	0.32	0.47	0.00	1.00	0.01	0.11	0.00	0.00
𝟙(Both)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
𝟙(Others)	0.00	0.00	0.00	0.00	0.08	0.28	0.00	0.00

Notes: This table shows summary statistics for the main variables used in the paper, focusing on green mortgage products. We show these statistics separately for the two main EPC rating requirements, as outlined in Table 2. These statistics are calculated using the full dataset at the product-day level. Panel A covers the owner-occupied segment, while Panel B refers to the investor segment. Appendix C provides a detailed description of the variables.

Table A2. Incentives: Cashback Amount Offered on Mortgages that Offer Cashback

Dependent Variable:	Cashback Amount (£)					
Segment:	Owner-Occupied			Investor		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	39.17	24.56	111.97	194.24	229.12	315.43
	(59.28)	(78.27)	(114.92)	(129.44)	(156.70)	(221.41)
Constant	423.91***	427.74***	408.89***	349.38***	341.38***	322.50***
	(30.71)	(33.27)	(33.35)	(19.26)	(27.23)	(47.69)
Observations	952,232	943,951	843,933	183,820	177,937	157,405
Adjusted R-Squared	0.04	0.18	0.65	0.24	0.34	0.57
Mean Dep. Variable	434.26	434.28	441.38	386.02	386.01	390.43
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

Notes: This table presents estimates of the difference in the cashback amount between green and non-green products conditional on products offering cashback, based on the model specified in Equation 1. Columns (1)-(3) refer to the owner-occupied segment, while columns (4)-(6) refer to the investor market. These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3. Incentives: Cashback Offered on Mortgages in the Investor Segment

Dependent Variable:	𝟙(Cashback)			Cashback Amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.13	0.10	0.09	100.52	95.48	109.33
	(0.11)	(0.09)	(0.08)	(85.49)	(86.58)	(98.96)
Constant	0.15***	0.15***	0.15***	51.37***	51.86***	49.02***
	(0.03)	(0.02)	(0.01)	(11.38)	(8.14)	(11.60)
Observations	1,138,870	1,126,318	1,062,067	1,138,786	1,126,259	1,062,067
Adjusted R-Squared	0.08	0.18	0.50	0.10	0.16	0.45
Mean Dep. Variable	0.16	0.16	0.16	62.78	62.81	61.84
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

Notes: This table presents estimates of the difference in cashback between green and non-green products, based on the model specified in Equation 1. The outcome variables are 𝟙(Cashback) (columns (1)-(3)) and Cashback Amount (£) (columns (4)-(6). These estimates refer to the investor segment and are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4. Incentives: Interest Rate and Cashback on Products Offered, Based on Lender's Ultimate Ownership

	Panel A: Green Products Stating "Preferential Rate" as a Benefit					
Dependent Variable:	Initial Rate (%)					
Segment:	Owner-Occupied			Investor		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.35	-0.35*	-0.09**	-0.36	-0.30	-0.11***
	(0.30)	(0.19)	(0.04)	(0.23)	(0.18)	(0.01)
Constant	5.53***	5.53***	5.56***	5.90***	5.91***	5.94***
	(0.17)	(0.13)	(0.00)	(0.19)	(0.15)	(0.00)
Observations	2,591,029	2,563,852	2,344,562	1,110,279	1,097,708	1,033,411
Adjusted R-Squared	0.53	0.64	0.95	0.53	0.62	0.94
Mean Dep. Variable	5.51	5.52	5.55	5.87	5.88	5.93
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Financial Group			Yes			Yes

	Panel B: Green Products Stating "Cashback" as a Benefit					
Segment:	Owner-Occupied					
Dependent Variable:	$\mathbb{1}$(Cashback)			Cashback Amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.62***	0.53***	0.51***	295.98***	241.76***	206.06***
	(0.07)	(0.10)	(0.14)	(63.27)	(48.45)	(48.88)
Constant	0.29***	0.30***	0.31***	123.20***	128.95***	136.04***
	(0.03)	(0.03)	(0.01)	(17.03)	(17.10)	(5.09)
Observations	2,718,053	2,691,805	2,497,826	2,717,949	2,691,701	2,497,806
Adjusted R-Squared	0.19	0.30	0.62	0.15	0.27	0.67
Mean Dep. Variable	0.35	0.35	0.36	151.74	152.49	157.51
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Financial Group			Yes			Yes

Notes: This table presents estimates of the difference in the initial rate between green and non-green products, based on the model specified in Equation 1. Panel A considers green products that state "preferential rate" as a financial benefit in the green description. Panel B considers green products that state "cashback" as a financial benefit. For Panel A, columns (1)-(3) refer to the owner-occupied segment, while columns (4)-(6) refer to the investor segment. In Panel B, all estimates correspond to the owner-occupied segment. These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. We use the consolidated lender classification based on ultimate ownership. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5. Other Contractual Features in the Investor Segment

	Green Products Stating "Preferential Rate"			
Dependent Variable:	$\mathbb{1}$(Cashback)	Cashback Amount (£)	Reversion Rate (%)	Flat Fees (£)
	(1)	(2)	(3)	(4)
Green	0.00	0.45	-0.02*	66.42**
	(0.00)	(0.38)	(0.01)	(31.51)
Constant	0.15***	49.77***	7.59***	831.47***
	(0.00)	(0.04)	(0.00)	(2.68)
Observations	1,033,411	1,033,411	970,225	659,277
Adjusted R-Squared	0.48	0.51	0.98	0.32
Mean Dep. Variable	0.15	49.81	7.58	837.13
Fixed Effects:				
Product × Borrower × Day × Lender	Yes	Yes	Yes	Yes

Notes: This table presents estimates of the difference in contractual features between green and non-green products in the investor segment, based on the model specified in Equation 1. All columns focus on products that state "preferential rate" as financial benefit. These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables. Standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A6. Customer Acquisition: Cashback Offers in the Owner-Occupied Segment

Dependent Variable:	𝟙(Stated Benefit: Cashback)					
Sample:	All Lenders			Top 7 Lenders Only		
	(1)	(2)	(3)	(4)	(5)	(6)
Owner-occupied Segment	0.52***	0.84***	0.72***	0.90***	0.93***	0.87***
	(0.18)	(0.14)	(0.19)	(0.09)	(0.09)	(0.14)
Constant	0.22	-0.00	0.08	0.06	0.05	0.11
	(0.15)	(0.10)	(0.14)	(0.06)	(0.08)	(0.12)
Observations	464,758	449,047	433,161	256,490	251,398	235,512
Adjusted R-Squared	0.62	0.91	0.90	0.80	0.98	0.98
Mean Dep. Variable	0.60	0.61	0.61	0.85	0.87	0.88
Fixed Effects:						
Product × Borrower × Day	Yes			Yes		
Product × Borrower × Day × Financial Group		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

Notes: This table presents estimates of the probability of green products stating cashback as benefit in the owner-occupied segment, relative to the investor segment. In columns (1)-(3), we include all green products. In columns (4)-(6), we restrict the sample to top 7 lenders. These estimates are based on the whole sample period (May/27/2022 to September/30/2023). Product types, included in the fixed effects, are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. Appendix C provides a detailed description of the variables. In columns (2) and (5), standard errors are clustered by financial group. In the remaining columns, standard errors are clustered by lender. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B Appendix: Price Paid and EPC Data

B.1 Energy Performance Certificates data

The Energy Performance Certificates data contains all the certificates issued in England and Wales since October 2008. EPCs have been required by law since 2008 for all properties sold, built or rented. Existing homes that have not been sold or rented out since October 2008 are not required to have an EPC, so that they may not appear in the data. The full sample of EPC data contains 27.5 million certificates for 18.9 million unique residential properties. EPC data not only records a property's energy performance but also building stock information, such as its address and total floor area.

B.2 Index of Multiple Deprivation (IMD)

We merge the EPC data with the 2019 Index of Multiple Deprivation (IMD) data. The IMD is the official measure of relative deprivation in England. It combines 39 indicators across seven weighted domains—including income, employment, health, education, crime, housing, and living environment—to rank neighbourhoods (LSOAs) based on their level of deprivation. It captures multiple aspects of deprivation beyond just income and provides a relative ranking, not an absolute measure: it ranks all LSOAs in England on a relative scale, from 1 (most deprived) to 32,844 (least deprived).

To identify the LSOA corresponding to each property, we use the postcode provided in the EPC data and link it to an LSOA using the postcode-LSOA linking table published by the Office for National Statistics.

B.3 Land Registry Price Paid Data

We combine the EPC dataset with property transaction records from the HM Land Registry Open Data repository, which contains detailed information on all residential property sales in England and Wales since 1995. The transaction data include sale price, date, and full address, along with several property characteristics, such as an indicator for whether a property is newly built.

We merge each transaction in the Price Paid data with the certificate for the property that was issued closest in time to the transaction date. The merge is done using the property address. We proceed in steps:

1. **Postcode filtering:** for each property in the Price Paid dataset, we extract the postcode and retrieve all corresponding addresses in the EPC dataset that share the same postcode. We remove all numbers and common words from the Price Paid and the corresponding EPC address (e.g. words such as "apartment" and "flat");

2. **Fuzzy matching**: we make all addresses lower case and use the Jaccard similarity to compare them. The Price Paid addresses are split into two parts: primary and secondary address. The EPC data addresses are split in 3 parts: Address 1, Address 2 and Address 3. We consider several permutations of these variables. If the distance is sufficiently close we consider the street names to be a match;

3. **Street name matching**: we restrict the sample to addresses where a match is found on the street name based on the fuzzy matching step;

4. **House number matching:** from this filtered set, we extract house numbers identifiers and determine whether they match exactly between the two datasets. Only addresses with a perfect numeric match are considered a match.

C Appendix: Moneyfacts data

As explained in Section 2.3, our data comes from Moneyfacts Group plc, an independent provider that collects daily information on mortgage products *on offer* in the UK. This dataset includes comprehensive information on mortgage products, comprising various numerical variables along with textual descriptions detailing product requirements, characteristics, and incentives. In this appendix section, we provide a detailed explanation of the variables used in our analysis and carefully describe the process of extracting numerical information from textual variables.

C.1 Data cleaning

Our sample period ranges from May 27, 2022 to September 30, 2023. The starting date is the day in which the green information (the green status and associated qualifying criteria and benefits) was added to the data. The main independent variable in our analysis is Green_{it}, which equals 1 for green mortgages and 0 otherwise. Given its importance, we carefully verify if it correctly captures green mortgages. Three major lenders in our sample — Lloyds Bank, Halifax, and Nationwide Building Society (BS) — offer cashback rewards on top of other product incentives, for properties eligible for a green mortgage. The product descriptions specify the criteria and corresponding rewards:

1. Lloyds Bank: "Green Home cashback for properties with an Energy Efficiency Band of A or B or a rating of 81 or higher £250. "

2. Halifax: "Green Home cashback for properties with an Energy Efficiency Band of A or B or a rating of 81 or higher £250. "

3. Nationwide BS: "Green reward for properties with an EPC score of 86 to 91 £250 or Green reward for properties with an EPC score of 92+ £500."

These green rewards are offered to qualifying mortgages on top of the other incentives for the non-qualifying (non-green) mortgages. However, for these lenders and products explicitly listing these incentives, Moneyfacts categorizes them only as green, without recording the non-green counterparts. To address this, we construct the non-green counterparts — identical products excluding the green cashback reward. For Nationwide BS (example 3), we assume a green reward of £250, as properties with an EPC score of 92+ make up a small proportion of the UK housing stock.

C.2 Variables

Table C1 below presents descriptions of the variables used in our analysis that did not require processing or extraction from textual sources. These variables are either numerical (recorded as such in the original dataset) or simple indicator or categorical variables.

Table C1. Variable Definitions

Variable	Description
Lender	Lender name and associated Moneyfacts company identifier
Product	Product name and associated unique Moneyfacts product identifier
Mortgage Type	Type of mortgage product: Owner-Occupied or Investor
Fixation Term	Number of years for the initial rate
Maximum LTV Ratio	Product maximum Loan-To-Value (LTV) ratio
Fixed Rate Mortgage	Indicator variable for fixed rate mortgages
Available to First Time Buyers	Indicator variable for products available to first time buyers
Available to Second Time Buyers	Indicator variable for products available to second time buyers
Available to Buyers Only	Indicator variable for products exclusively available to buyers, including first-time buyers, second-time buyers, or both
Available to Remortgagors	Indicator variable for products available to remortgagors
Available to Other Borrowers	Indicator variable for products available to other borrowers
Initial Rate	Interest rate charged for the initial period of the mortgage (fixation period)
Reversion Rate	Interest rate charged for the remainder of the mortgage (after the fixation period, if the borrower does not refinance the mortgage)
$\mathbb{1}$(Cashback)	Indicator variable for products that offer cashback
Available to New Builds (Binary)	Indicator variable for products available to new builds
Shared ownership (Binary)	Indicator variable if the product is offered under shared ownership or shared equity schemes, and zero otherwise

Many key variables in our analysis are extracted from textual data. In the remainder of this section, we describe the original data provided by Moneyfacts and the extraction process for each variable. After extracting the information from the textual variables, we manually check the outcome of the extraction process to assure its accuracy.

C.2.1 Requirements for Green Mortgages and Stated Benefits

As a central focus of our analysis is to understand the requirements for green mortgages and the associated financial benefits outlined by lenders. This information is compiled by Moneyfacts in the "Green Description" variable, that provides a textual description of the green product.

C.2.2 EPC Rating

We begin by extracting information regarding the property's EPC rating requirements for a mortgage to be classified as green. The "Green Description" provides this information for virtually all the green mortgages, under different forms. Below, we provide examples of the green description of three different products:

- Example 1: "Preferential rate for the purchase or remortgage of a property with an EPC rating of A-C."
- Example 2: "Cashback for the purchase of a property with an EPC of A or B."
- Example 3: "Cashback for the purchase or remortgage of a property when the energy efficiency rating is improved by 10 or more SAP points within 12 months of completion."

We classify the EPC rating requirement of each green product into the four categories we identify across all green products: (i) A; (ii) A or B; (iii) A, B or C, (iv) E or Above. For example, a product's EPC rating is classified as "A or B" if the green description contains "A or B" or equivalents such as "minimum of B" or "B and above". We follow this procedure for all green products, which allows us to map the EPC requirements for the vast majority (over 97%) of products on offer. In example 1, the EPC requirement is "A, B, or C," while in Example 2, it is "A or B." In Example 3, we cannot identify the required EPC rating (not reported).

We also classify each product based on whether it targets properties with a current required EPC rating or if it allows for future energy improvements. Products are classified as targeting a current EPC rating if their green description refers to a "property with an EPC"(or equivalents such as "property must have an EPC"), which is the case of examples 1 and 2. Alternatively, products are classified as allowing for energy efficiency improvements if their green description contains terms such as "improving", "upgrade" or "renovation", as in example 3.

C.2.3 Stated benefits

We extract information on the stated product benefits from the green description. We identify three types of benefits: (i) preferential rate if the green description contains "preferential rate" or "rate reduction", such as example 1; (ii) cashback if the green description contains "cashback" or "cash payments", such as examples 2 and 3; (iii) reduced fees if the green description contains "reduced fees". Products can fall into multiple categories if they reference more than one benefit. We are able to extract this information for over 98% of the products.

We identified some green products that state offering cashback, but the original cashback variable - $\mathbb{1}$(Cashback) in Table C1 - is recorded as zero. These cases correspond to around 84,000 green observations, and fall into 3 types of "Green Descriptions": (i) products that state cashback only (around 39,000 observations); (ii) products that state preferential rate *and* cashback (around 16,000 observations); (iii) products that state preferential rate *and/or* cashback (around 29,000 observations). We replaced the original cashback variable by one for the observations in the first case, as these observations explicitly state they offer cashback in the green description. For the products in the second case, we record them as stating both preferential rate and cashback. For the products in the third case, it is unclear if they offer cashback only, preferential rate only, or both. We adopt a conservative approach and record them as not stating cashback if the original cashback variable takes the value of zero. All the other products in this case remain recorded as offering both preferential rate and cashback.

C.2.4 Financial Incentives: Cashback Amount

We extract the cashback amount for the variable "Incentives" provided by Moneyfacts. This variable provides a textual description of all the incentives offered on the product, including cashback and waived fees. For example, one entry in this variable states: "Free valuation fees. No arrangement fees. £400 cashback On Completion". As we want to retrieve the cashback amount only, we focus on the part of the text that mentions cashback, and we extract the corresponding pound (£) amount (£400 in the example). Products may offer cashback exclusively to specific types of borrowers or provide different cashback amounts for different borrower types. In such cases, we extract the cashback amount separately for each borrower type and consider the mean across all types.[1] Finally, we replace the cashback amount by zero if the variable "Cashback" (described in Table C1) takes the value of zero.

C.2.5 Product Fees

We extract product fees from two variables: "Product Flat Fees", which specifies the amount in pounds, and "Product Percent Fees", which provides the fees as a percentage of the loan amount. Almost all products report either flat fees or percentage fees. There are three different types of fees: (i) completion fees; (ii) booking fees; (iii) arrangement fees. A product may report one or more types of fees, as illustrated in the following examples: "Arrangement £500 ; Booking £699" or "Completion £495". For both flat and percentage fees, we extract each product's reported completion, booking,

[1] In some cases, the cashback depends on the mortgage advance made by the borrower, such as in the following example: "£250 cashback £30K - £74999 of Mortgage Advance; £400 cashback Min £75K of Mortgage Advance". In these cases, we consider the midpoint (£325 in this case).

and arrangement fees, and then calculate the total fees as the sum of these three types. Finally, we set the total fees (both flat and percentage) to zero if the product states "No additional fees".

Table C2 below presents descriptions of the variables that we extracted from textual sources as described before.

Table C2. Variable Definitions (Continued)

Variable	Description
EPC Rating	EPC rating requirement for green product
Current EPC	Green product offered based on property's current EPC rating
Improving EPC	Green product offered for property's EPC rating improvement
Stated Benefit (Green): Preferential Rate	Product's green description states that the product offers a preferential rate
Stated Benefit (Green): Cashback	Product's green description states that the product offers cashback
Stated Benefit (Green): Reduced Fees	Product's green description states that the product offers reduced fees
Cashback Amount	Cashback amount
Flat Fees	Total fees (completion, booking and arrangement) in pounds
Percent Fees	Total fees (completion, booking and arrangement) in percentage of loan amount

C.2.6 Lenders

Lender Classification. We use the lender names provided by Moneyfacts to classify lenders into four categories: (i) the top 7 mortgage lenders; (ii) banks; (iii) building societies; (iv) others. We identify the largest 7 mortgage lenders from the annual ranking of mortgage lenders by outstanding balances provided by the UK Finance Association.[2] We distinguish between banks and building societies primarily using the lender names provided by Moneyfacts, which include terms such as "Bank" or "Building Society" for most lenders. We manually verify and supplement this classification by searching each lender name and organization type online. The "Others" category primarily consists of lending companies (shadow banks).

Brands and Subsidiaries. We construct a consolidated lender identification variable based on the ultimate ownership of brands or subsidiaries as originally reported by Moneyfacts. For each lender in our original dataset, we manually identify their parent company and assign the lender to this parent company if it corresponds to a brand or subsidiary under its ownership. For instance, under this new variable, Birmingham Midshires Solutions is assigned the lender name and identifier of Lloyds Bank, as

[2]UK Finance is an association that represents the banking and finance industry in the UK (UK Largest Mortgage Lenders).

it is one of its brands. We primarily extract this information from the "Brands" page of major lenders in the UK or from the websites of the individual lenders as originally reported by Moneyfacts.[3]

[3]Example from Lloyds Bank: Brands webpage.

D Appendix: Credit Risk using Interest Rate Shock

We exploit the UK mini-budget announcement of 23 September 2022, when the UK chancellor unexpectedly announced large unfunded tax cuts. The announcement was received with skepticism by markets, triggering large increases in swap rates, used by lenders for the pricing of mortgages. The mortgage market effects were significant, with a sharp decrease in the number of products on offer (Figures 1a and 1b) and a rise in the average interest rates. Figure 2 shows that prior to the mini-budget announcement interest rates were already increasing as a result of monetary policy tightening. However, the announcement triggered an unanticipated and large increase in interest rates.[1] The event was widely discussed in the news and very salient for borrowers.

The resulting increase in mortgage rates raised debt service requirements for new borrowers and remortgagors. Green property owners, facing lower energy bills, may have had greater capacity to manage the higher debt repayments. Consequently, if lenders use green mortgage products to attract borrowers with lower default risk, one would expect the financial advantages of green products relative to comparable non-green products to widen following the mini-budget announcement. The unexpected nature of the event, combined with the high-frequency nature of the data, strengthens the empirical identification.

We formally test this hypothesis by narrowing our analysis to a three-month window surrounding the mini-budget announcement, and estimating the temporal dynamics of the incentives over this period. We focus on variation across weeks, and create an indicator variable for each week of our sample and include interaction terms between each of these indicator variables and Green_{it}. Formally, we estimate the following empirical specification with the initial loan rate as the outcome variable:

$$y_{ijblt} = \alpha + \beta \cdot \text{Green}_{it} + \sum_{t=1}^{T} \theta_t \cdot \mathbb{1}(t) \cdot \text{Green}_{it} + \lambda_{jblt} + \epsilon_{ijblt}, \tag{4}$$

where $\mathbb{1}(t)$ denotes the dummy variable for week t and λ_{jblt} represents product type (j) $\times$ borrower type (b) $\times$ lender (l) $\times$ week (t) fixed effects.

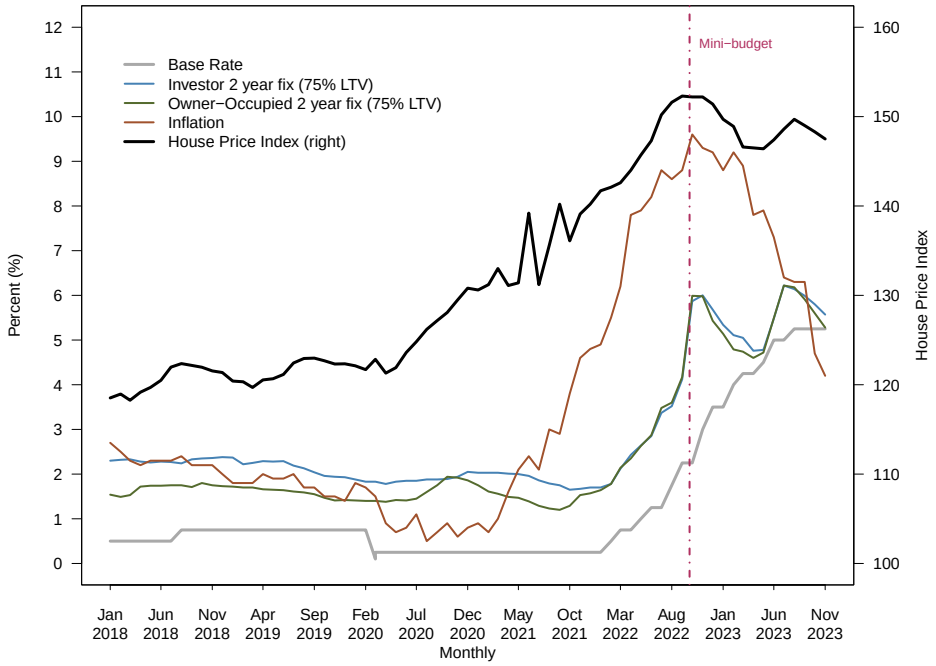
Appendix Figure D2 shows the estimates for the owner-occupied (Panel A) and investor (Panel B) segments of the market. We plot the estimated coefficients along with the corresponding 95% confidence intervals for the interaction terms between each weekly dummy and the indicator variable for green products. This event-study approach allows us to examine the time-series evolution of

[1] We confirm the significant impact on the interest rates using aggregated data from the Bank of England. Appendix Figure D1 shows large increases in the initial interest rates for the typical mortgage contracts (2-year fixed mortgages, for loans with 75% LTV ratio). Both inflation and the house price index reversed their upward trends following the event.

the difference in initial rate between green and comparable non-green products. We normalize this difference to zero in the first week of the estimation window, so all estimates can be interpreted relative to this baseline. Most of the estimated coefficients are not statistically different from zero. The only exception is for the owner-occupied market which shows an *increase* in the initial rate of green products compared to non-green ones after the interest rate rise (Appendix Figure D2b). This is exactly the opposite of what the cash-flow channel would predict.

Appendix Figure D3 shows the results for the probability of cashback (Panel A) and cashback amount (Panel B) as outcome variables, for the owner-occupied segment. The probability of green loans offering cashback declines following the interest rate rise, though the change is not statistically significant. In any case, the decline in the probability of cashback is the opposite of what the cash-flow channel would predict. Focusing on the cashback amount (Panel B), we again find no evidence that lenders improve the benefits of green products following the mini-budget announcement. Rather, sub-figure (d) documents a short-lived *negative* coefficient after the mini-budget announcement. Overall, the results based on the rise in borrowing costs around the mini-budget announcement reinforce our previous results that lower financing risk does not explain why lenders offer green products.

Figure D1. Mortgage Interest Rates, House Price Index and Inflation around Mini-Budget Announcement

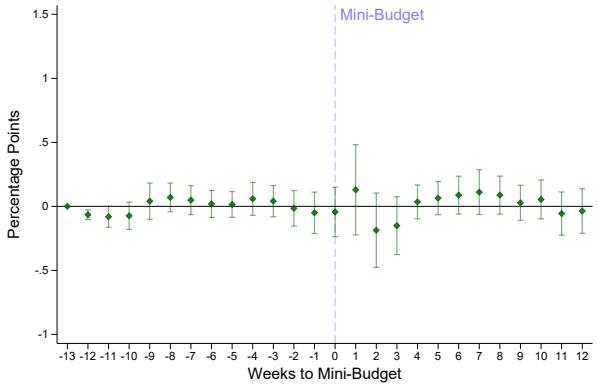


Notes: This figure shows the time-series of interest rates (Bank of England base rate, and both owner-occupied and investor 2-year fix rates for loans with 75% LTV ratio), inflation, and the house price inde (provided by the UK Land Registry). The vertical line identifies the mini-budget announcement.

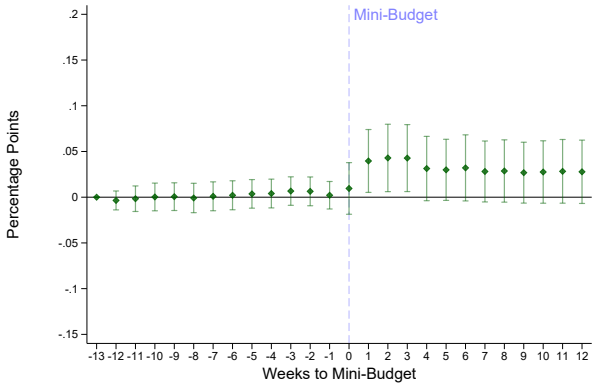
Figure D2. Initial Rate Around Mini-Budget Announcement

Panel A: Owner-Occupied

(a) Product × Borrower × Week

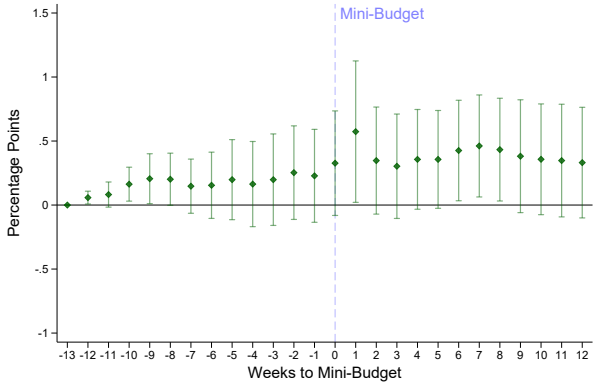


(b) Lender × Product × Borrower × Week

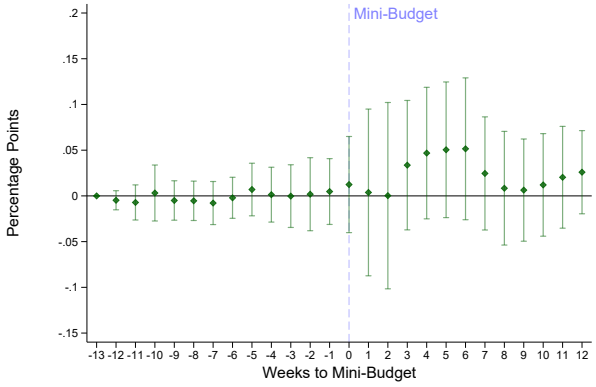


Panel B: Investor

(c) Product × Borrower × Week



(d) Lender × Product × Borrower × Week

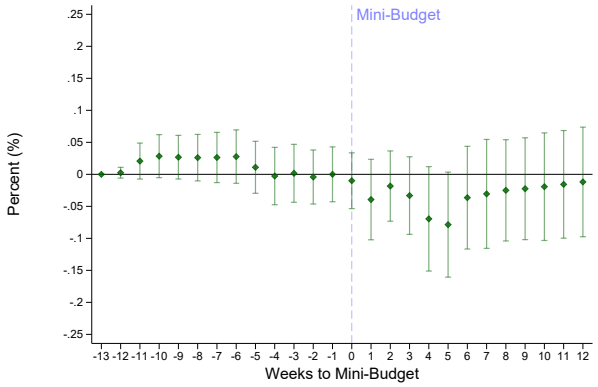


Notes: This figure shows the estimated coefficients and 95% confidence intervals of estimating Equation (4) with the initial loan rate as the outcome variable. We narrow our analysis to a three-month window surrounding the mini-budget announcement on 23 September 2022. Panel A refers to the owner-occupied market, while Panel B focus on the investor segment. Figures D2a and D2c show the estimation results when including Product Type × Borrower Type × Week fixed effects. Figures D2b and D2d show the estimation results when including Lender × Product Type × Borrower Type × Week fixed effects. Product types are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. The first week of the estimation window is omitted as the reference week. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables.

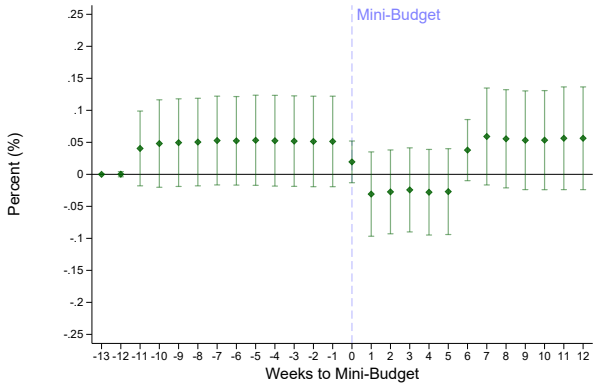
Figure D3. Cashback Around Mini-Budget Announcement in the Owner-Occupied Segment

Panel A: Probability of Cashback

(a) Product × Borrower × Week

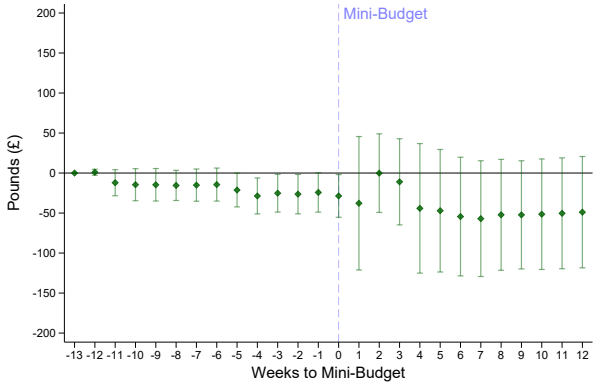


(b) Lender × Product × Borrower × Week

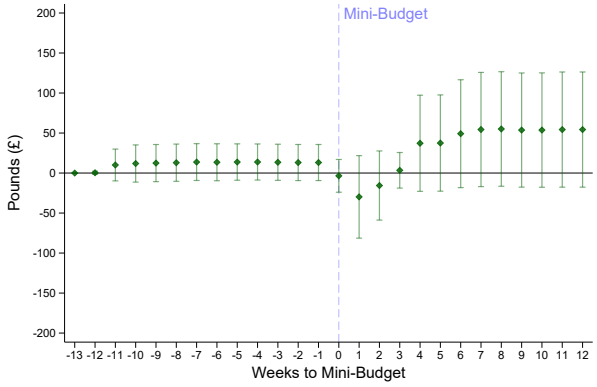


Panel B: Cashback Amount

(c) Product × Borrower × Week



(d) Lender × Product × Borrower × Week



Notes: This figure shows the estimated coefficients and 95% confidence intervals of estimating Equation (4) with 𝟙(cashback) (Panel A) and cashback amount (Panel B) as outcome variables. These estimates refer to the owner-occupied market. We narrow our analysis to a three-month window surrounding the mini-budget announcement on 23 September 2022. Figures D3a and D3c show the estimation results when including Product Type × Borrower Type × Week fixed effects. Figures D3b and D3d show the estimation results when including Lender × Product Type × Borrower Type × Week fixed effects. Product types are defined as groups of products that share the same interest rate type (fixed or variable), the same initial interest rate fixation period, and the same maximum loan-to-value ratio. Borrower types refer to the categories of borrowers for which the product is available, including first-time buyers, second-time buyers, remortgagors and others. Products may be available to any combination of these four borrower types. The first week of the estimation window is omitted as the reference week. We use the original classification of lenders provided by Moneyfacts. Appendix C provides a detailed description of the variables.