

Green Mortgages

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ABFER 12th Annual Conference

19-22 May 2025

Financing the green transition

- ▶ Banks play a central role in capital allocation in the economy and are key to financing the transition to a net-zero economy (\$9.2 trillion per year ([McKinsey \(2022\)](#))
- ▶ Among the assets they finance, **residential real estate** is particularly significant in the context of the transition
 - ▶ Residential buildings account for approximately 22% of global energy consumption and 17% of CO₂ emissions ([Programme, 2020](#); [International Energy Agency, 2023](#))
- ▶ However, significant barriers persist in financing energy efficiency improvements ([Giglio et al., 2021](#); [Berkouwer and Dean, 2022](#); [Lanteri and Rampini, 2023](#))
- ▶ In response, banks are increasingly offering products known as **Green Mortgages**
 - ▶ Energy efficient mortgages (EEMs)

What are green mortgages?

- ▶ The term 'green' refers to the energy efficiency of the properties being financed

Objective:

- ▶ Incentivize borrowers to own more environmentally friendly properties
- ▶ Purchase energy-efficient properties or retrofit existing ones

▶ FCA definition

What are green mortgages?



Barclays Green Buy-to-Let mortgages
Buy an energy efficient property and get a lower rate



Get rewarded for buying a greener home

With our Green Reward offer, you could get up to £500 cashback when you buy an energy-efficient home.



EKO £500 REWARD

For clients purchasing a property with high levels of energy efficiency.

Place your case



What is a Green Mortgage?

- Our Green Mortgages reward you for purchasing or remortgaging an energy efficient home by offering a reduced mortgage rate on a 2 year or 5 year fixed rate mortgage.
- If you're purchasing or remortgaging a property with a valid Energy Performance Certificate (EPC) rating of A or B then you could get mortgage with a lower interest rate with a Green Mortgage.

► Barclays

► Kensington

► Nationwide

► NatWest

This paper

1. What financial benefits do lenders offer on green mortgages?
 2. Test two explanations for why lenders offer green mortgages
- ▶ Daily data on the universe of mortgage loans *on offer* in the UK mortgage market — 'Mortgage Supermarket' (Benetton, 2021)
 - ▶ **Magnitude of financial benefits:** compare *green* to similar *non-green* products available on the market on the same day
 - ▶ Test two explanations for **why** lenders offer green mortgages:
 - ▶ **Lower financing risk**, as more energy-efficient properties are less expensive to run and have higher collateral value
 - ▶ **Market segmentation**, as part of lenders' product differentiation strategy and customer acquisition

Preview of the results

I: Characterization of green mortgages

- ▶ Green products are significant and have been growing in prominence, particularly in the owner-occupied segment — 10% to 15% during our sample period
- ▶ Offered by private lenders, without government subsidies or regulatory requirements
- ▶ The vast majority of green mortgages offered are based on the current energy rating of the property (97%) instead of future improvements in energy efficiency (3%)
- ▶ Two types of financial benefits: **preferential rate** and **cashback**
 - ▶ Owner-occupied segment: preferential rate (39%) and cashback (76%)
 - ▶ Landlord segment: preferential rate (78%) and cashback (14%)
- ▶ May reflect differences in borrowers' financial conditions

Preview of the results

II: Financial benefits on green mortgages

▶ Preferential rate:

- ▶ *Across* lenders: 35 b.p. discount → annual benefits of £700
- ▶ *Within* lender: 9 b.p discount → annual benefits of £180
- ▶ Similar in owner-occupied and landlord segments

▶ Cashback:

- ▶ Similar *across* and *within* lenders: 52-53% more likely to offer cashback
- ▶ Average equivalent annual cashback amount £49-56 higher

- ▶ Products with preferential rates offer more significant financial benefits
- ▶ In contrast, green products offering cashback provide significantly smaller financial gains

Preview of the results

III: Potential explanations

- ▶ Evidence does not support lower financing risk
- ▶ Evidence supporting customer acquisition
 - ▶ Particularly for cashback-based products

Related Literature

1. Debt contracts targeting climate change + bank lending to firms for climate transition

(Zerbib (2019); Tang and Zhang (2020); Flammer (2021); Baker et al. (2022); Kim et al., (2022); Du et al., (2023); Flammer et al., (2024); Kacperczyk and Peydro (2022); Houston and Shan (2022); Sachdeva et al. (2024); Green and Vallee (2024); Ivanov et al. (2024))

→ *Menu of green mortgages and their features/benefits (green transition)*

2. Climate change impacts mortgage markets + energy efficiency gap + credit for the adoption of energy savings technologies (government interventions)

(Issler et al., (2020); Gete and Tsouderou, (2021); Allcott and Greenstone, (2012); Berkouwer and Dean (2022); Adelino and Robinson, (2023); Bellon et al., (2024); Fowlie et al. (2018); Clara et al. (2024))

→ *Provision of credit by the private sector and loan features offered by lenders*

3. Motivations of banks to originate green lending

Giannetti et al., (2023); Haushalter et al., (2023); De Haas (2024); Morse and Sastry (2024); de Bandt et al. (2023)

→ *Heterogeneity in the nature and magnitudes of the benefits of green mortgages*

The UK mortgage market

'Mortgage Supermarket' ([Benetton, 2021](#)):

- ▶ Many different products on offer each day, by different lenders, and with different characteristics
- ▶ **Initial period of discounted and fixed interest rate** (2- and 5-years), and most borrowers refinance their loans after this period
- ▶ Two distinct segments: owner-occupied (70% of mortgages products) and buy-to-let

Moneyfacts Group Plc data ([Coen et al. \(2023\)](#); [Benetton et al. \(2024\)](#)):

- ▶ Universe on mortgages *on offer* in the UK
- ▶ Daily detailed information on: (i) market segment; (ii) product characteristics (including green status and requirements); (iii) lender identity
- ▶ Around 180,000 unique mortgage contracts (4M obs. — 480,000 green obs.) between May 27, 2022 and September 30, 2023

▶ Green Mortgages in the UK

Financial Benefits on Green Mortgages

Estimating the green premium *on offer*

Econometric Specification:

$$y_{ijblt} = \alpha + \beta \cdot \text{Green}_i + \lambda_{jbt} + \varepsilon_{ijblt} \quad (1)$$

- ▶ λ_{jbt} : **product** type (j) \times **borrower** type (b) \times **day** (t) fixed effects
 - ▶ Product types: interest rate type, initial interest rate fixation period, maximum LTV ratio
 - ▶ Borrower types: first-time buyers, second-time buyers, remortgagors and others
 - ▶ Products offered on the same day
- ▶ Products offered by the same lender \rightarrow **lender** (l) fixed effects
- ▶ Standard errors clustered by lender
- ▶ β compares benefits using variation across green and non-green products of the same type, offered to similar borrowers, on the same day, by the same lender

Magnitude of the financial benefits: Initial rate

Green Products Stating "Preferential Rate" as a Benefit						
Dependent Variable:	Initial Rate (%)					
Segment:	Owner-occupied			Landlord		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.35 (0.30)	-0.35* (0.19)	-0.09** (0.04)	-0.36 (0.23)	-0.30 (0.18)	-0.11*** (0.01)
Constant	5.53*** (0.17)	5.53*** (0.13)	5.56*** (0.00)	5.90*** (0.19)	5.91*** (0.15)	5.94*** (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

- ▶ Green products offer an average 35 b.p. discount relative to similar non-green products
- ▶ Conditioning on similar products offered by the same lender, the discount decreases to 9 b.p.

Magnitude of the financial benefits: Cashback

Dependent Variable:	Green Products Stating "Cashback" as a Benefit					
	Cashback (Binary)			Cashback Amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.62*** (0.06)	0.53*** (0.08)	0.52*** (0.14)	295.98*** (55.79)	241.76*** (43.64)	211.25*** (43.75)
Constant	0.29*** (0.03)	0.30*** (0.03)	0.31*** (0.01)	123.20*** (16.74)	128.95*** (16.22)	135.22*** (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

- ▶ Green products are 52-53% more likely to offer cashback
- ▶ Average cashback amount is £211-241 higher

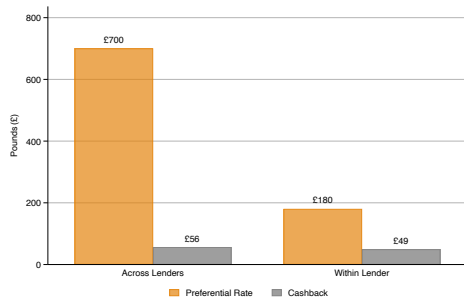
Back-of-the-envelope calculations

- ▶ Average owner-occupied mortgage in the UK:
 - ▶ Loan amount = £200,000
 - ▶ 5-year fixation period
 - ▶ Initial interest rate (discount rate) = 5.26% (or 5% within top 7 lenders)

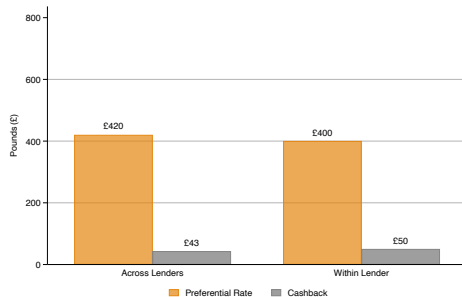
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(a) All lenders



(b) Top 7 lenders



Additional Results

- ▶ Lender heterogeneity [▶ Go](#)
- ▶ *Financial group* fixed effects (based on ultimate ownership) [▶ Go](#)
- ▶ Other contractual features:
 - ▶ Product fees [▶ Go](#)
 - ▶ Reversion rate [▶ Go](#)
- ▶ Interaction between stated benefits and contractual features [▶ Go](#)

Default Risk:

Cash-flow and collateral value channels

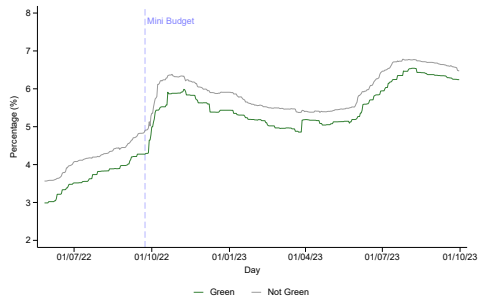
Default Risk

- ▶ All else equal, borrowers seeking mortgages for green properties have **lower financing risk**
- ▶ **Cash-flow channel:**
 - ▶ Green properties are less expensive to run \Rightarrow greater capacity to service debt
 - ▶ Particularly relevant in periods of high interest rate
 - ▶ Under this channel, \uparrow interest rate \Rightarrow \uparrow financial benefits of green mortgages
 - ▶ *How to test:* exploit mini-budget announcement [▶ Go](#)
 - ▶ Alternatively: changes in energy prices

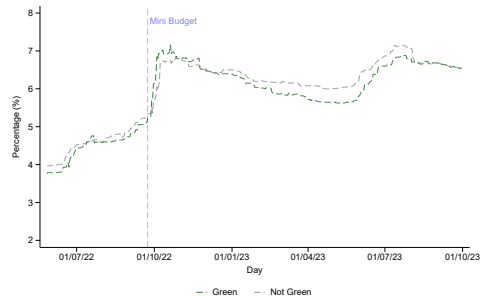
Default Risk

Average Initial Interest Rate

(a) Owner-occupied



(b) Landlord



Default Risk

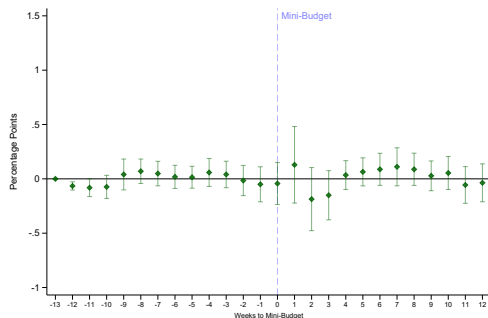
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 - ▶ Under this channel, \uparrow interest rate $\Rightarrow \uparrow$ financial benefits of green mortgages
 - ▶ *How to test:* exploit mini-budget announcement [▶ Go](#)
 - ▶ Alternatively: changes in energy prices [▶ Go](#)
- ▶ **Collateral value channel:**
 - ▶ Green properties have higher value ('green premium') and are resilient to 'brown discount'
 - ▶ Particularly important for loans with high LTV ratios
 - ▶ Under this channel, \uparrow LTV ratio $\Rightarrow \uparrow$ financial benefits of green mortgages
 - ▶ *How to test:* heterogeneity by LTV ratio [▶ Go](#)

Cash-flow channel

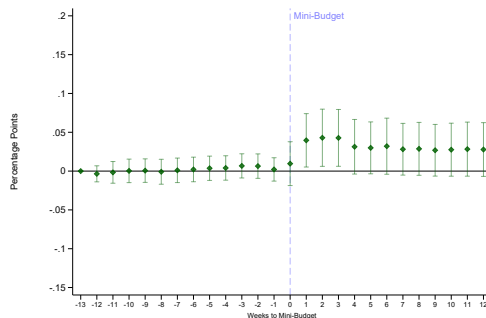
- 3-month window around the mini-budget announcement — **Owner-occupied**

$$\text{Initial Rate}_{ijblt} = \alpha + \beta \cdot \text{Green}_i + \sum_{t=1}^T \theta_t \cdot \mathbb{1}(t) \cdot \text{Green}_i + \lambda_{jblt} + \varepsilon_{ijblt} \quad (2)$$

(a) Product \times Borrower \times Week



(b) Lender \times Product \times Borrower \times Week

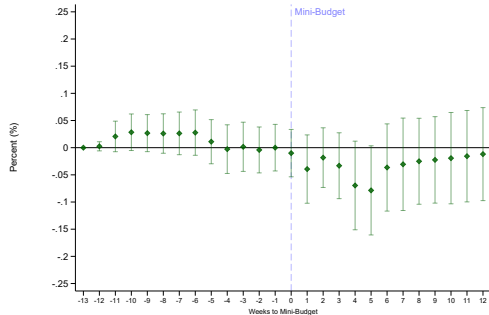


Cash-flow channel

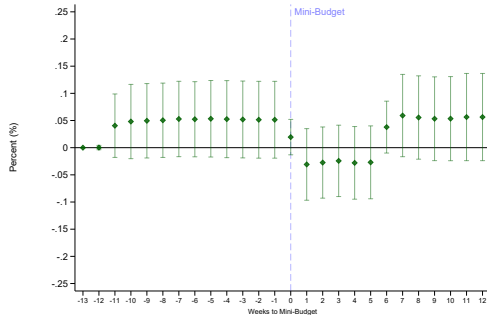
- 3-month window around the mini-budget announcement — **Owner-occupied**

$$\text{Cashback}_{ijblt} = \alpha + \beta \cdot \text{Green}_i + \sum_{t=1}^T \theta_t \cdot \mathbb{1}(t) \cdot \text{Green}_i + \lambda_{jblt} + \varepsilon_{ijblt} \quad (2)$$

(a) Product \times Borrower \times Week



(b) Lender \times Product \times Borrower \times Week



Collateral value channel

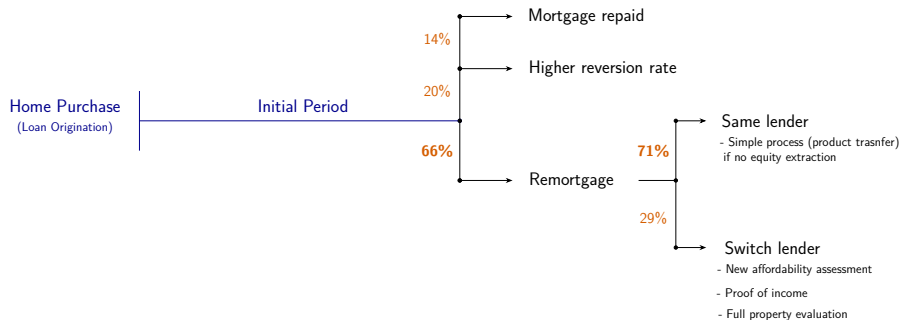
Segment:	Owner-occupied						Landlord	
Dependent Variable:	Initial Rate (%)		Cashback (Binary)		Cashback Amount (£)		Initial Rate (%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Green	-0.39 (0.24)	-0.05* (0.02)	0.40*** (0.13)	0.39** (0.17)	168.57*** (34.06)	131.84** (65.85)	-0.17 (0.19)	-0.10*** (0.01)
Green × 65 < LTV Ratio ≤ 75	-0.01 (0.12)	-0.02 (0.01)	-0.11 (0.09)	-0.09 (0.06)	-19.51 (46.30)	-14.54 (38.36)		
Green × 75 < LTV Ratio ≤ 85	0.23 (0.19)	0.01 (0.02)	-0.09 (0.08)	-0.01 (0.07)	-12.61 (46.74)	26.37 (42.69)		
Green × LTV Ratio > 85	0.36 (0.25)	0.03 (0.02)	-0.01 (0.07)	0.12 (0.08)	-1.15 (28.33)	41.74 (29.55)		
Green × LTV Ratio = 70							-0.33 (0.22)	0.00 (0.01)
Green × LTV Ratio = 75							0.09 (0.19)	0.05 (0.06)
Green × LTV Ratio > 75							0.45*** (0.17)	0.35*** (0.10)
Constant	5.51*** (0.13)	5.52*** (0.00)	0.30*** (0.03)	0.30*** (0.02)	128.94*** (15.96)	133.48*** (8.65)	5.92*** (0.15)	5.96*** (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

► **Does not support** the higher collateral value explanation

Market Segmentation

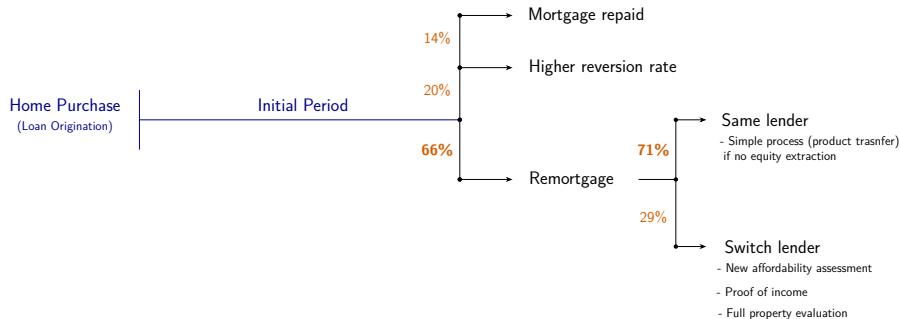
Customer acquisition: cashback offers to buyers only

- We leverage distinctive features of the UK mortgage market (Belgibayeva et al., 2024))



Customer acquisition: cashback offers to buyers only

- We leverage distinctive features of the UK mortgage market ([Belgibayeva et al., 2024](#))



- Products are differentially available to buyers and remortgagors (observable in the data)

Customer acquisition: cashback offers to buyers only

Dependent Variable:	Buyers Only (Binary)			Available to Remortgagors (Binary)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.31*** (0.10)	0.22** (0.10)	0.02 (0.03)	-0.23*** (0.07)	-0.10*** (0.04)	0.07* (0.04)
Cashback (Binary) [β_1]			-0.12 (0.13)			0.28*** (0.10)
Green \times Cashback (Binary) [β_2]			0.35*** (0.12)			-0.40*** (0.10)
Constant	0.32*** (0.03)	0.34*** (0.01)	0.38*** (0.04)	0.60*** (0.04)	0.58*** (0.00)	0.50*** (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 \times Day	Yes			Yes		
Product \times Day \times Lender		Yes	Yes		Yes	Yes

- Green products are much more (less) likely to be offered to buyers only (remortgagors)
- Driven exclusively by products offering cashback

Customer acquisition: cashback offers prevalent in the owner-occupied segment

Dependent Variable:	Stated Benefit: Cashback (Binary)					
Sample:	All Green Products			Top Seven Lenders Only		
	(1)	(2)	(3)	(4)	(5)	(6)
Owner-occupied Segment	0.517*** (0.183)	0.837*** (0.142)	0.721*** (0.191)	0.899*** (0.086)	0.931*** (0.088)	0.871*** (0.138)
Constant	0.222 (0.151)	-0.000 (0.104)	0.080 (0.139)	0.064 (0.058)	0.053 (0.078)	0.106 (0.122)
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

- Cashback-based products are more likely to be offered in the owner-occupied segment
- Holds *within* financial group or lender

Customer acquisition: cashback offers target new builds and financially constrained

Sample: Dependent Variable:	All Green Products		Top 7 Lenders Only	
	Available to New Builds (Binary)	Shared Ownership (Binary)	Available to New Builds (Binary)	Shared Ownership (Binary)
	(1)	(2)	(3)	(4)
Green	0.01 (0.03)	-0.08** (0.04)	-0.04 (0.09)	-0.19*** (0.02)
Cashback (Binary) [β_1]	0.07 (0.06)	0.12** (0.06)	0.18* (0.10)	0.22*** (0.07)
Green \times Cashback (Binary) [β_2]	0.09** (0.05)	0.08* (0.05)	0.09 (0.09)	0.13*** (0.04)
Constant	0.18*** (0.02)	0.15*** (0.02)	0.24*** (0.04)	0.27*** (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

Green products offering cashback are:

1. More likely to be available to new builds [▶ Market characteristics by EPC rating](#)
2. More likely to be offered under *Shared Ownership* schemes [▶ Definitions](#)

Main Take-Aways

- ▶ First large-sample characterization of green mortgages *on offer* available to both homeowners and investors
- ▶ These products offer financial benefits for energy-efficient properties
- ▶ Significant heterogeneity in the nature and magnitude of the financial benefits:
 - ▶ Preferential rate: 9-35 b.p. discount, annual gains of £180-£700
 - ▶ Cashback: annual gains of £49-£56
- ▶ Evidence does not support lower financing risk explanation
- ▶ Evidence supports customer acquisition explanation, as part of lenders' product differentiation strategy, for cashback-based products

THANK YOU

Green Mortgages

João F. Cocco, Bernardo Mendes, S. Lakshmi Naaraayanan

Appendix

FCA's view of green mortgages



The FCA's view of green mortgages

Speeches | First published: 19/04/2023 | Last updated: 19/04/2023



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What are green mortgages?

I am here to talk to you about a topic that is becoming increasingly important in today's mortgage market – green home finance, often known as 'green mortgages'. Let's start by exploring what we mean by 'green mortgages', as there isn't a commonly-accepted definition, and regulated returns data do not distinguish between 'green' and 'normal' mortgages.

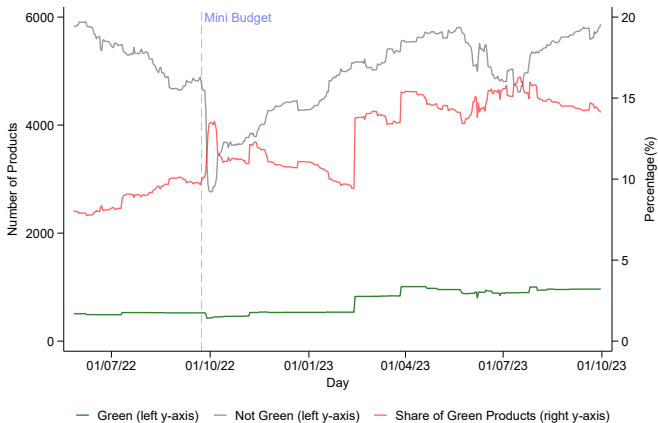
What we do know is that the reference to 'green' relates to the property the mortgage is taken out on, rather than the mortgage itself. So perhaps 'green home finance' is a more accurate term?

But whatever we call it, in essence we are referring to a mortgage which includes an incentive for people to either purchase an energy-efficient property, or improve the energy efficiency of an existing property. The incentives vary, but typically involve a discount to the fixed rate, or cashback payable after completion of the improvement.

► Back

Green mortgages in the UK

Owner-occupied Mortgage Market

[► Landlord Market](#)[► Share of Lenders](#)[► Back](#)

Green mortgages in the UK

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
Fixed Rate Mortgage (Binary)	0.90	0.30	1.00	1.00	0.85	0.36	1.00	1.00
Available to First Time Buyers (Binary)	0.69	0.46	0.00	1.00	0.66	0.47	0.00	1.00
Available to Second Time Buyers (Binary)	0.64	0.48	0.00	1.00	0.65	0.48	0.00	1.00
Available to Remortgagors (Binary)	0.36	0.48	0.00	1.00	0.60	0.49	0.00	1.00
Available to Other Borrowers (Binary)	0.00	0.00	0.00	0.00	0.07	0.26	0.00	0.00
Initial Rate (%)	5.26	1.18	4.43	6.14	5.51	1.52	4.48	6.37
Reversion Rate (%)	7.18	1.43	6.20	7.99	6.86	1.44	5.74	7.87
Cashback (Binary)	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
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 Benefit (Green): Preferential Rate (Binary)	0.39	0.49	0.00	1.00	—	—	—	—
Stated Benefit (Green): Cashback (Binary)	0.76	0.43	1.00	1.00	—	—	—	—
Stated Benefit (Green): Reduced Fees (Binary)	0.01	0.08	0.00	0.00	—	—	—	—

► Landlord Market

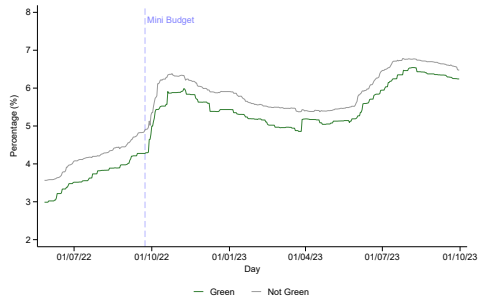
► By Lender Category

► Stated Benefits

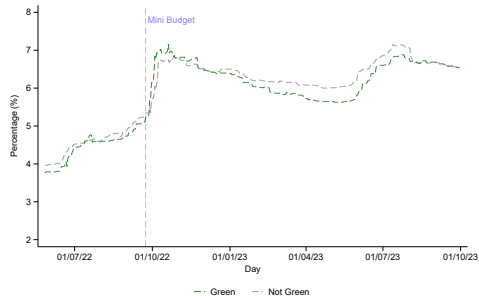
Green mortgages in the UK

Average Initial Rate

(a) Owner-occupied



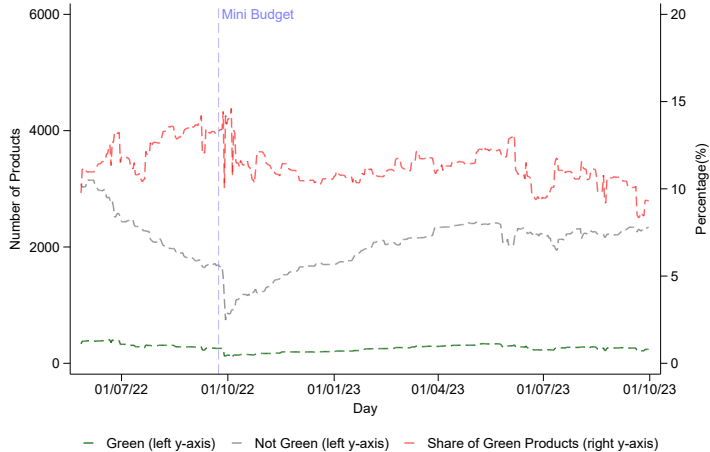
(b) Landlord



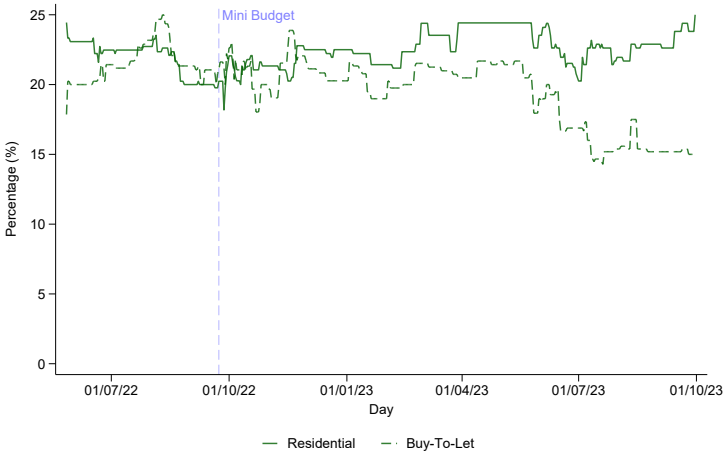
► Cashback

Green products are significant and increasingly prominent in the UK

Landlord Mortgage Market



Share of lender offering green mortgages



UK housing stock

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	Number of Dwellings (000s)
	A/B	C	A/B/C	D	E/F/G				
Pre-1919		21	21	56	23	275	1,894	5.7	5,099
1919-44		28	28	63	9	247	1,592	4.4	3,801
1945-64	1	47	48	45	6	231	1,370	3.7	4,550
1965-80	1	49	49	43	7	235	1,346	3.7	4,674
1981-90	3	57	60	34	6	227	1,251	3.4	1,660
Post-1990	13	70	83	15	2	176	1,074	2.8	5,376

► Back

Summary statistics: Landlord market

Panel B: Landlord								
	Green (<i>n</i> = 129,365)				Not Green (<i>n</i> = 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
Fixed Rate Mortgage (Binary)	0.91	0.28	1.00	1.00	0.79	0.41	1.00	1.00
Available to First Time Buyers (Binary)	0.10	0.30	0.00	0.00	0.18	0.39	0.00	0.00
Available to Second Time Buyers (Binary)	0.81	0.40	1.00	1.00	0.82	0.38	1.00	1.00
Available to Remortgagors (Binary)	0.80	0.40	1.00	1.00	0.81	0.39	1.00	1.00
Available to Other Borrowers (Binary)	0.04	0.19	0.00	0.00	0.08	0.27	0.00	0.00
Initial Rate (%)	5.70	1.30	4.84	6.65	5.91	1.69	4.84	6.75
Reversion Rate (%)	7.51	1.51	6.24	8.59	7.55	1.56	6.25	8.74
Cashback (Binary)	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
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 Benefit (Green): Preferential Rate (Binary)	0.78	0.41	1.00	1.00	—	—	—	—
Stated Benefit (Green): Cashback (Binary)	0.14	0.35	0.00	0.00	—	—	—	—
Stated Benefit (Green): Reduced Fees (Binary)	0.06	0.23	0.00	0.00	—	—	—	—

► Back

Summary statistics by lender category

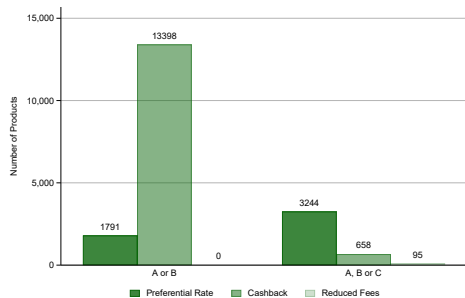
Panel A: Owner-occupied								
	Top 7 Lender		Banks		Building Societies		Others	
Number of Green Observations	226,266		63,024		6,791		50,696	
Number of Non-Green Observations	826,948		457,456		551,451		628,328	
Share of Green	0.21		0.12		0.01		0.07	
	Green	Non-Green	Green	Non-Green	Green	Non-Green	Green	Non-Green
Fixation Term (Years)	4.07	3.76	3.17	3.46	1.25	3.17	3.38	3.20
Maximum LTV Ratio (%)	78.36	78.73	78.19	77.81	84.03	80.17	78.25	74.74
Fixed Rate Mortgage (Binary)	0.92	0.86	0.87	0.94	0.15	0.70	0.93	0.90
Available to First Time Buyers (Binary)	0.61	0.47	0.66	0.72	0.99	0.70	1.00	0.83
Available to Second Time Buyers (Binary)	0.55	0.44	0.66	0.77	0.99	0.68	1.00	0.81
Available to Remortgagors (Binary)	0.22	0.41	0.43	0.71	0.62	0.62	0.89	0.76
Available to Other Borrowers (Binary)	0.00	0.14	0.00	0.02	0.00	0.09	0.00	0.00
Initial Rate (%)	5.00	4.90	5.07	5.45	4.95	4.86	6.74	6.92
Reversion Rate (%)	7.03	6.66	6.41	6.83	6.66	6.27	8.74	7.78
Cashback (Binary)	0.92	0.30	0.53	0.38	0.08	0.25	0.21	0.23
Cashback Amount (£)	366.76	116.08	397.04	187.13	18.00	95.88	150.61	103.53
Total Flat Fees (£)	550.72	586.16	165.71	700.68	565.51	571.49	799.05	676.79
Total Percent Fees (%)	0.00	0.00	0.00	0.04	0.24	0.05	0.00	0.02
Stated Benefit (Green): Preferential Rate (Binary)	0.11	—	1.00	—	0.92	—	0.79	—
Stated Benefit (Green): Cashback (Binary)	0.97	—	0.51	—	0.08	—	0.21	—
Stated Benefit (Green): Reduced Fees (Binary)	0.00	—	0.00	—	0.00	—	0.04	—

Summary statistics by lender category

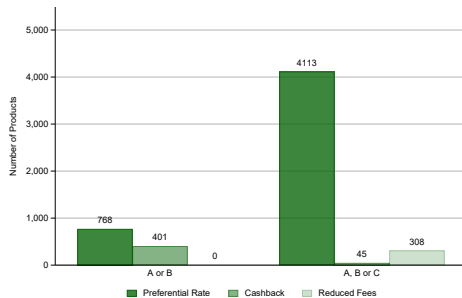
Panel B: Landlord								
	Top 7 Lender		Banks		Building Societies		Others	
Number of Green Observations	30,936		21,931		1,570		74,928	
Number of Non-Green Observations	223,841		161,642		202,751		422,750	
Share of Green	0.12		0.12		0.007		0.15	
	Green	Non-Green	Green	Non-Green	Green	Non-Green	Green	Non-Green
Fixation Term (Years)	3.56	3.43	3.94	3.51	2.79	3.08	4.17	3.33
Maximum LTV Ratio (%)	67.00	67.80	70.24	72.34	77.05	70.86	72.14	72.69
Fixed Rate Mortgage (Binary)	1.00	0.89	0.90	0.90	0.43	0.60	0.89	0.79
Available to First Time Buyers (Binary)	0.20	0.12	0.10	0.05	0.00	0.14	0.05	0.29
Available to Second Time Buyers (Binary)	0.35	0.66	0.87	0.89	0.95	0.67	0.97	0.95
Available to Remortgagors (Binary)	0.65	0.61	0.80	0.80	0.73	0.74	0.86	0.96
Available to Other Borrowers (Binary)	0.00	0.11	0.13	0.05	0.00	0.13	0.03	0.04
Initial Rate (%)	5.04	5.04	5.51	5.67	4.33	5.08	6.05	6.87
Reversion Rate (%)	7.44	7.27	7.22	7.76	6.37	6.74	7.66	8.06
Cashback (Binary)	0.33	0.33	0.25	0.11	0.53	0.19	0.24	0.05
Cashback Amount (£)	98.37	122.53	80.86	40.21	203.23	61.64	185.48	14.35
Total Flat Fees (£)	1,471.05	940.84	651.44	928.07	820.24	1,105.78	106.83	464.09
Total Percent Fees (%)	0.00	0.89	1.59	1.85	0.00	0.49	1.67	1.96
Stated Benefit (Green): Preferential Rate (Binary)	1.00	—	0.87	—	0.46	—	0.67	—
Stated Benefit (Green): Cashback (Binary)	0.00	—	0.00	—	0.05	—	0.24	—
Stated Benefit (Green): Reduced Fees (Binary)	0.00	—	0.00	—	0.00	—	0.10	—

Stated benefits of green mortgages

(a) Owner-occupied



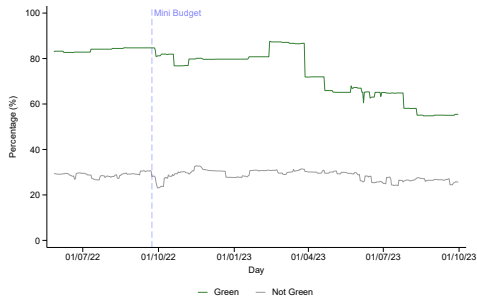
(b) Landlord



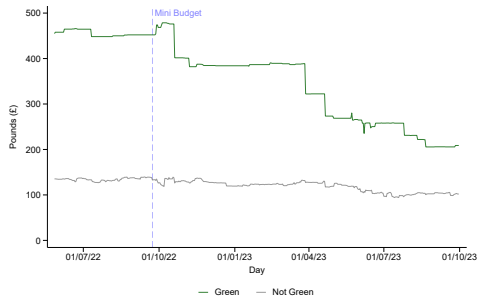
► Back

Time-series of probability of offering cashback and cashback amount

(a) Owner-occupied



(b) Landlord



► Back

Magnitude of the financial benefits: Initial rate

All Green Products						
Dependent Variable:	Initial Rate (%)					
Segment:	Owner-occupied			Landlord		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.39** (0.18)	-0.24* (0.14)	-0.04** (0.02)	-0.18 (0.23)	-0.13 (0.19)	-0.05 (0.05)
Constant	5.53*** (0.17)	5.51*** (0.13)	5.52*** (0.00)	5.91*** (0.19)	5.92*** (0.15)	5.96*** (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

Magnitude of the financial benefits: Initial rate

- Restricting the sample to products offered by top 7 lenders

Dependent Variable:	Initial Rate (%)					
Segment:	Owner-occupied			Landlord		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.19*** (0.03)	-0.21*** (0.04)	-0.20*** (0.01)	-0.19** (0.07)	-0.17*** (0.05)	-0.10*** (0.03)
Constant	4.90*** (0.02)	4.90*** (0.02)	4.90*** (0.00)	5.06*** (0.03)	5.06*** (0.02)	5.04*** (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

Magnitude of the financial benefits: Cashback

All Green Products						
Dependent Variable:	Cashback (Binary)			Cashback Amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.42*** (0.13)	0.34*** (0.13)	0.39** (0.15)	206.17*** (52.85)	158.60*** (41.50)	145.24** (65.51)
Constant	0.29*** (0.03)	0.30*** (0.03)	0.30*** (0.02)	122.50*** (16.39)	128.96*** (15.96)	133.55*** (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

Magnitude of the financial benefits: Cashback

- Restricting the sample to products offered by top 7 lenders

Dependent Variable:	Cashback (Binary)			Cashback Amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.61*** (0.08)	0.50*** (0.14)	0.55*** (0.16)	249.04*** (47.35)	187.33*** (29.39)	214.76*** (31.83)
Constant	0.30*** (0.05)	0.33*** (0.05)	0.31*** (0.03)	117.05*** (22.58)	129.52*** (16.79)	122.25*** (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

Lender heterogeneity

► Adjusted R-Squared Across Various Fixed Effects Specifications

Dependent Variable:	Initial Rate (%)	Cashback (Binary)	Cashback Amount (£)
Fixed Effects Specification:			
Owner-occupied			
Product × Borrower × Day	0.64	0.27	0.19
Product × Borrower × Day × Lender Category	0.82	0.35	0.37
Product × Borrower × Day × Lender	0.95	0.67	0.60
Landlord:			
Product × Borrower × Day	0.62	0.18	0.16
Product × Borrower × Day × Lender Category	0.73	0.32	0.29
Product × Borrower × Day × Lender	0.94	0.50	0.45

► Back

Financial groups

- Consolidated lender classification based on the ultimate ownership of brands or subsidiaries

Dependent Variable:	Initial Rate (%)					
Segment:	Owner-occupied			Landlord		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.35 (0.31)	-0.35* (0.20)	-0.09** (0.04)	-0.36 (0.24)	-0.30 (0.18)	-0.13*** (0.02)
Constant	5.53*** (0.18)	5.53*** (0.14)	5.55*** (0.00)	5.90*** (0.19)	5.91*** (0.16)	5.94*** (0.00)
Observations	2,591,029	2,563,852	2,373,853	1,110,279	1,097,708	1,046,444
Adjusted R-Squared	0.53	0.64	0.94	0.53	0.62	0.94
Mean Dep. Variable	5.51	5.52	5.54	5.87	5.88	5.93
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Financial Group			Yes			Yes

Financial groups

- Consolidated lender classification based on the ultimate ownership of brands or subsidiaries

Dependent Variable:	Cashback (Binary)			Cashback Amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.62*** (0.07)	0.53*** (0.10)	0.51*** (0.14)	295.98*** (63.27)	241.76*** (48.45)	206.06*** (48.88)
Constant	0.29*** (0.03)	0.30*** (0.03)	0.31*** (0.01)	123.20*** (17.03)	128.95*** (17.10)	136.04*** (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

► Back

Product fees

► Flat fees charged on products offered

Dependent Variable:	Flat Fees (£)					
Segment:	Owner-occupied			Landlord		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-94.24 (65.31)	-43.22 (60.78)	28.04 (27.80)	-87.14 (255.54)	-73.21 (218.48)	-157.96 (199.79)
Constant	625.24*** (26.82)	618.92*** (22.94)	611.47*** (3.75)	841.07*** (56.76)	833.47*** (46.37)	832.94*** (22.25)
Observations	2,774,254	2,750,445	2,531,803	748,365	735,559	678,843
Adjusted R-Squared	0.04	0.08	0.22	0.08	0.12	0.32
Mean Dep. Variable	613.47	613.48	615.25	831.70	825.48	815.35
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

Product fees

► Percentage fees charged on products offered

Dependent Variable:	Percent Fees (%)					
Segment:	Owner-occupied			Landlord		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.01* (0.01)	-0.01* (0.00)	-0.00 (0.00)	-0.22 (0.28)	-0.13 (0.23)	-0.14 (0.11)
Constant	0.02*** (0.01)	0.02*** (0.01)	0.01*** (0.00)	1.65*** (0.13)	1.66*** (0.08)	1.74*** (0.02)
Observations	1,208,625	1,190,379	909,065	772,302	757,500	715,333
Adjusted R-Squared	0.20	0.25	0.97	0.21	0.35	0.62
Mean Dep. Variable	0.02	0.02	0.01	1.62	1.65	1.72
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

Reversion rate

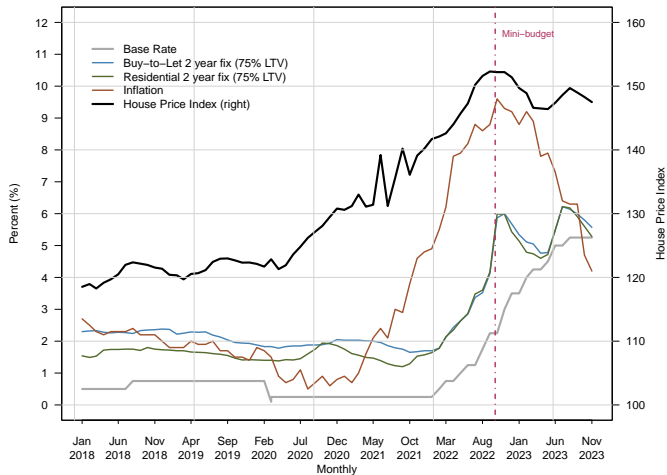
Dependent Variable:	Reversion Rate (%)					
Segment:	Owner-occupied			Landlord		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	0.07 (0.14)	0.14 (0.10)	-0.00 (0.00)	-0.00 (0.15)	0.06 (0.13)	-0.02* (0.01)
Constant	6.89*** (0.10)	6.88*** (0.08)	6.94*** (0.00)	7.55*** (0.10)	7.55*** (0.09)	7.59*** (0.00)
Observations	2,662,324	2,638,494	2,428,978	1,071,034	1,060,557	998,881
Adjusted R-Squared	0.74	0.78	0.99	0.64	0.73	0.98
Mean Dep. Variable	6.90	6.90	6.94	7.55	7.56	7.59
Fixed Effects:						
Product × Day	Yes			Yes		
Product × Borrower × Day		Yes			Yes	
Product × Borrower × Day × Lender			Yes			Yes

Interaction between stated benefits and contractual features

Dependent Variable:	Owner-occupied Segment				
	Initial Rate (%)	Cashback (Binary)	Cashback amount (£)	Flat fees (£)	Reversion Rate (%)
	(1)	(2)	(3)	(4)	(5)
Green × Stated Benefit: Cashback	-0.01 (0.00)	0.66*** (0.14)	281.50*** (29.16)	-23.66 (26.37)	-0.00 (0.00)
Green × Stated Benefit: Preferential Rate	-0.20*** (0.06)	-0.12 (0.11)	-119.11 (94.06)	116.08* (65.89)	-0.00* (0.00)
Green × Stated Benefit: Both	0.05 (0.13)	0.15 (0.14)	34.31 (40.06)	87.05 (170.35)	-0.00* (0.00)
Constant	5.52*** (0.00)	0.30*** (0.01)	132.93*** (3.73)	611.77*** (3.95)	6.94*** (0.00)
Observations	2,555,156	2,555,156	2,555,136	2,531,765	2,428,942
Adjusted R-Squared	0.95	0.65	0.66	0.22	0.99
Mean Dep. Variable	5.51	0.35	152.95	615.25	6.94
Fixed Effects:					
Product × Borrower × Day × Lender	Yes	Yes	Yes	Yes	Yes

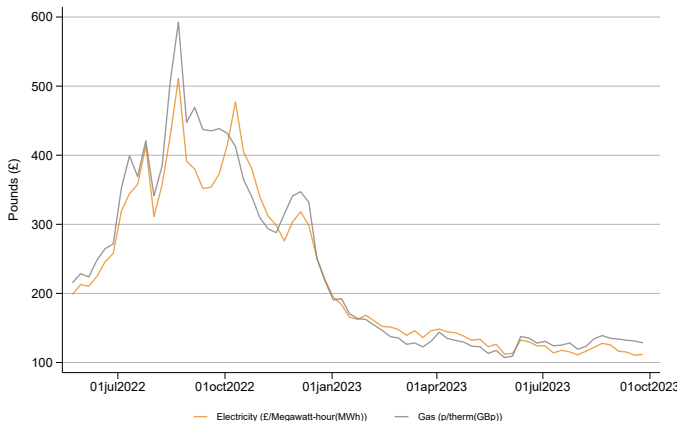
► Back

Mini-Budget Announcement



Energy Prices

- ▶ Wholesale forward delivery contracts price (Source: Ofgem)
- ▶ Weekly frequency
- ▶ The cost of suppliers purchasing wholesale energy is the largest component of a customer's bill



Energy Prices

► Weekly electricity price

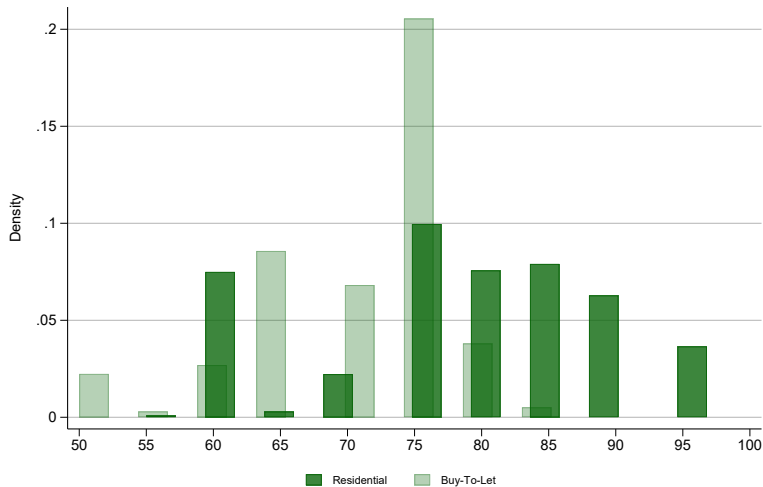
Dependent Variable:	Owner-occupied Segment					
	Initial Rate (%)			Cashback amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.0817*** (0.0099)	-0.0768*** (0.0106)	-0.0739*** (0.0116)	285.2859*** (32.6096)	287.5036*** (34.5314)	286.7157*** (34.5834)
Green × Weekly Electricity Price	-0.0001 (0.0002)			-0.3567 (0.2566)		
Green × Weekly Electricity Price (2-Weeks Lead)		-0.0001 (0.0002)			-0.3722 (0.2707)	
Green × Weekly Electricity Price (4-Weeks Lead)			-0.0001 (0.0002)			-0.3733 (0.2747)
Constant	5.5565*** (0.0020)	5.5565*** (0.0020)	5.5565*** (0.0021)	135.1765*** (4.3449)	135.1771*** (4.3321)	135.1798*** (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

Energy Prices

► Weekly gas price

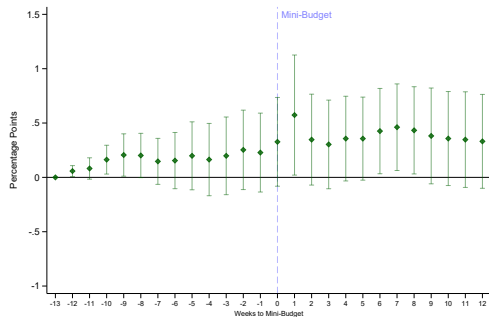
Dependent Variable:	Owner-occupied Segment					
	Initial Rate (%)			Cashback amount (£)		
	(1)	(2)	(3)	(4)	(5)	(6)
Green	-0.0786*** (0.0112)	-0.0748*** (0.0118)	-0.0733*** (0.0126)	279.6319*** (30.1707)	279.8198*** (30.7353)	278.9698*** (30.6376)
Green × Weekly Gas Price	-0.0001 (0.0001)			-0.3165 (0.2267)		
Green × Weekly Gas Price (2-Weeks Lead)		-0.0001 (0.0001)			-0.3209 (0.2325)	
Green × Weekly Gas Price (4-Weeks Lead)			-0.0001 (0.0001)			-0.3212 (0.2346)
Constant	5.5565*** (0.0020)	5.5565*** (0.0021)	5.5565*** (0.0021)	135.1797*** (4.3574)	135.1816*** (4.3569)	135.1845*** (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

Distribution of maximum LTV for green products

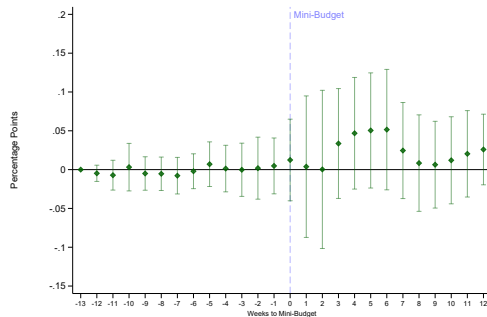


Cash-flow channel: Landlord Market

(a) Product \times Borrower \times Week



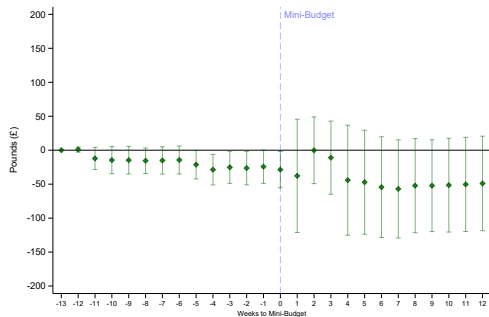
(b) Lender \times Product \times Borrower \times Week



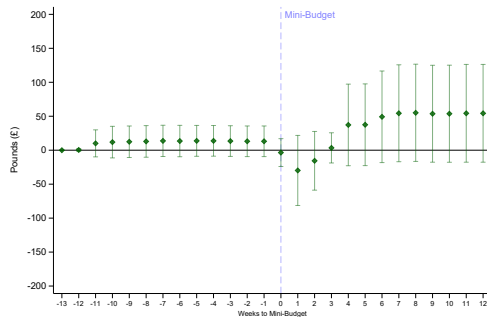
► Back

Cash-flow channel: Cashback amount

(a) Product \times Borrower \times Week



(b) \times Product \times Borrower \times Week

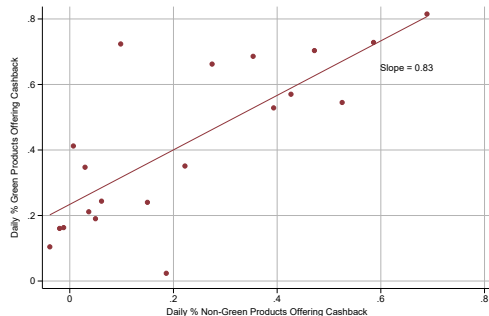


► Back

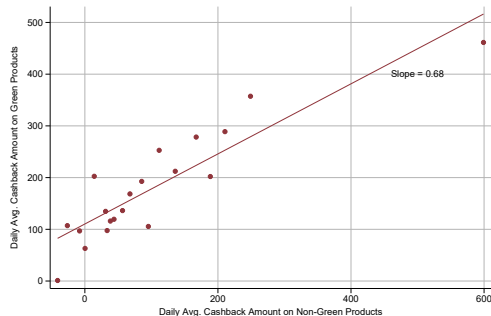
Cashback as acquisition strategy

- ▶ Lenders offering cashback on non-green products are also likely to do so for green products
- ▶ Suggests cashback on green mortgage is part of a broader customer acquisition strategy

(a) Cashback (Binary)



(b) Cashback Amount (£)



Market characteristics by EPC rating

	EPC Rating:						
	A	B	C	D	E	F	G
EPC Data (Full Sample):							
Nr. of Properties	80,266	2,814,350	6,536,408	7,963,413	3,228,962	824,070	244,960
Property Construction Year	2,006	2,005	1,971	1,950	1,938	1,930	1,923
Owner-Occupied (Binary)	0.69	0.58	0.44	0.60	0.66	0.71	0.71
Total Floor Area	114.43	86.65	77.76	87.45	97.19	107.79	102.12
Index of Multiple Deprivation (IMD) Rank (where 1 is most deprived)	17,254.06	16,206.48	14,258.47	15,444.79	15,752.64	16,024.52	14,535.48
Income Rank (where 1 is most deprived)	17,621.42	16,346.24	14,142.00	15,440.31	16,186.76	17,223.19	16,034.44
Employment Rank (where 1 is most deprived)	17,573.83	17,163.05	14,608.73	15,579.30	16,290.19	17,197.42	16,072.93
Education, Skills and Training Rank (where 1 is most deprived)	16,793.61	16,937.78	14,958.34	15,829.76	16,663.51	17,448.97	16,401.46
Price Paid (A/B/C) - EPC Merge Data (27/05/2022 - 30/09/2023):							
Nr. of Transactions	6,347	230,137	369,498				
Property Construction Year	2,015	2,017	1,972				
Transaction Price	500,969.31	405,439.18	351,034.83				
New Build	0.54	0.57	0.02				
Total Floor Area	126.71	97.45	90.48				
Index of Multiple Deprivation (IMD) Rank (where 1 is most deprived)	19,824.44	18,482.24	17,325.27				

► Back

Help to Buy schemes: Shared Ownership and Shared Equity

► Shared Ownership

- Buy a portion of the property (e.g., 25%) and pay rent on the rest
- Example: £200,000 home
 - Buy 25% share = £50,000
 - 10% deposit = £5,000; mortgage = £45,000
 - Pay rent on remaining £150,000 share
 - [► Source](#)

► Shared Equity

- Buy with a small deposit; government or provider offers a loan for part of the price
- Example: £200,000 home
 - 5% deposit = £10,000
 - 75% mortgage = £150,000
 - 20% equity loan = £40,000
 - Buyer fully owns the property
 - [► Source](#)