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Working Paper

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CESifo Working Paper, No. 8669

Provided in Cooperation with:
Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

Suggested Citation: Sejas-Portillo, Rodolfo; Comerford, David; Moro, Mirko; Stowasser, Till (2020) : Limited Attention in the Housing Market: Threshold Effects of Energy-Performance Certificates on Property Prices and Energy-Efficiency Investments, CESifo Working Paper, No. 8669, Center for Economic Studies and Ifo Institute (CESifo), Munich

This Version is available at:
https://hdl.handle.net/10419/229487

CESifo WORKING PAPERS

8669
2020

November 2020

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CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
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Limited Attention in the Housing Market: Threshold Effects of Energy-Performance Certificates on Property Prices and Energy-Efficiency Investments

Abstract

We study the effects of limited attention on property prices and energy efficiency (EE) investments in the housing market. Using a novel dataset, we analyse over 5 million residential property sale transactions in England and Wales, each containing information about sale price, property and location characteristics, and a mandatory energy performance certificate (EPC). The EPC includes a continuous energy cost rating (SAP rating) which is mapped into seven colour-coded rating bands (ranging from green A to red G). Applying a Regression Discontinuity Design (RDD), we document significant price discontinuities at the rating band thresholds. We estimate that - holding the underlying SAP score equal - being in a higher rating band increases the final sale price of a property between 0.8% and 2.5% ($2,000 and $6,625 based on average sale prices) depending on the threshold crossed. The presence of price discontinuities suggests that individuals are attentive to the simpler colour-coded rating band and partially inattentive to the more precise SAP rating. We present a simple model for estimating the degree of inattention and show that, for a given level of attention, rating bands reduce attention to the SAP rating by 25% on average. Importantly, the detected price discontinuities appear to influence market behaviour: Sellers whose property receives an EPC rating just below a threshold to the next-higher rating band are between 0.4% and 11% more likely to make last-minute EE investments before placing their property on the market. We discuss a number of recommendations of how to best leverage these threshold effects to improve policy design, which can be extended to other settings where the provision of simplified information creates reference thresholds.

JEL-Codes: D120, D830, L150, R210, R310, Q480.

Keywords: limited attention, heuristic decision-making, price discontinuities, housing market, anchoring and adjustment, energy policy, energy efficiency, energy performance certificates, EPC.

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October 2020

1 Introduction

The role of information processing by agents in market interactions is central to modern economic theory. Neo-classical economic models normally assume that agents, in order to make optimal decisions, process all of the information available to them within a utility maximising function. Yet, even when presented with all the relevant information, agents may not have the necessary skills, the cognitive ability (Simon 1955), the incentives (Stigler 1961) or the time to process or evaluate it as part of a complex utility maximisation calculation. A growing body of literature proposes models in which agents simplify decisions by processing only a subset of the available information, a heuristic referred to as inattention or limited attention (DellaVigna 2009, Gabaix 2019). In certain markets, policy makers may attempt to help inattentive agents make better decisions by requiring the provision of simplified information and thus reduce the complexity of processing information or acquiring the skills to do so.

In this paper we present evidence that requiring the provision of simplified information, in addition to the underlying detailed information it is based on, can create threshold effects and we discuss how these can be leveraged to improve policy design. We argue that these effects occur as attention is diverted from detailed information to less precise but easier to understand simplified information. While threshold effects represent imperfect optimisation by agents, it is important to note that the absence of simplified information would likely create other (potentially more harmful) market inefficiencies on its own. For instance, as mentioned above, agents may not have the skills or time to accurately interpret detailed information or they may endogenously anchor around other reference points to simplify decision making (e.g. the left-most digit of a number, a heuristic referred to as left-digit bias, see Lacetera et al. 2012). Moreover, as shown by Newell & Siikamäki (2014), the provision of simplified information can increase the salience and thereby the relative importance of a product's energy efficiency within the purchasing decision process, which coincides with the ultimate policy goal of introducing mandatory EE certificates in the first place. Thus, our policy recommendations do not argue against the provision of simplified information but instead for the design of policies and labels that account for selective attention and that actively leverage the threshold effects we identify.[1]

We study inattention and heuristic decision-making in the housing market by analysing the effect that energy efficiency (EE) information has on the final sale price of a property. We show that the provision of simplified information in the form of arbitrary EE rating bands, on top of a more comprehensive energy cost

[1]See Comerford et al. (2020) for a discussion of leveraging energy labels to incentivise retrofitting in the housing market.

rating (referred to as SAP rating and provided on a scale from 1 to 100), leads to price discontinuities at the rating band thresholds. Specifically, the SAP rating scale (raging from 1 to 100) is split into 7 rating bands, labelled with different letters and colours from green A to red G. Under the assumption of full attention, as the rating band classification does not provide additional information over the SAP rating, there should be no systematic price discontinuities at the thresholds. Using a novel dataset, we analyse over 5 million geocoded residential property sale transactions completed after the introduction of legislation that made it mandatory for sellers to provide an energy performance certificate (EPC) to potential buyers. For each transaction, we observe the sale date, price, property characteristics, location information and EPC at the date of sale. The EPC contains energy performance indicators including the SAP rating and the associated rating band.

We implement a regression discontinuity design (RDD) with local linear estimators and find statistically significant discontinuities at the rating band thresholds. We estimate that, all else equal, the sale price of a property increases between 0.8% and 2.5% on average when the SAP rating crosses a rating band threshold (compared to counterfactual predicted prices for the SAP rating without the higher rating band assigned). These results are robust to different modelling strategies, the inclusion of a wide range of baseline covariates (property characteristics, geographic area fixed effects and date fixed effects) and a set of comprehensive placebo tests. The sizes of these estimates are economically significant, as a back of the envelope calculation they range from £2,000 (0.8% at the D-C threshold with a mean sale price of £250,000 around the threshold) to £6,625 (2.5% at the G-F threshold with a mean sale price of £265,000 around the threshold). Using a simple model that accounts for the identified price discontinuities and the aggregated nature of rating band information, we estimate that, for a given level of attention paid to the EE label, rating bands reduce attention to the SAP rating between 12.5% (at the D-C threshold) and 34.2% (at the E-D threshold), with an average of 25.3%.

We also find evidence that some sellers make EE investments that improve the rating band of a property, for example from D to C, before marketing it for sale. We document that properties that had initial SAP scores that arbitrarily placed them close to the next rating band threshold were 0.4% to 11% more likely to receive EE investments. Our findings suggest that some sellers are aware of the price discontinuities and are willing to invest in EE before a sale, under the expectation of obtaining a higher selling price that covers both the EE investments and an additional price premium. These results suggest that policies can leverage threshold effects to improve overall welfare, for instance the investment incentives we identify can lead to a more energy efficient housing stock and thus help reduce CO_2 emissions from energy generation.

Irrespective of whether inattention is driven by behavioural biases (e.g. salience – Finkelstein 2009, Chetty et al. 2009) or deliberate attentional choice (i.e. agents minimising information acquisition costs – Stigler 1961, Caplin 2016), our results suggest that agents follow an anchoring and adjustment decision process (as proposed by Gabaix 2019 incorporating concepts from Tversky & Kahneman 1974). We argue that agents anchor at the simplified colour coded rating band and adjust with the more detailed SAP rating, where the partial nature of this adjustment leads to price discontinuities. Our results speak to domains beyond property markets. In the spirit of Mullainathan et al.'s (2008) model of coarse thinking, agents may transfer informational content from other situations into the housing market, for example home appliance EE ratings as they use a similar EE label. Regulators may attempt to frame how simplified information is provided to achieve policy objectives, for instance by using a green A as the most EE rating since an A grade is the highest in school and green is normally associated with the preferred outcome in a traffic-light style label.

Our paper is closely related to the existing literature on limited attention in market activities. Lacetera et al. (2012) and Englmaier et al. (2018) find evidence of limited attention in car markets,[2] which suggests individuals can be inattentive in durable product markets. Gilbert et al. (2012) and DellaVigna & Pollet (2009) document inattention in financial investment markets (e.g. the stock market).[3] Our paper provides evidence that limited attention also plays a role in high-value asset markets, such as the housing market, where consumers spend considerably more time and effort making purchasing decisions, but invest less frequently. Our paper also contributes to current research on limited attention as the result of the provision of simplified information. Pope (2009) studies the effect that simplified aggregate information, in the form of rankings, have on hospital non-emergency admissions and finds an effect even after accounting for the underlining objective information on which the rankings are based. Gilbert et al. (2012) find that stock market and government futures prices react sharply to a monthly summary statistic constructed from previously released detailed information. Although our research focuses on the provision of simplified aggregate information and the resulting threshold effects, it is also more broadly related to studies that find imperfect optimisation as the result of shrouded information (Chetty et al. 2009, Gabaix et al. 2006) or information that is visible but not considered when making decisions (Englmaier et al. 2018 and Lacetera et al. 2012). Our paper further contributes to the literature on limited attention by discussing policy implications when leveraging the threshold effects generated by simplified information.

[2]Other authors expand on the topic, for instance Busse et al. (2013) who extend the analysis of Lacetera et al. (2012).

[3]Similarly, other authors provide further evidence of inattention in financial markets, including Hirshleifer et al. (2009).

This paper is also related to the literature on housing energy efficiency, particularly the work by Comerford et al. (2018) who provide evidence of bunching at the EPC rating band thresholds after the introduction of the EPC legislation in the UK.[4] In our study we find evidence that some sellers actively invest to get their property to the next rating band, supporting the mechanism proposed by Comerford et al. (2018), and thus suggesting that they are aware of rating band price premiums. We also confirm the causal effect of energy labels on property selling prices in the UK presented by Fuerst et al. (2015).

The subsequent sections are organised as follows. Section 2 explains EPCs in the context of the UK housing market. Section 3 describes our data. Sections 4 and 5 present our empirical strategy and the results of our main analysis. Section 6 discusses the implications of our results for market behaviour. Section 7 discusses the wide range of robustness checks we perform and Section 8 concludes.

2 Energy Performance Certificates in the UK Housing Market

Before entering the market, residential and commercial properties in the UK are required to undergo an energy performance audit and the resulting Energy Performance Certificate (EPC) must be provided to potential buyers or tenants at the earliest point of contact (e.g. as part of marketing materials or during an arranged viewing). The audit and EPC requirements were introduced in the *Energy Performance of Buildings (Certificates and Inspections) (England and Wales) 2007* which came into force in 2007 as part of the UK government's strategy to reduce greenhouse gas emissions and following the European Union (EU) directive on the energy performance of buildings - EU 2002/91/EC (Housing Act 2004). The *Energy Performance of Buildings (Certificates and Inspections) (England and Wales) (Amendment) Regulations 2011* came into force in April 2012 making it mandatory to include the energy performance rating in all marketing publications, including printed material and online listings (in line with the recast of the EU directive - HMG 2016).[5] An EPC contains detailed information about the energy performance of the property including expected running energy costs, the energy efficiency rating, recommendations for improving energy performance and

[4]Other studies that analyse the effect of EPCs in European housing markets include Hyland et al. (2016), Broberg et al. (2019) and Bian & Fabra (2020).

[5]The *Energy Performance of Buildings (England and Wales) Regulations 2012* came into force in January 2013 with the requirement to provide a valid EPC to potential buyers at the first point of contact unchanged and the requirement to include the energy efficiency rating in marketing materials made more explicit.

the overall impact of the energy consumption of the property on the environment. Importantly for our study, the EPC displays the energy efficiency rating of the property in a graph with a predefined format (an example is shown in Figure 1). An accredited assessor must perform the audit and issue the corresponding EPC. All EPCs must be lodged by the assessor in a centralised public access register managed by the government agency responsible for housing.[6] EPCs are valid for 10 years from the date they were issued, after this time the property must undergo a new audit and a new EPC must be lodged, however a new audit and EPC can be requested at any time, for example after improvements such as roof insulation have been installed in a property.

The energy performance audit for residential properties (i.e. dwellings) is performed following the UK Government's Standard Assessment Procedure (SAP) methodology. The SAP was developed in 1993 by the Building Research Establishment (BRE), then a UK government-funded research laboratory, and is revised and updated regularly by the now independent BRE,[7] the present edition is SAP 2012 with the latest revision from 2014 (BRE 2014). The aim of the SAP is to provide uniform energy consumption estimates for dwellings as to the energy consumption required to deliver a defined level of comfort and service provision based on standard occupancy and behaviour patterns (DCLG 2017).

The SAP audit generates a set of energy performance indicators that are presented in the EPC, including the total expected energy cost and the energy cost rating (SAP rating). These indicators are calculated using a range of property factors that affect energy efficiency (e.g. property type, build materials, efficiency of heating systems, etc.), regional environmental information (e.g. climatic data) and predefined fuel prices which are calculated as averages of the previous three years across all regions (BRE 2014). This means that, for the purposes of the SAP calculations, energy prices are uniform across the UK and across months, although fuel prices are updated regularly. The energy cost of various energy requirement categories (e.g. space heating, electricity for lighting, etc.) is calculated by multiplying its energy demand in kWh/year by the standardised fuel cost, and the total energy cost for a property is simply the total sum of all category costs.

The SAP rating is calculated based on the total energy cost using a formula that accounts for the total floor area of the property (to make it comparable across different property sizes) and using a cost deflator parameter to provide comparability across years and SAP revisions. The SAP rating is presented on

[6] As of 2019, the register is managed by the Ministry of Housing, Communities and Local Government. Although owners can request their properties to be removed from the register it rarely happens as they can only request the whole property to be removed from the register i.e. they cannot request a specific certificate (e.g. a less favourable recent certificate) to be removed (DCLG 2019*a*).

[7] The BRE was privatised in 1997 and is now owned by the registered charity BRE Trust.

a scale from 1 to 100 where higher values represent lower running energy costs and thus higher energy efficiency. While the formula is not linear and slightly penalises high-energy cost properties (BRE 2014), the non-linearity kink occurs at SAP rating 51, which does not coincide with a rating band threshold and therefore does not represent a concern for our analysis.[8]

Importantly for our study, starting in 2005 and in preparation for the introduction of the EPC legislation, the SAP audit additionally produces colour coded rating bands from green A to red G (BRE 2005). Each rating band represents a predefined range of SAP rating scores (of between 9 and 20 units), with the least efficient scores (1 to 20) assigned to rating band red G and the most efficient scores (92 and above) to rating band green A. That is, the rating band for a property is assigned exclusively based on the calculated SAP rating and where it falls within the rating band ranges. For instance, a property with SAP rating 15 will be assigned the rating band G as it falls within the range of 1 to 20.

The total energy cost, the SAP rating and the rating band are included in the first page of the EPC.[9] In the present format of the EPC,[10] the total energy cost is shown first (below general property information) as the estimated costs for three years (i.e. multiplied by three). The SAP rating and the rating band are shown in a graph following the visual format specified in the EU Energy Labelling Framework Directive (EU 92/75/EEC), where energy efficiency is presented as a discrete colour-coded grade from green A to red G overlapped over the continuous SAP rating. The energy efficiency rating graph also shows the rating band ranges as part of the colour coded row (e.g. 1-20 for G, 21-38 for F, etc.). An example EPC energy efficiency rating graph is shown in Figure 1.

The first legislation referencing EE rating bands is the *The Energy Efficiency (Private Rented Property) (England and Wales) Regulations 2015*. This legislation requires any property offered for rent on or after April 2018 (and tenancy renewals after the 1st of April 2020) to have a rating band E or better. Buyers of properties with rating bands G and F will have to make EE investments if they want to offer them for rent after this date. Our formal analysis shows that while these changes generate fewer sales of properties with rating bands G and F after April 2018 they do not drive, or have a substantial effect, on our identified price discontinuities.

[8]The formula for calculating the SAP rating (BRE 2014) involves the calculation of an energy cost factor (ECF):

$ECF = deflator \times totalcost/(totalfloorarea + 45)$

$if ECF >= 3.5, SAP = 117–121 \times log(ECF)$

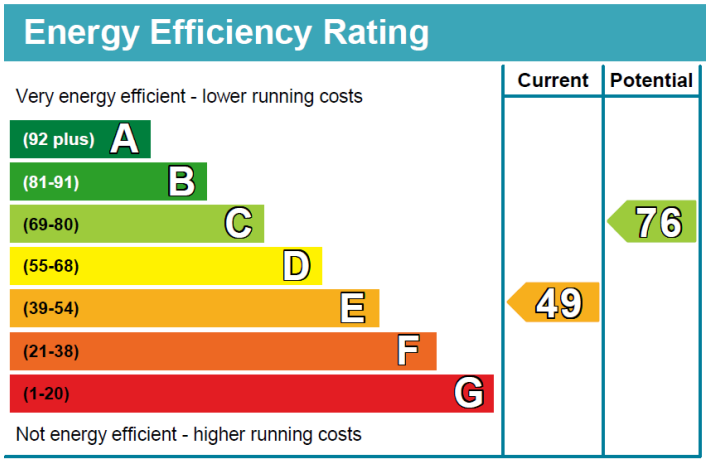
$if ECF < 3.5, SAP = 100–13.95 \times ECF$

When the ECF is around the kink (3.5) both formulas will result in an SAP rating of 51.

[9]The first page of an example EPC is shown in Appendix E.

[10]The format of the EPC changed slightly as part of the regulation amendments of 2012, but the unchanged rating graph was maintained as the main source of information.

Figure 1: Example Energy Efficiency Rating Graph



3 Data

In order to identify sale price discontinuities at the rating band thresholds we use a novel dataset constructed by merging three data sources: a) Her Majesty's Land Registry (HMLR) *Price Paid Data* (PP); b) The Department for Communities and Local Government (DCLG) *Energy Performance of Buildings Data: England and Wales* (EPB); and c) Rural Urban Classification official statistics. The PP dataset contains transaction information for residential properties sold in England and Wales at full market value after 1995 and submitted to HMLR for registration (HMLR 2019). The EPB dataset contains property level data from the Energy Performance Certificate register for England and Wales covering the period from October 2008 to September 2019 (DCLG 2019*b*). The datasets were matched by property addresses using the official address data lookup dataset, maintained by Ordnance Survey (the national mapping agency of Great Britain). Urban area classification information (based on population density) was then added to the dataset from the Rural Urban Classification official statistics (Bibby 2013). The address matching process followed a deterministic multi-stage approach. Each address in the PP and EPB datasets was matched applying different address equality criteria at each stage. The first stage attempted an exact match on house name, house number, street name and postcode, the second stage attempted an exact match on house number, street name and postcode, and so forth. The matching was successful on 94% of the sale transactions. There were no systematic differences of concern between the type of properties, location or prices between the matched and unmatched transactions.

As explained in Section 2, legislation amendments requiring sellers to provide energy rating information during marketing activities became effective on April

2012 with the purpose of ensuring an EPC was available to buyers before they make an offer for a property (HMG 2016). Prior to this date, legislation could be interpreted as only requiring an EPC before the sale was completed, or when requested by a buyer, potentially allowing some sellers to commission the EPC after a price was agreed and other sellers to actively promote the EPC as a desirable feature. In order to ensure our results are not biased, our main analysis is performed over residential property sales completed on or after July 2012 (3 months after the amended legislation became effective).

We exclude new buildings from our analysis as due to construction regulations (HMG 2016) most of them (70%) fall within rating band B.[11] Moreover, an EPC is not always available during the selling process as new buildings can be sold by developers as off-plan (i.e. where the sale happens before the construction is complete) and thus a sale price can be agreed before the SAP rating or the rating band are known. The results of our analysis for new buildings are included in Appendix A and as anticipated show no systematic discontinuities at the rating band thresholds.

The frequency distribution of sales across the SAP rating scale is presented in Panel A of Figure 2, the vertical lines show the rating band thresholds with the rating band names (G, F, E, etc.) included at the top. The distributions of existing and new properties are presented separately to highlight that they represent two distinct populations. Both are approximately normally distributed. The distribution of sales for existing properties peaks at SAP rating 67 and for new properties at SAP rating 84. An aspect worth mentioning is the potential clustering of transactions just above the rating band thresholds, which may indicate the presence of sellers who are aware of threshold effects. Minor, but noticeable, frequency increases are visible at the rating band thresholds in Panel A of Figure 2. It is worth noting that these frequency increases are unlikely to be explained by misreporting or gaming of the EE auditing process, which is rule based and does not leave room for much distortion on the auditors part.[12] Rather, we are able to precisely identify the sale transactions where more than one EPC was commissioned before a sale and which resulted in a rating band increase. The latest EPC for each of these transactions is produced after a new audit took place and where EE improvements were reported, providing evidence that the rating band increases are the results of actual investment in EE. It is important for our study to identify these transactions as they could represent sellers aiming for a specific

[11] Construction requirements are not specified in SAP rating units but rather in building material qualities, for example heat transfer (HMG 2016).

[12] Further evidence against misreporting as the sole driver of these frequency increases is that they were also found in data where homeowners would have no incentive to misreport and auditors would have a disincentive to misreport: home energy audit data collected by the English Ministry of Housing, Communities and Local Government (Comerford et al. 2018).

rating band before advertising a property for sale. Panel B of Figure 2 shows the frequency distribution excluding transactions with a rating band increase as previously described. The slightly higher frequencies at rating band thresholds decrease considerably especially at SAP rating 69. These density increases are accounted for in our formal analysis and we show in Section 7 that they do not drive the price discontinuities. Finally, we re-address this issue in Section 6.1 which presents a more detailed discussion of seller behaviour.

The final dataset contains over 5 million transactions from July 2012 to September 2019 where a valid EPC was available at the date of sale (81% of the total sale transactions during that period).[13] Each transaction contains the sale date and price, property characteristics, location information and the valid EPC at the date of sale. Summary statistics for key variables are provided in Tables 1 and 2. Property characteristics and location are fixed before the EPC audit (i.e. they are pre-assignment variables), the sale price and date can be influenced by the energy efficiency rating reported in the EPC[14] (i.e. they are post-assignment variables).

Detached houses account for 23.5% of the transactions we study, flats for 15.2%, semi-detached houses for 29.5% and terraced properties for 31.8%. The tenure of a property indicates the ownership of the building and the land it stands on, with freehold representing perpetual ownership and leasehold a lease from the freeholder, usually long term (90+ years), agreed at the beginning and decreasing by year.[15] Typically freehold properties will sell for a higher price. The majority of sales in our data are freehold (79.8%), with leasehold transactions mostly for Flats/Maisonettes (74.2% of leasehold transactions). Almost 40% of the transactions are from the south of England (South East, South West and London), suggesting a more active housing market in the region, also the majority of transactions are for properties in urban areas (81.4%). There is an upward time trend in the number of properties sold per year, which we account for in our formal analysis by controlling for sale year and sale quarter. The average house price in our data is £263,677, the average size is 94 m^2 and the average number of rooms is 5.[16] Finally, most of the properties have a rating band D (almost 48.3%), with the average SAP rating at 60.

[13] Sales of properties with total floor area of less than $30m^2$ and sale prices of less than £1,000 were excluded from the analysis (0.4% of all sales) to avoid registration errors and extreme outliers (e.g. living spaces of less than $30m^2$ are not realistic).

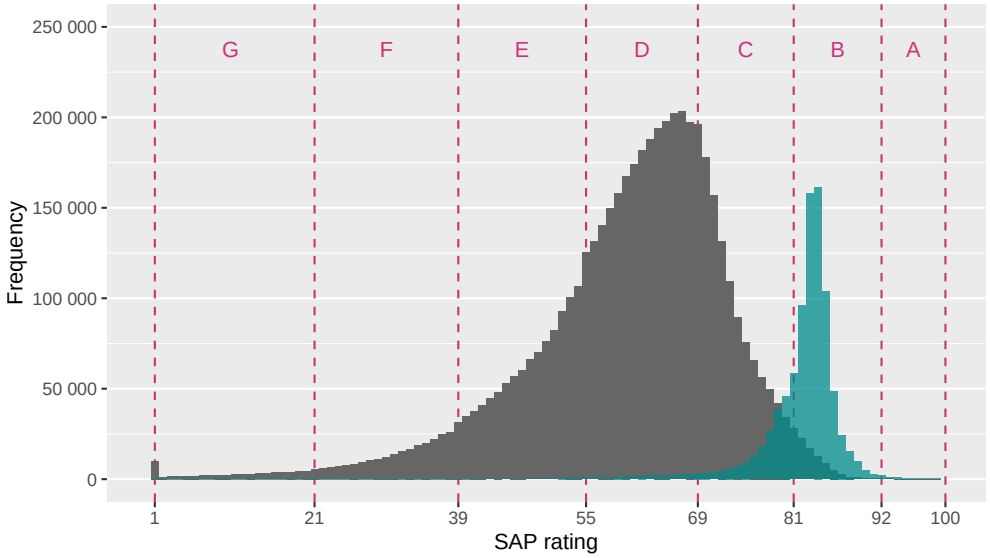
[14] The energy rating can affect the time a property stays in the market, and thus the final sale date.

[15] Leaseholders own the property but they face ground rents. Houses tend to be sold as freehold properties but most flats are sold as leasehold properties with the freehold held by a company, usually the building company.

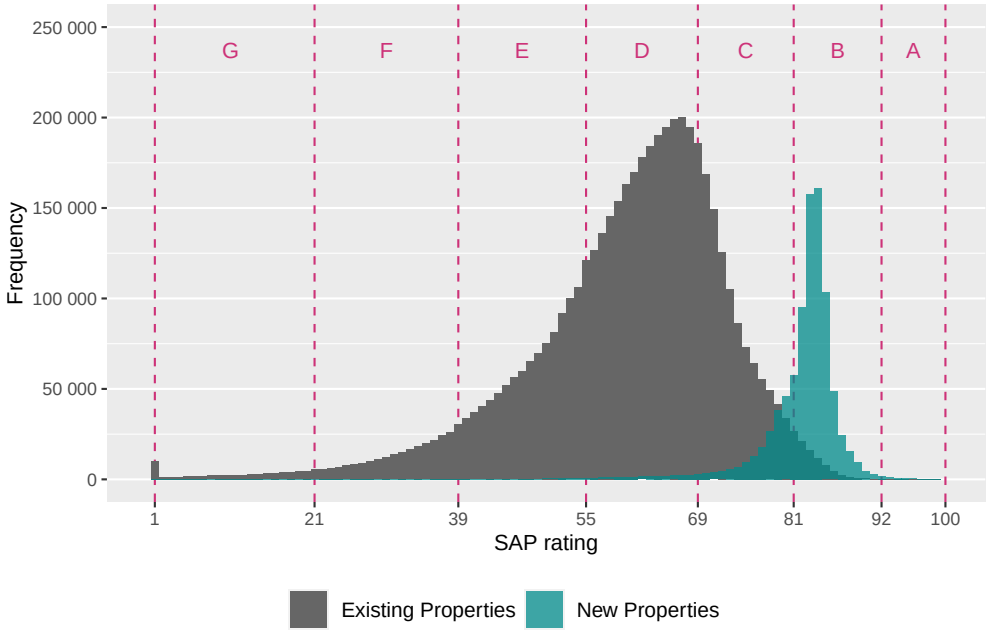
[16] A very small portion of properties do not have the number of rooms recorded (0.2% - 11,164 out of 5,000,363).

Figure 2: Sale Frequency Distribution by SAP Rating

Panel A. All sales



Panel B. Excluding sales with Rating Band increases



Notes: Panel A plots the frequency distribution of all sales for each SAP rating. Panel B plots the frequency distribution excluding sales where the rating band increased before the sale. The distributions of existing and new properties are shown separately.

Table 1: Summary Statistics for Continuous Variables

	Mean	*Median*	*SD*	*Min*	*Max*
Price Paid (£)	263,677	200,000	290,167	1,000	46,013,365
Total Floor Area (m^2)	94	84	47	30	8,824
Number of Rooms	5	5	2	1	99
Price per Square Meter (£/m^2)	2,807	2,361	1,958	4	266,340
SAP Rating	60	62	13	1	100
Number of Observations	5,000,363				

Notes: This table presents summary statistics for key continuous variables. SD stands for Standard Deviation.

Table 2: Summary Statistics for Categorical Variables

Variable	*Freq.*	%	Variable	*Freq.*	%
Property Type			Sale Date		
Detached	1,175,542	23.5	2012	281,456	5.6
Flat	761,388	15.2	2013	623,752	12.5
Semi-detached	1,472,852	29.5	2014	745,699	14.9
Terraced	1,590,581	31.8	2015	742,152	14.8
Tenure			2016	733,036	14.7
Freehold	3,991,578	79.8	2017	720,415	14.4
Leasehold	1,008,785	20.2	2018	702,791	14.1
Location			2019	451,062	9.0
East	578,688	11.6	Energy rating band		
East Midlands	439,281	8.8	A	967	0.0
London	554,630	11.1	B	98,920	2.0
North East	210,194	4.2	C	1,185,556	23.7
North West	625,745	12.5	D	2,411,210	48.2
South East	858,930	17.2	E	1,002,156	20.0
South West	544,138	10.9	F	240,746	4.8
Wales	249,443	5.0	G	60,808	1.2
West Midlands	469,721	9.4	Rating band increase before sale		
Yorkshire and			No	4,881,291	97.6
The Humber	469,593	9.4	Yes	119,072	2.4
Area Density					
Urban	4,068,522	81.4			
Rural	931,841	18.6			
Number of Observations	5,000,363				

Notes: This table presents the frequencies and proportions (%) for key categorical variables.

4 Empirical Strategy

Our strategy for inference and estimation of price discontinuities at rating band thresholds follows a regression discontinuity (RD) design (for an overview of the applicability and methodological implications of RD designs see Lee & Lemieux 2010). The discontinuous changes in sale prices that occur as the SAP rating crosses a rating band threshold are interpreted as the causal effect of a property having a higher rating band during a sale transaction beyond the underlying rating that it is based on. The treatment variable is the rating band, which is deterministically assigned from the SAP rating (the running variable), a design normally referred to as sharp RD in the literature.

We model property price as a function of the SAP rating. As sellers cannot precisely predict the SAP rating before an EPC is commissioned (they will at most have imprecise control) the distribution of properties with different characteristics across each SAP rating unit can be assumed to be as-good-as random and the relationship between price and SAP rating will be continuous. As the rating bands are assigned based solely on the SAP rating, price discontinuities at the thresholds strongly suggest that the rating band has an effect on price beyond that attributable to the increased SAP rating score. We run models separately at each threshold using a local-linear regression approach with data-driven optimal bandwidths as described in Imbens & Lemieux (2008), Gelman & Imbens (2019) and Calonico et al. (2018)[17] with the following specification:

$$P_i = \alpha + \tau T_i + \beta_- SAP_i + \beta_+ T_i SAP_i + \epsilon_i \ , \tag{1}$$

where the dependent variable P_i represents the price per square meter[18] of property i, T_i represents the treatment variable (i.e. whether the SAP rating has crossed the rating band threshold), SAP_i represents the SAP rating of property i (normalised at the rating band threshold), and ϵ_i the random error term. The coefficient of interest is τ which represents the difference between the price of a property at a rating band threshold and a counterfactual predicted price per square meter of the property without the higher rating band assigned (for a more detailed explanation of RD design estimation models see Lee & Lemieux 2010). τ can then be interpreted as the discontinuous increase in price as the SAP rating of a property

[17] Our results also hold under parametric estimation specifications similar to Lacetera et al. (2012) as discussed in Section 7.

[18] We use price per square meter as our dependent variable to increase the comparability of properties of different sizes, as discussed in Section 7 the results are similar when using total sale price as the dependent variable.

crosses a rating band threshold. The interaction between T_i and SAP_i, and the corresponding coefficients β_- and β_+, allow for different slopes at each side of the threshold, which is important in our study as the slopes across rating bands are in fact different.

While some property characteristics are correlated with the SAP rating, this does not represent a threat to our identification strategy because of the inability of sellers to precisely predict the SAP rating before the EPC audit. For example, the property type is correlated with energy performance, and flats may have another flat above and/or below them, which reduces heat loss even without insulation. Thus, in order to show that the discontinuities are not driven by differences in covariates (or, put differently, that covariates are balanced around the thresholds), we present our results both without and with the baseline covariates described in Tables 1 and 2. The model specification when including covariates is:

$$P_i = \alpha + \tau T_i + \beta_- SAP_i + \beta_+ T_i SAP_i + \boldsymbol{Z_i}\gamma + \epsilon_i \ , \tag{2}$$

where Z_i represents the vector of baseline covariates for property i.

Note that our running variable (the SAP rating) is a rounded, and therefore clustered, measure of the energy costs of a property (as explained above, when calculating the SAP rating clustering aims at providing comparability across different types, sizes and locations of properties), thus although it runs from 1 to 100, it is discrete at each unit point. Rounding takes place during the SAP rating calculations (as explained in Section 2), thus since the formula and rounding criteria (to the closest integer) are the same at both sides of each cut-off any potential rounding errors are unlikely to systematically affect our results. The assignment of the rating band is determined exclusively using the final SAP rating, and because our design is aimed at estimating the effect that information provided as rating bands has on sale prices, there is no need to account for rounding errors in our study.[19] Having a clustered running variable with a large number of observations in each cluster does not present a limitation for inference (Kolesár & Rothe 2018) or estimation (Bartalotti & Brummet 2017).

To reduce estimation bias and coverage errors we run the regressions independently for each threshold (which implies multiple cut-offs) as the functional form is not uniform across the SAP rating range. As will become clear from the graphical analysis presented in the next section, a pooled estimation would not be suit-

[19]SAP ratings are rounded to the closest integer, there is no rounding-down or truncation, and thus methods similar to the one proposed by Dong 2015 are not applicable to our analysis.

able due to different sizes of the discontinuities and the different functional forms around each threshold. When running the analysis at each threshold we include the transactions from the current rating band and the previous rating band. For example to run the analysis for the threshold at SAP rating 55 (rating band D), we include the transactions from rating bands E (left of the threshold - SAP ratings 39 to 54) and D (right of the threshold - SAP ratings 55 to 68). As explained with the frequency distributions in Figure 2, we find evidence of sorting around the thresholds, specifically that some sellers increase the rating band of a property before a sale. To account for potential endogeneity, we exclude these transactions from our main analysis (they only amount to 2.4% of our data - 119,072 out of 5,000,363 transactions) and we show and discuss in Section 7 how they do not in fact increase the price discontinuities. We present a detailed analysis of the sorting behaviour induced by the thresholds in Section 6.

We implement local-linear regressions with data-driven optimal bandwidths for estimation and inference at each rating band threshold (as described in Imbens & Kalyanaraman 2012, Calonico et al. 2014 and Calonico et al. 2018). We use data-driven mean square error (MSE) optimal bandwidths to minimize the asymptotic MSE of the τ estimator, and robust bias-corrected (RBC) inference methods to calculate confidence intervals as proposed by Calonico et al. (2018). To validate the local regression fit near the threshold (see Calonico et al. 2018 for an in-depth explanation) we run local-linear regressions using both uniform kernel functions (where all observations are weighted equally) and triangular kernel functions (where observations are linear down-weighted away from the threshold), and likewise, using a single MSE-optimal bandwidth per threshold and two MSE-optimal bandwidths per threshold (i.e. one before and one after the threshold). Our formal analysis clusters standard errors at the SAP rating to guard against model misspecification due to the discrete nature of the running variable as proposed by Lee & Card (2008).

5 Analysis

We first present the graphical analysis to provide an intuitive description of the relationship between property prices and SAP ratings and the occurrence of price discontinuities at the rating band thresholds. We then present and discuss the estimation and inference results of the local-linear regression analysis.

5.1 Graphical Analysis

We begin with the graphical analysis of property price as a function of the energy efficiency SAP rating score. Figure 3 shows average price per square meter (log)

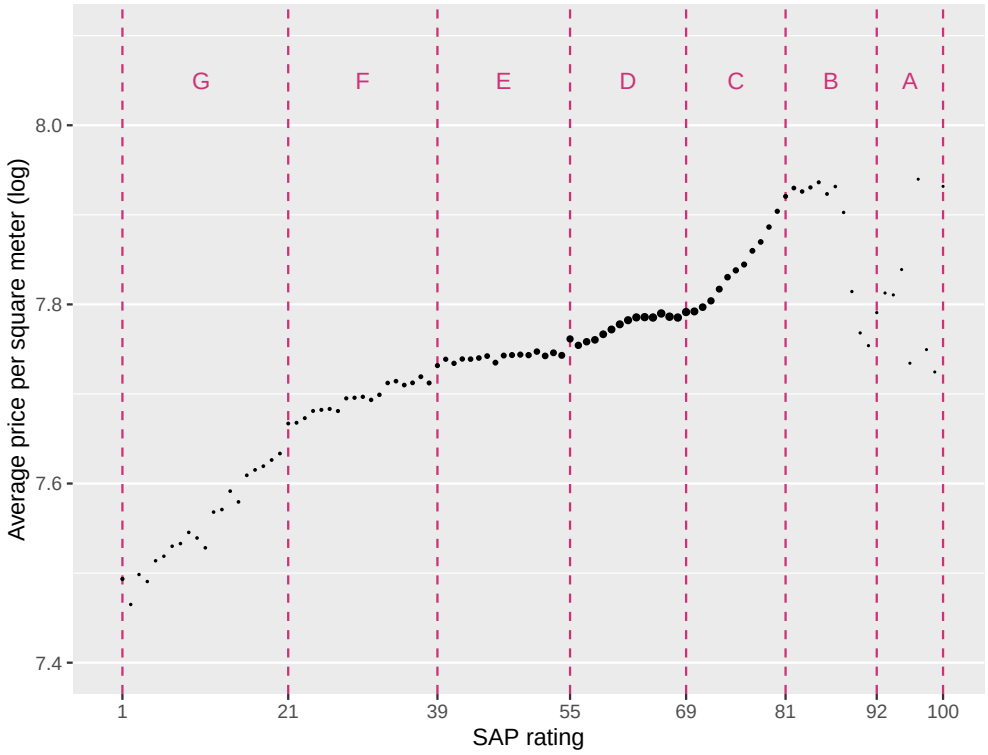
bins for each SAP rating unit, with the size of the symbol proportional to the frequency of sale transactions in the bin.[20] The vertical lines show the rating band thresholds, the arbitrary change from one rating band to the next one, with the rating band names (G, F, E, D, C, B and A) shown at the top. Price discontinuities are clearly visible around the thresholds between bands G, F, E, D and C and between B and A. Different slopes for each rating band are also visible. Although the functional form is not linear, it is continuous, reinforcing our claim that sellers do not have perfect control over the SAP rating or the rating band.[21] The differences in slopes and sizes of discontinuities suggest that the most appropriate empirical strategy is one that focuses on estimating price discontinuities separately (as mentioned in the previous section). The relationship between price per meter and the SAP rating is naturally positive: properties with higher energy efficiency will command higher sale prices (e.g. triple window glazing compared to single window glazing or a modern combi-boiler compared to an older electric boiler). The number of observations for SAP ratings 88 and above drops considerably as shown in the histogram in Figure 3 (with only roughly 3,000 observations for the range 88 to 100), and thus the functional form is much less clear and the discontinuity between rating bands B and A, although visible, needs to be interpreted with caution.

In order to verify graphically that the discontinuities are not driven by differences in covariates, Figure 4 shows the price per square meter residuals after controlling for property characteristics (property type, number of rooms and tenure), location (geographic area and urban classification) and the sale date (year and quarter). The identified price discontinuities are still pronounced and the different slopes around each rating band also remain. Further evidence that the baseline covariates are in fact balanced around the rating band thresholds for existing properties is presented in Section 7 as a robustness check.

[20] We apply the log transformation because the distribution of price per square meter is right-skewed but normally log distributed. The non-log transformed analysis produces similar results although noisier and is discussed in Section 7.

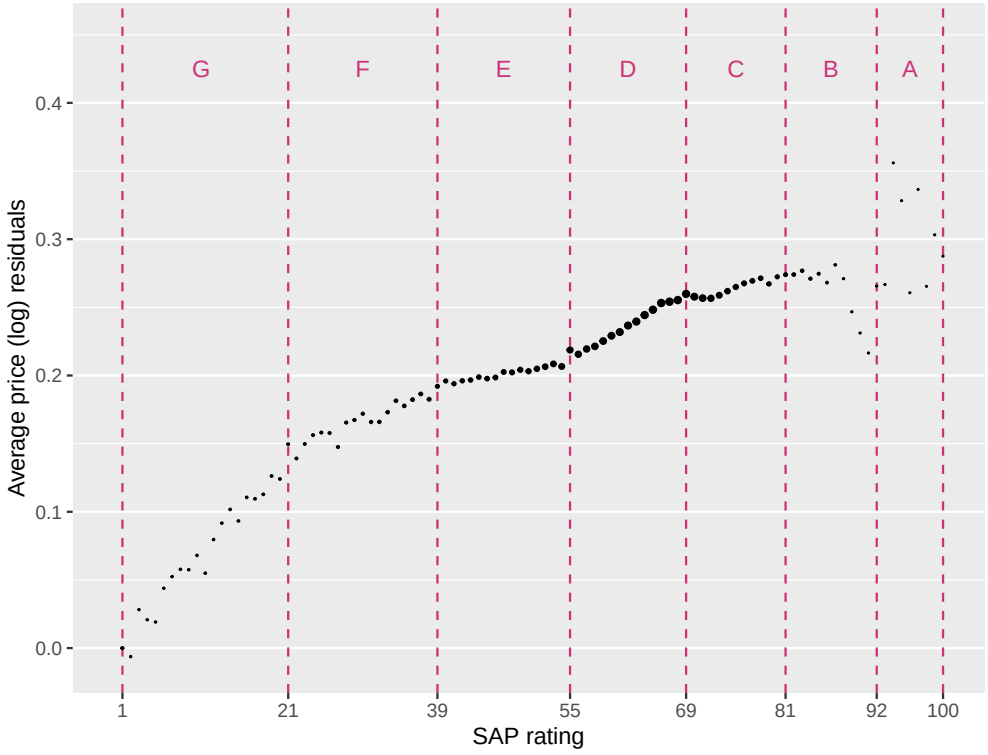
[21] As sellers cannot perfectly predict the SAP rating before the EE audit, and because SAP ratings are standardised across property types and sizes, each SAP score is randomly distributed across properties with different characteristics and EE features. Since higher EE features result in higher selling prices (e.g. expensive modern boilers) the relationship between final sale prices and SAP ratings has an upward slope.

Figure 3: Price Per Square Meter (Log) – SAP Rating



Notes: This figure plots average price per meter (log) bins for each *SAP rating unit.* N=4,881,291.

Figure 4: Price Per Square Meter (Log) Residuals – SAP Rating



Notes: This figure plots average residual price per square meter (log) bins for each SAP rating after controlling for property characteristics, location and sale date.
N= 4,870,265.

5.2 Regression Results

We now present the results of the regression analysis using Specifications (1) and (2) with price per square meter (log) as the dependent variable.[22] Table 3 presents the estimated price discontinuities from local-linear regressions at each rating band threshold in panel rows from F [SAP 21] to A [SAP 92] (the SAP rating of the threshold is included in square brackets). For example, the first panel row reports the results for threshold G-F at SAP rating 21. Each column represents a separate model. The parameter τ is our discontinuity estimate and can be interpreted as the percentage increase[23] in price of having the higher rating band. The standard errors of the estimate are shown in parenthesis. We also include the robust bias-corrected (RBC) confidence interval and p-value (RBC reduces coverage error for inference – Calonico et al. 2019) obtained using the methods presented by Calonico et al. (2019) and Calonico et al. (2018) . The data-driven MSE-optimal bandwidths (as explained in Section 4) for the estimate and the RBC correction are shown as BW estimate (h) and BW bias (b) respectively. Each panel row also shows the total number of observations for the threshold and the effective number of observations (i.e. the observations within the optimal bandwidth) used in the local linear regression. The stars next to the estimators represent the significance level of their corresponding RBC p-value.

Column (1) shows the estimated price discontinuities under Specification (1) (without baseline covariates), using a triangular kernel (i.e. observations linear down-weighted away from the threshold), with a data driven MSE-optimal bandwidth and standard errors clustered at the SAP rating. Column (2) shows the results using a uniform kernel (i.e. all observations equally weighted) and Column (3) using two MSE-Optimal bandwidths (one for each side of the threshold). Columns (4) through (7) show the estimations under Specification (2) while controlling for covariate fixed effects (FE). Column (4) controls for property characteristics (property type, number of rooms and tenure), Column (5) for geographic area FE (region and urban classification), Column (6) for date FE (sale year and sale quarter) and Column (7) is the most restrictive controlling for all of the previously mentioned FE.

The price discontinuities for thresholds G-F, F-E, E-D and D-C are positive and statistically significant and vary between 0.8% (at threshold D-C) and 2.5% (at threshold G-F) of the property sale price under Specification (1) (Column 1) 0.3% (at threshold D-C) and 1.9% (at threshold G-F) and of the property sale

[22] As explained above we apply log transform because the distribution of price per square meter is right-skewed but normally log distributed. Non-log transformed analysis produces qualitatively similar results that are discussed in more detail in Section 7.

[23] We interpret the coefficient τ as a percentage increase approximation since our dependent variable is the log transformation of price per square meter and the values are small.

price under Specification (2) (Column 7). The results for these thresholds are robust to the kernel specification and to using different bandwidths at each side of the threshold as there is little variation in the estimations shown in Columns (2) and (3). The results do not change significantly when controlling for property characteristics (Column 4) or date FE (Column 6). The estimated discontinuities when controlling for geographic area FE are smaller, especially for threshold D-C, suggesting that the location of a property will play a part in the size of the rating band price premium. The results when controlling for all FE (Column 7) are statistically significant although the size of the estimate is smaller due to the geographic area effects. We present robustness checks in Section 7 to further confirm that the heterogeneity of property characteristics, geographic area and date are not driving the discontinuities. The RBC confidence intervals for rating bands B-C and B-A include 0 and the estimates vary considerably across specifications and the inclusion of covariate controls. The number of observations for rating band A is too low for the estimation of threshold B-A to be reliable.

In summary, the results of the regression analysis mirror those of the graphical analysis and provide strong evidence of price discontinuities when crossing rating band thresholds G-F, F-E, E-D and D-C. These results are economically significant, on average the price discontinuities range from roughly £2,000 (0.8% at the D-C threshold with a mean sale price of £250,000 around the threshold) to £6,625 (2.5% at the G-F threshold with a mean sale price of £265,000 around the threshold) under Specification (1). Furthermore, although the results are smaller for rating band C, this threshold contains the largest number of transactions (Figure 3 shows the frequency distribution) and thus the overall effect on the market of these transactions is bigger.

Table 3: Local Linear RD Estimates for Price Discontinuities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	0.025***	0.026***	0.025***	0.021***	0.021*	0.025***	0.019**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.009)	(0.001)	(0.008)
Bias-corrected 95% CI	0.020|0.035	0.021|0.035	0.021|0.033	0.016|0.026	0.006|0.044	0.020|0.035	0.008|0.038
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.010	0.000	0.003
BW estimate (h)	3.697|3.697	4.443|4.443	3.769|4.472	5.582|5.582	5.731|5.731	3.689|3.689	5.544|5.544
BW bias (b)	6.924|6.924	7.077|7.077	7.403|7.728	8.803|8.803	7.608|7.608	6.797|6.797	7.953|7.953
Observations	60,808|239,167	60,808|239,167	60,808|239,167	60,769|238,990	60,808|239,167	60,808|239,167	60,769|238,990
Effective observations	12,824|24,642	16,634|32,253	12,824|32,253	20,190|40,523	20,202|40,545	12,824|24,642	20,190|40,523
E [SAP 39] τ	0.020***	0.019***	0.020***	0.017***	0.016***	0.017***	0.010***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.002)	(0.004)	(0.001)
Bias-corrected 95% CI	0.013|0.030	0.009|0.030	0.013|0.029	0.010|0.030	0.015|0.024	0.010|0.027	0.010|0.017
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	4.391|4.391	3.417|3.417	4.448|4.439	3.741|3.741	3.843|3.843	4.529|4.529	3.456|3.456
BW bias (b)	6.263|6.263	5.660|5.660	6.510|5.765	5.979|5.979	6.115|6.115	6.364|6.364	5.625|5.625
Observations	239,167|990,784	239,167|990,784	239,167|990,784	238,990|989,983	239,167|990,784	239,167|990,784	238,990|989,983
Effective observations	92,187|185,700	72,323|141,765	92,187|185,700	72,278|141,657	72,323|141,765	92,187|185,700	72,278|141,657
D [SAP 55] τ	0.016***	0.019***	0.016***	0.016***	0.014***	0.016***	0.012***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
Bias-corrected 95% CI	0.012|0.024	0.015|0.026	0.014|0.023	0.013|0.023	0.013|0.019	0.012|0.024	0.013|0.017
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.936|3.936	2.954|2.954	4.256|4.311	3.672|3.672	3.910|3.910	3.915|3.915	3.550|3.550
BW bias (b)	5.743|5.743	5.197|5.197	7.434|5.307	5.421|5.421	6.022|6.022	5.725|5.725	5.587|5.587
Observations	990,784|2,357,103	990,784|2,357,103	990,784|2,357,103	989,983|2,355,440	990,784|2,357,103	990,784|2,357,103	989,983|2,355,440
Effective observations	297,781|529,425	205,917|384,020	379,385|683,250	297,567|529,057	297,781|529,425	297,781|529,425	297,567|529,057
C [SAP 69] τ	0.008***	0.007***	0.006***	0.008***	0.003***	0.007***	0.003***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.000)
Bias-corrected 95% CI	0.007|0.015	0.006|0.016	0.006|0.014	0.006|0.014	0.004|0.009	0.006|0.014	0.003|0.007
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.866|3.866	3.452|3.452	3.576|5.067	3.960|3.960	3.685|3.685	3.906|3.906	3.445|3.445
BW bias (b)	5.548|5.548	5.755|5.755	5.784|5.054	6.089|6.089	5.308|5.308	5.561|5.561	5.165|5.165
Observations	2,357,103|1,139,132	2,357,103|1,139,132	2,357,103|1,139,132	2,355,440|1,135,285	2,357,103|1,139,132	2,357,103|1,139,132	2,355,440|1,135,285
Effective observations	593,851|629,750	593,851|629,750	593,851|821,323	593,389|629,103	593,851|629,750	593,851|629,750	593,389|629,103
B [SAP 81] τ	0.002	0.002	0.002	0.004*	0.001	0.002	-0.001
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Bias-corrected 95% CI	-0.006|0.001	-0.007|0.001	-0.007|0.000	0.000|0.009	-0.006|0.006	-0.006|0.001	-0.005|0.005
Bias-corrected p-value	0.214	0.180	0.050	0.038	0.987	0.099	0.991
BW estimate (h)	4.177|4.177	3.971|3.971	3.494|7.352	4.325|4.325	3.776|3.776	4.226|4.226	3.742|3.742
BW bias (b)	6.942|6.942	6.107|6.107	5.183|6.283	6.354|6.354	6.360|6.360	6.946|6.946	6.390|6.390
Observations	1,139,132|93,583	1,139,132|93,583	1,139,132|93,583	1,135,285|89,119	1,139,132|93,583	1,139,132|93,583	1,135,285|89,119
Effective observations	180,116|84,097	124,580|76,039	124,580|92,258	177,827|80,161	124,580|76,039	180,116|84,097	122,663|72,522
A [SAP 92] τ	0.071*	0.054	0.073*	0.057***	0.056***	0.071*	0.055***
	(0.009)	(0.003)	(0.010)	(0.005)	(0.008)	(0.010)	(0.005)
Bias-corrected 95% CI	0.007|0.103	-0.112|0.253	0.008|0.092	0.068|0.110	0.027|0.074	0.008|0.111	0.029|0.074
Bias-corrected p-value	0.025	0.451	0.018	0.000	0.000	0.023	0.000
BW estimate (h)	3.769|3.769	2.529|2.529	3.630|4.511	3.034|3.034	4.111|4.111	3.760|3.760	4.329|4.329
BW bias (b)	5.706|5.706	6.188|6.188	5.321|5.471	6.077|6.077	5.693|5.693	5.953|5.953	5.923|5.923
Observations	93,583|714	93,583|714	93,583|714	89,119|679	93,583|714	93,583|714	89,119|679
Effective observations	1,325|571	740|488	1,325|631	1,253|538	2,431|631	1,325|571	2,283|597
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

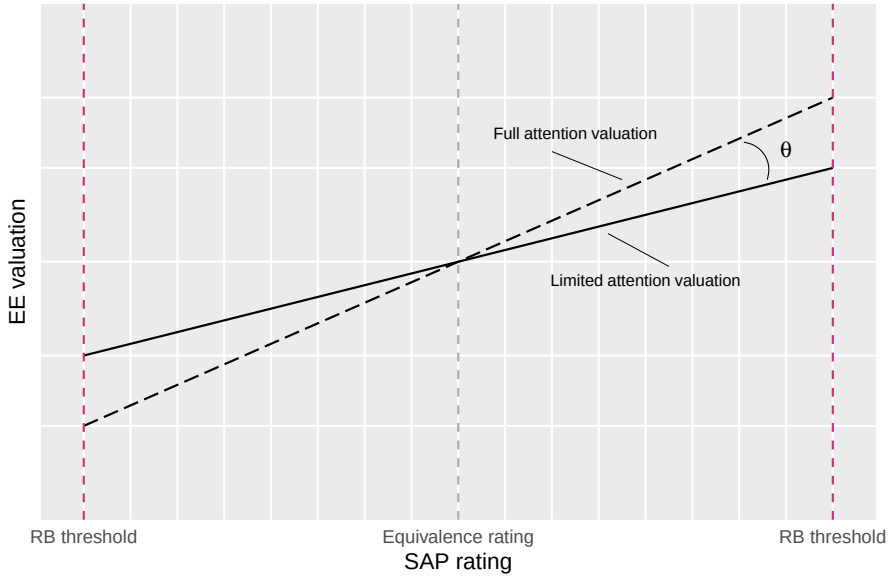
Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: This table presents the results from the local linear RD analysis for price discontinuities at each rating band threshold. Each panel row contains the estimate for the coefficient τ which represents the estimated price discontinuity of having the higher rating band (Section 4 explains our empirical strategy in detail). Each column contains the results from a different model, Columns (1) to (3) present the results from Specification (1) with different bandwidth selection procedures and kernels. Columns (4) to (7) present the results from Specification (2) including different sets of covariate controls. Property characteristics include property type, number of rooms and tenure, area fixed effects (FE) include region and urban classification and date FE adds sale year and sale quarter.

5.3 Estimating the Degree of Inattention

We estimate the degree of inattention using a simple model that accounts for the aggregated nature of rating band information and the estimated price discontinuities at the thresholds. The results from Section 5.2 provide evidence that rating bands divert attention from the more precise SAP rating, making it opaque. Inattention to the SAP score implies that agents may perceive the EE of all properties within a rating band as close to equal. For example, for EE valuation purposes, a fully inattentive agent sees a property with an SAP score of 39 as similar to a property with an SAP score of 54 as both have rating band E. Because EE increases with the SAP rating, properties with SAP scores on the lower end of the rating band range will be over-valued since they are being perceived has similar to more EE properties, conversely properties in the higher end will be under-valued. The valuation effect will be strongest towards the rating band thresholds and there will be an *equivalence* SAP rating where the effect will be close to zero. The size of the effect depends on the degree of inattention to the SAP score measured by the inattention parameter θ. Figure 5 shows a visual representation of the predicted effect of θ.

Figure 5: Effect of rating band information on the valuation of EE



We propose the following simple model for estimating inattention when sim-

plified aggregated information can make detailed information opaque.[24]

$$V_i^{EE} = (1-\theta)V_i^{SAP} + \theta V^{RB} \tag{3}$$

Where V_i^{EE} represents the final valuation of EE for property i, V_i^{SAP} represents the un-affected valuation for the SAP rating of property i (this value is never observed on final sale data) and V^{RB} represents the common EE valuation for the rating band. The parameter $\theta \in [0,1]$ measures the degree of inattention to the more informative SAP rating. At $\theta = 1$ the agent is fully inattentive to the precise measure and makes her EE valuation solely based on the rating band. Conversely at $\theta = 0$ the agent is fully attentive and does not take into account the rating band in the valuation as it does not provide additional information. As EE comparisons are made between properties within a rating band, the best choice of V^{RB} for an agent will be the expectation of the valuation of EE for properties within the rating band. The acquisition of a value for V^{RB} can depend on a prior value (based on how familiar the agent is with EE valuations) and an information acquisition and updating process based, for instance, on the number of properties seen before making a buying offer or the estimate in the EPC of the financial cost of energy for the property.[25]

$$V^{RB} = E[V^{EE}|RB]$$

The price discontinuity τ at rating band thresholds will then capture both the EE under-valuation of properties from the lower rating band and the EE over-valuation of properties of the higher rating band. The un-affected valuation of EE for the SAP rating (i.e. the true valuation un-effected by the rating band effects) shown as V_t^{SAP} will be the same at the threshold.

$$\begin{aligned}
\tau &= V_H^{EE} - V_L^{EE} \\
&= [(1-\theta)V_t^{SAP} + \theta V_H^{RB}] - [(1-\theta)V_t^{SAP} + \theta V_L^{RB}] \\
&= \theta V_H^{RB} - \theta V_L^{RB} \\
&= \theta(V_H^{RB} - V_L^{RB})
\end{aligned}$$

[24]Our model differs from the model proposed by DellaVigna (2009) in that in our setting more attention to the opaque attribute (the SAP rating) means less attention to the salient attribute (the rating band) as this does not provide any additional information over the opaque attribute. The model builds on the model proposed by Gabaix (2019) by representing the prior value as depending on the valuations of the other products within a category.

[25]The number of properties seen does not have to depend on the buying process, as they could be properties belonging to friends or family.

And thus:

$$\theta = \frac{\tau}{V_H^{RB} - V_L^{RB}} \tag{4}$$

For the empirical estimation of θ with our data we use price residuals as a measure of EE valuation. We obtain the price residuals from a regression that controls for property characteristics, area fixed effects and date fixed effects. Effectively we remove the portion of the price that can be attributed to these features.[26] We then use the weighted average of these residuals within each rating band as estimates of V_H^{RB} and V_L^{RB}.[27]

Table 4 presents our results for θ using the values for τ from Section 5.2. We present the estimates for the thresholds where we find price discontinuities. Our estimates for θ range from 0.125 to 0.342 with an average of 0.253, which fall within the range reported in other inattention studies and supports the notion that attention is higher when payoffs are higher (Gabaix 2019, DellaVigna 2009), steeper slopes approaching rating bands F and C can be observed in Figure 4.

Table 4: Inattention Parameter Estimates

	θ	τ	V_H^{RB}	V_L^{RB}
F [SAP 21]	0.218	0.019	0.171	0.084
E [SAP 39]	0.324	0.010	0.202	0.171
D [SAP 55]	0.342	0.012	0.237	0.202
C [SAP 69]	0.125	0.003	0.261	0.237
Average	0.253			

We also perform a linear approximation of θ assuming a linear relationship between EE valuation and the SAP rating within each rating band (similar to Lacetera et al. 2012). Although the functional form of the relationship between price and SAP rating is not linear across the full range of SAP scores, it is remarkably linear within each rating band as can be seen in Figure 4. The linear estimations for θ range from 0.076 to 0.451 with an average of 0.222, very close to the average of our model estimation. The complete results and the description of the process is included in Appendix D.

[26] We follow the same process as Lacetera et al. (2012) to remove the effect of covariates.

[27] We assume a Bayesian belief updating signal extraction process when using the weighed average as the value for $E[V^{EE}|RB]$.

6 Discussion: Market Behaviour

Having identified price discontinuities at the rating band thresholds, we now discuss the effect that these have on market behaviour and provide policy considerations.

6.1 Seller Behaviour

Price discontinuities at rating band thresholds can generate incentives for sellers to extract additional profit. These incentives will exist if: *a*) buyers fall for this behavioural effect and; *b*) sellers are aware of the price discontinuities. The housing market for existing properties in England and Wales follows a double auction structure. Sellers set an initial asking price and potential buyers make offers over, or under, this reference price. A seller then decides which offer to accept, if any (offers are not legally binding - HM Government 2020), buyers can make offers for multiple properties simultaneously. With respect to *a*), in Section 5 we analyse final sale transactions (i.e. buyer offers that were accepted by sellers), thus the price discontinuities we identify at rating band thresholds suggest that some buyers exhibit limited attention and end up paying a rating band price premium. Regarding *b*), in this section we show evidence that rating band thresholds influence the decision of some sellers to make EE investments before offering a property for sale, suggesting that they are aware of rating band price premiums.

Rational sellers will only invest in a pre-sale EE improvement if they believe they are able to, at the very least, recoup the full investment cost, and investments that get over a rating band threshold will have a better chance of achieving this because of the additional profits from the discontinuity. Then, the incentive for sellers who anticipate price discontinuities is to make EE investments that will take the property to a higher rating band. The clearest incentive is for sellers who have a property with an SAP rating just below a rating band threshold, and who can make small investments to get the property to the next rating band (as described in Comerford et al. 2018 – for example by investing in LED light bulbs).[28] If the property has an SAP rating just above a threshold the incentive will be lower as it will be more expensive and difficult to make EE improvements to reach the next rating band, for instance by replacing all windows with triple glazing and further delaying the sale of the property. Rational sellers who want to exploit buyers naivety and bet on the price premium of a higher rating band will then use the pre-defined thresholds (at SAP ratings 21, 39, 55, 69, 81 and 92) as reference points for investment. Sellers are provided with the necessary

[28]The cost of an EPC in the UK varies across assessors but was as low as £50 within the period of our analysis.

information to evaluate the required investment, as explained in Section 2, the recommendations section of the EPC contains information about the expected costs of EE improvements (e.g. increased loft insulation at a cost of £100-£350) and, importantly, the resulting colour coded rating band and SAP rating after these improvements are made.

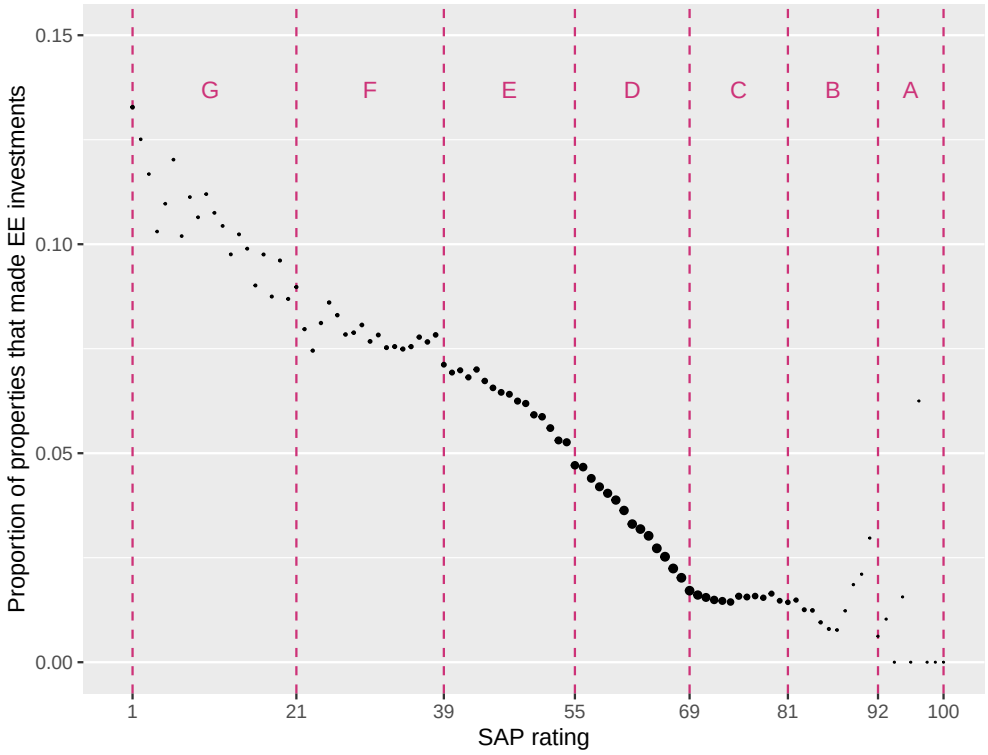
In order to study seller behaviour, we re-analyse our sample of properties that made EE improvements before a sale. We look at properties that requested more than one EPC before a sale and where the latest SAP rating is higher than the previous one (203,081 properties). As the property characteristics (e.g. property type, location, etc.) remain fixed, and as energy prices have been increasing, a higher SAP rating is evidence that EE improvements were made on the property. For many sellers, a new EPC (with a new SAP rating) will be a belief update (whether the improvements have resulted in a higher rating band or not) and they can react by either continuing with the selling process or making additional investments and requesting a new EPC audit.

We analyse whether rating band thresholds have an effect on the probability of pre-sale investing, as this would be an indication that the arbitrary thresholds are having an effect on seller behaviour in the market. To avoid confounding our results with buy-to-rent transactions we exclude properties sold on or after April 2018 since, as explained in Section 2, regulations require properties offered for rent after that date to have a minimum rating band E. Figure 6 shows the proportion of properties that made pre-sale EE investments for each SAP rating (based on the initial SAP rating *before the investment* for properties that increased their EE). The proportion of properties that make EE investments decreases as the SAP rating increases since, as explained above, it becomes more expensive and difficult to improve the EE of properties with an already high rating. Importantly, the proportion of properties that made EE investment before a sale drops considerably after crossing the rating band thresholds at F-E, E-D, D-C and B-A.

To obtain an estimate of the effect that rating band thresholds have on the decision to invest in EE, we perform a regression discontinuity analysis similar to our price discontinuity analysis. The same assumptions stated in Section 4 apply as the initial SAP rating (our running variable for this analysis) cannot be precisely controlled by sellers when requesting the initial EPC. We measure the probability to invest in EE as the proportion of properties that made EE investments at each SAP rating score and the treatment (if a threshold was crossed) is the higher rating band assigned. We use the following specifications for a linear probability model to estimate the difference in the probability to invest as a result of rating band thresholds.[29]

[29]We use a linear probability model to simplify the interpretation of results from a regression discontinuity analysis.

Figure 6: Proportion of Properties that Made EE Investments – Initial SAP Rating



Notes: This figure plots the proportion of properties that made EE investments before a sale for each SAP rating. The SAP rating is the initial rating for properties that made EE investments (i.e. the rating before making an investment).
N=3,999,155.

$$I_i = \alpha + \tau T_i + \beta_- SAP_i^s + \beta_+ T_i SAP_i^s + \epsilon_i \tag{5}$$

$$I_i = \alpha + \tau T_i + \beta_- SAP_i^s + \beta_+ T_i SAP_i^s + \boldsymbol{Z_i}\gamma + \epsilon_i \tag{6}$$

The dependent variable I_i takes the value of 1 if property i had EE investments before the sale,[30] and 0 otherwise. T_i represents the rating band treatment (i.e.

[30]If the EPC at the date of sale has a higher SAP rating than the previously registered EPC.

if a threshold was crossed), SAP_i^s represents the initial SAP rating of property i (normalised at the rating band threshold), and ϵ_i the error term. The coefficient of interest is τ which represents the difference in the proportion of properties that invested in EE at a rating band threshold and a counterfactual predicted probability at the same SAP score without a higher rating band being assigned. Similar to our main analysis, the interaction between T_i and SAP_i^s, and the corresponding coefficients β_- and β_+, allow for different slopes at each side of the threshold. Z_i in Specification 6 represents the vector of baseline covariates for property i, which are the same as those of our price discontinuity analysis (property characteristics, geographic area FE and date FE).

Table 5 presents the estimated discontinuities using local linear regressions of the same form as our main analysis, we run the models separately for each threshold. The results confirm the graphical analysis of Figure 6, with statistically significant estimates for rating band thresholds F-E, E-D, D-C and B-A.[31] The estimates do not change much across all of our specifications. In our dataset the proportion of properties that invested in EE before a sale is 4.06% (203,081 of 5,000,363), so as a back of the envelope calculation our estimate for threshold F-E (-0.008) represents a considerable 3.25% higher probability of investing in EE for properties with an SAP rating just below the threshold. Similarly, the estimates for E-D (-0.003) would represent 1.22%, D-C (-0.001) 0.4% and B-A (-0.027) 11% higher probabilities before crossing the corresponding thresholds (under Specification 5).

[31] As with our main analysis, the estimates for threshold B-A need to be interpreted with caution as there are only 714 observations with rating band A.

Table 5: Local Linear RD Estimates for EE Investment Probability

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	0.000	0.011	-0.002	-0.001	0.000	0.000	-0.001
	(0.005)	(0.001)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Bias-corrected 95% CI	-0.010|0.012	0.000|0.028	-0.010|0.009	-0.012|0.012	-0.010|0.013	-0.010|0.013	-0.011|0.012
Bias-corrected p-value	0.854	0.053	0.877	0.979	0.791	0.849	0.954
BW estimate (h)	4.524|4.524	2.533|2.533	6.855|4.401	4.758|4.758	4.482|4.482	4.548|4.548	4.743|4.743
BW bias (b)	7.274|7.274	5.452|5.452	11.015|6.614	7.579|7.579	7.259|7.259	7.316|7.316	7.628|7.628
Observations	55,552|212,881	55,552|212,881	55,552|212,881	55,509|212,715	55,552|212,881	55,552|212,881	55,509|212,715
Effective observations	14,758|28,710	7,779|15,863	20,863|28,710	14,746|28,695	14,758|28,710	14,758|28,710	14,746|28,695
E [SAP 39] τ	-0.008***	-0.007***	-0.008***	-0.008***	-0.007***	-0.008***	-0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.010|-0.006	-0.010|-0.004	-0.011|-0.006	-0.010|-0.005	-0.010|-0.005	-0.011|-0.006	-0.010|-0.005
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	4.085|4.085	3.613|3.613	3.686|4.985	3.992|3.992	3.844|3.844	4.117|4.117	3.870|3.870
BW bias (b)	6.376|6.376	5.404|5.404	6.122|8.189	6.338|6.338	6.210|6.210	6.424|6.424	6.258|6.258
Observations	212,881|847,082	212,881|847,082	212,881|847,082	212,715|846,397	212,881|847,082	212,881|847,082	212,715|846,397
Effective observations	82,257|162,878	64,682|124,591	64,682|162,878	64,639|124,490	64,682|124,591	82,257|162,878	64,639|124,490
D [SAP 55] τ	-0.003**	-0.002*	-0.003***	-0.003*	-0.003*	-0.003**	-0.003*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.005|-0.001	-0.005|0.000	-0.006|-0.002	-0.004|-0.001	-0.004|-0.001	-0.005|-0.001	-0.004|-0.001
Bias-corrected p-value	0.006	0.038	0.000	0.011	0.011	0.004	0.011
BW estimate (h)	6.182|6.182	4.022|4.022	3.922|4.916	6.592|6.592	6.395|6.395	6.074|6.074	6.610|6.610
BW bias (b)	9.124|9.124	6.385|6.385	6.612|5.771	9.615|9.615	9.570|9.570	9.037|9.037	9.897|9.897
Observations	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	846,397|1,899,716	847,082|1,901,099	847,082|1,901,099	846,397|1,899,716
Effective observations	441,896|841,490	318,459|569,763	249,402|569,763	441,534|840,909	441,896|841,490	441,896|841,490	441,534|840,909
C [SAP 69] τ	-0.001**	-0.001**	-0.001	-0.001**	-0.001**	-0.001**	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bias-corrected 95% CI	-0.001|0.000	-0.002|0.000	-0.001|0.000	-0.001|0.000	-0.001|0.000	-0.001|0.000	-0.001|0.000
Bias-corrected p-value	0.002	0.004	0.097	0.001	0.001	0.001	0.001
BW estimate (h)	4.935|4.935	4.551|4.551	3.801|6.524	4.440|4.440	4.855|4.855	5.004|5.004	4.460|4.460
BW bias (b)	5.377|5.377	5.134|5.134	8.280|5.849	5.415|5.415	5.401|5.401	5.355|5.355	5.397|5.397
Observations	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,899,716|903,313	1,901,099|906,395	1,901,099|906,395	1,899,716|903,313
Effective observations	617,403|585,021	617,403|585,021	463,988|712,117	616,903|584,337	617,403|585,021	768,864|653,892	616,903|584,337
B [SAP 81] τ	0.000	0.000	0.002	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.001|0.002	-0.002|0.002	0.000|0.004	-0.001|0.002	-0.001|0.002	-0.001|0.002	-0.001|0.002
Bias-corrected p-value	0.751	0.924	0.098	0.782	0.776	0.746	0.832
BW estimate (h)	4.508|4.508	4.379|4.379	2.948|6.038	4.687|4.687	4.532|4.532	4.504|4.504	4.758|4.758
BW bias (b)	6.509|6.509	6.353|6.353	5.365|5.877	6.337|6.337	6.519|6.519	6.507|6.507	6.400|6.400
Observations	906,395|75,629	906,395|75,629	906,395|75,629	903,313|72,126	906,395|75,629	906,395|75,629	903,313|72,126
Effective observations	143,176|68,490	143,176|68,490	59,917|73,952	141,381|65,390	143,176|68,490	143,176|68,490	141,381|65,390
A [SAP 92] τ	-0.027***	-0.027***	-0.028***	-0.027***	-0.025***	-0.028***	-0.024***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
Bias-corrected 95% CI	-0.033|-0.024	-0.033|-0.017	-0.034|-0.025	-0.037|-0.024	-0.029|-0.022	-0.033|-0.022	-0.031|-0.018
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	4.806|4.806	4.157|4.157	4.234|4.375	3.372|3.372	4.919|4.919	4.768|4.768	3.472|3.472
BW bias (b)	5.532|5.532	5.234|5.234	5.122|5.086	5.579|5.579	5.568|5.568	5.487|5.487	5.519|5.519
Observations	75,629|515	75,629|515	75,629|515	72,126|487	75,629|515	75,629|515	72,126|487
Effective observations	1,677|452	1,677|452	1,677|452	812|387	1,677|452	1,677|452	812|387
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: This table presents the results from the local linear RD analysis for EE investment probability discontinuities at each rating band threshold. Each panel row contains the estimate for coefficient τ which represents the estimated EE investment discontinuity of being above the rating band threshold. Columns (1) to (3) present the results from Specification (5) with different bandwidth selection procedures and kernels. Columns (4) to (7) present the results from Specification (6) including different sets of covariate controls. Property Characteristics include property type, number of rooms and tenure, Area FE include region and urban classification and Date FE adds sale year and sale quarter.

6.2 Policy Considerations

Our results suggest that the EE investment incentives generated for sellers by price discontinuities at the rating band thresholds are aligned with the main objective of the policy, which, as explained in Section 2, is to reduce greenhouse gas emissions by making the UK housing stock more energy efficient. Although rating bands distract attention form the more precise SAP rating, we do not advocate their removal from the label. Previous research (e.g. Newell & Siikamäki 2014, Stadelmann & Schubert 2018) provides evidence that simple salient labels encourage EE consumption and that the absence of simplified information is likely to induce other biases (such as left-digit bias on the SAP score) that can be difficult to leverage. Instead, because policy makers have control over the format of energy labels, we propose that the design of rating bands can be improved by accounting for selective attention to further incentivise EE investments. While our recommendations are focused on EE in the housing market, we believe them to also be relevant for other settings where labelling is implemented aggregating detailed information into broader categories and thereby creating arbitrary thresholds.

We find that effect sizes of rating band thresholds on price and seller investment behaviour decrease as EE increases. For instance, we estimate a price premium of 2.5% for rating band F, 0.8% for rating band C, and find no statistically significant discontinuity for rating band B. Similarly, our estimated probability of investment in EE before a sale is 3.25% higher before crossing the threshold for rating band E, 0.4% higher before crossing the threshold for rating band C and there is no effect for rating band B.[32] The lower investment probabilities can be explained by a lower expected price premium and the increasing cost and effort of making EE improvements[33] when the SAP rating is high. Thus, it is unclear if moving the thresholds towards the higher end of the SAP rating scale (for example by increasing the threshold for rating band D from 55 to 65) would maintain the size of the effects.[34] Rating band thresholds are currently designed so that the lower bands are wider: For instance rating band G comprises 20 SAP rating units while rating band A only 9. An alternative design is to make lower rating bands narrower and higher rating bands wider as this would increase the number of thresholds where we find stronger effects. However, as the housing stock moves towards higher EE the number of properties in the lower rating bands will decrease. Introducing a dynamic rating band design, as proposed by Comerford et al. (2020), for example

[32]While we find price and EE investment incentive effects for rating band A, our average estimates are very noisy and need to be interpreted with caution due to the limited number of properties within this rating band (0.01% of all transactions).

[33]For example by having to replace all wall insulation or install solar panels.

[34]It should be noted though that almost half of the properties in our sample (48%) have a rating band of either D or C.

using septiles of the existing housing stock, can maintain the volume of properties at the lower rating bands consistent and further incentivise EE investment as owners could risk dropping into a lower rating band before a sale if no EE improvements are made.

We find no price or incentive discontinuities at the threshold between rating bands C and B, and although we observe an investment incentive discontinuity between rating bands B and A those results need to be interpreted with caution as there are very few observations with an A rating. A possible explanation for the absence of consistent discontinuities in this range is that rating bands A, B and C are all coloured green and thus not strikingly visually different. Previous research (e.g. Waechter et al. 2016) propose that the salience of the colour traffic-light system (Green-Yellow-Red) is stronger than the letter scale in the EU energy efficiency label, and thus it is possible that once a property has reached the green rating C the marginal benefit of increasing it to a *greener* B or A is seen as lower than increasing from red to yellow, or yellow to green. A more salient colour variation for these bands, for example moving C and B towards the yellow scale, could help trigger the price and EE investment threshold effects we identified in Section 6.1. A possible explanation for the EE investment incentive discontinuity for reaching rating band A (11%) is that some sellers are targeting a very specific group of buyers (e.g. individuals who have a high valuation for the environment or who are very cost sensitive with regards to energy consumption), and because other sellers are reaching that A rating for different reasons (e.g. the quality of the materials) the heterogeneity around this threshold is large and therefore the price premium discontinuities are not statistically significant. As mentioned before, we refrain from drawing conclusions from evidence around this threshold due to the limited amount of transactions with rating band A.

We also show that rating band price premiums are present in sales of existing properties but not of newly built properties. While having the same EE rating scale for existing and new buildings[35] can help individuals compare EE across properties, the typically different sale process and geographic distribution of existing and new buildings make the comparison less relevant: As mentioned above, new buildings are sometimes sold off-plan before an EPC is available and normally as part of a new area development. Our results suggest that individuals are more attentive to the rating bands which by themselves do not provide precise information that buyers can use to compare the estimated running energy costs between existing and new properties. Furthermore, as there is legislation in place requiring strict minimum levels of EE for new and repurposed buildings (HMG 2016[36] most of the

[35]As mentioned in Section 2, the procedure for calculating the SAP rating is different for existing properties and new properties, but the final results are based on the same energy costs methodology.

[36]This requirements are not specified in SAP rating units but rather in building material

new properties in our dataset (70%) have SAP ratings between 81 and 86 that fall within rating band B. The distribution of new buildings across the SAP range is highly compressed which makes their discrimination in terms of EE difficult. Also, some existing properties (due to their built type or their listed building status[37]) cannot reach the higher ends of the current SAP rating scale and thus achieve higher rating bands. We propose that having a different EE efficiency scale for new buildings, either at the SAP ratings or the rating bands, can distribute them across a broader range of SAP scores and across rating bands to trigger the threshold effects we identified. For instance, new properties that are at the lower end of the new scale could be assigned an orange or yellow rating band leveraging the salience of the colour traffic-light system discussed above. This change would also give room for adjusting the EE scale of existing buildings to provide a wider distribution across the higher rating bands and further incentivise investment. With the current scale some old buildings have a *potential* rating band of E or F, which means that even by making all of the EE improvements listed in the EPC it is not possible to reach a higher rating band. An adjusted scale could allow these properties to reach the higher yellow or green rating bands and trigger the threshold effects we identify.

Finally, the literature on behavioural organisational economics studies how rational firms, or sophisticated sellers in the case of the housing market, profit from limited attention and how policies can be promoted to protect inattentive buyers. The argument is subtly different in high value asset markets, such as the housing market, where purchasing transactions amount to wealth acquisition at the same time: While the rating bands are static and the validity of the EPC is long term (currently 10 years), although buyers may pay a price premium for an EE rating band they will expect to get that price premium back if they decide to sell. However, the welfare effects will be different if rating bands are dynamic (i.e. the thresholds change at different times) or if the base measurement has depreciation implications (e.g. SAP ratings are based on energy costs which are sensitive to large increases across time and higher energy costs translate to lower SAP ratings), then the surplus that buyers get will diminish over time. For instance, a buyer might purchase a property with rating band C that drops to D after requesting a new EPC, and they will be forced to make increasingly more expensive EE investments to take it back to rating C. This may create an unstable equilibrium where sellers benefit the most. The impact would be stronger for individuals entering the market (e.g. first time home buyers) as homeowners moving up the housing market (e.g. buying bigger houses) would be able to extract the price premium before the

qualities (e.g. heat transfer - HMG 2016).

[37]Listed buildings are of historic or architectural interest and thus structural changes are normally not permitted, for instance replacing the window structure.

sale. As former buyers can become future sellers, there is a potential problem stemming from heterogeneity in agent sophistication (i.e. the savviness of market participants). Nonetheless, as mentioned above, dynamic rating bands where the thresholds regularly shift upwards, towards the more efficient end of the SAP scale (as proposed by Comerford et al. 2020), have the potential to continuously incentivise EE investments during the sale process and help make the housing stock more energy efficient. Therefore, we put forward for consideration that while the benefits of promoting EE investments in the overall housing stock using labels can be attractive, the welfare effects are not immediately clear.

As mentioned earlier, our findings and recommendations are relevant to settings other than EE in the housing market. Labelling policies that require aggregating detailed information into broad categories will create thresholds that may trigger the effects that we document in this paper. For instance, our recommendations apply closely to the UK market of household appliances (e.g. refrigerators or washing machines). The appliances EE labels, using a similar visual format to the EPC, group kilowatt hours (kWh) ranges into colour coded rating bands,[38] these groupings will create thresholds that can be leveraged, for example by moving them to ranges that are more cost effective for manufacturers and thus increase their incentives to produce more EE lines. Similarly, the UK government recommends including front of pack (FoP) nutrition labels for pre-packed food products sold through retail outlets (DH 2016). While these labels are voluntary, if provided they must comply with a traffic light system designed to convey the "healthiness" of the product. The information on the contents of sugar, salt, fat and saturated fat in a product must be displayed as a percentage of the recommended daily allowance and within a colour coded box (red, amber or green). The specific colour for each component is assigned using rules that take into account the total contents (in grams) compared to the total recommended daily allowance. These rules create thresholds that, as before, can be leveraged to further incentivise the production and consumption of healthy alternatives.

7 Robustness Analysis

To show the validity of our findings, we perform a wide range of robustness checks, which we summarise here. The comprehensive results of the tests described in this section are included in Appendices B and C.

[38]The current appliances EE labels include the A+, A++ and A+++ rating bands for the most efficient products.

7.1 Price Discontinuities

7.1.1 Empirical Specification and Placebo Tests

Our main analysis for price discontinuities (Section 5) already documents that results are robust to different bandwidth selection procedures and kernels for local linear regressions. We also perform the bandwidth selection procedure using the full range of SAP ratings for each threshold, instead of only the previous and current rating bands, and obtain results that are essentially the same. We also run the analysis using wider ad-hoc bandwidths and find no substantial differences. The results obtained with different bandwidths are shown in Table B1.

We repeat our analysis using price per square meter as the dependent variable (instead of its log-transformed version) and find the same qualitative results. The discontinuities are present and statistically significant for rating band thresholds G-F, F-E, E-D and D-C and vary from £19.79 per square-meter at threshold D-C to £53.10 per square-meter at threshold G-F under Specification (1). Similar to our main results, there are no statistically significant price increases for rating band thresholds B and A. The results of this analysis are included in Table B2. We perform our analysis using total sale price (log) as the dependent variable (instead of price per square meter (log)). As with our main analysis, the results (Table B3) show statistically significant price discontinuities at the thresholds G-F, E-F, E-D and D-C with similar effect sizes to our main results when the controls include total floor area.[39]

To further rule out specification issues we perform various falsification and placebo tests. We test for discontinuities for three SAP rating units before and after the thresholds and find no consistent or statistically significant discontinuities (results are shown in Table B4). Similarly, to rule out the presence of left digit bias, we perform tests at 10 SAP rating intervals (10, 20, 30, etc.) and find no systematic discontinuities as shown in Table B5. These results provide further evidence that market participants pay less attention to the more precise SAP rating, as at least some left-digit bias would be expected[40] if the underlying SAP rating was an important metric for market participants.

Finally, we replicated our analysis using a high-order polynomial function model, similar to Englmaier et al. (2018) and Lacetera et al. (2012) and find largely similar results. The main difference is that under this method the discontinuity at

[39]The analysis using total sale price (log) as the dependent variable also finds a statistically significant discontinuity for threshold B-A. However, the effect size varies considerably with the inclusion of covariates and as explained above must be interpreted with caution due to the limited number of properties with rating band A.

[40]Left-digit bias is a heuristic where individuals focus on the left-most digit of a number and are inattentive to the other digits, evidence of this bias in the car market is provided by Englmaier et al. (2018) and Lacetera et al. (2012).

D-C (69) is consistently estimated at 1%.

7.1.2 Balance of Baseline Covariates

Our main analysis already includes baseline covariate controls throughout to document that the discontinuities are not the result of differences in the distribution of property characteristics, sale dates or geographic areas around the thresholds. We additionally check for discontinuities at the rating band thresholds for each of the covariates by performing separate discontinuity analyses, with local linear regressions, to further show that the price discontinuities are not driven by systematic differences in the characteristics of properties on either side of the thresholds. Figures B1, B2, B3 and B4 present the proportions per SAP rating for geographic region, sale year, sale quarter and property type respectively. The results of the regression analysis for area covariates (Table B6) show no systematic discontinuities. The results for date covariates (Table B7) show a discontinuity for year 2019 at the F-E threshold. As explained in Section 2, regulations came into force in 2018 requiring properties that are offered for rent to have rating band E or higher, which makes this discontinuity likely the result of buy-to-rent transactions. We show that our estimated price discontinuities are not driven by these transactions by running the price discontinuity analysis excluding sales registered on or after April 2018. The results (Table B8) vary little from our main estimates and are even bigger for threshold G-F, providing further evidence that these transactions are not responsible for price discontinuities. The results for property covariates show small but statistically significant discontinuities only in the proportion of detached properties (Table B9). While these results could potentially be indicative of sorting for detached houses, we again show that the price discontinuities are not driven by the differences in proportions by running the price discontinuity analysis excluding detached properties. Again the estimated price discontinuities vary very little as shown in Table B10. Our main analysis uses UK regions (10 regions) to control for geographic area fixed effects. We repeat our analysis using post code areas instead (the first portion of the postcode - 105 postcode areas) and find largely the same results (Table B11).[41] These results also provide evidence that the price discontinuities are not due to local area property market characteristics (i.e. market hotness) as these would be accounted for when controlling for date FE and postcode area FE.

Since the dependent variable in our main analysis is price per square meter, we also perform the discontinuity analysis for total floor area (Figure B5 and

[41]The estimated size of the discontinuity at threshold G-F is smaller when controlling for postcode area FE as there is less variability (fewer comparable properties within each postcode area around the threshold) and the bandwidth for the local linear regression needs to be larger to increase precision but also increases bias.

Table B12). Although we find total-floor-area discontinuities at the E-D and D-C thresholds, the estimates are small (0.428 and 0.856 square meters after controlling for covariates) and, importantly, positive.[42] The higher total floor area averages at these thresholds are unlikely to drive the size of our estimated price discontinuities as the relationship between price per square meter and total floor area is negative.[43] If anything, the total floor area discontinuities will understate the higher prices above the threshold and make our estimates slightly smaller. Nonetheless, total floor area discontinuities provide further evidence of sorting (similar to the density increases mentioned in Section 3), which we discuss in more detail in Section 6. The sorting in this case would be of large properties. A potential explanation is that people with larger houses may react stronger to the price and EE investment threshold effects we identify (discussed in Sections 5 and 6.1) due to the expectation of higher energy cost savings.

7.1.3 Rating Band Increases

Our main analysis excludes properties that we have identified as having increased their rating band before a sale as they could represent self-selection into treatment. On average, the price per square meter for these properties is lower than that of other properties, for instance the average square meter price for properties with SAP rating 69 that have not increased their rating band is £2,781 compared to £2,640 for properties that increased their rating band before a sale.[44] A possible explanation is that some of the properties that are increasing their rating band before a sale are of lower quality in terms of condition or features that are unobservable to the researcher. Owners could then be trying to compensate for this lack of attractiveness with a variety of methods including an increase of the EE rating band. Table B13 presents the results of our analysis when we include properties that increased their rating band, the estimated discontinuities do not vary considerably but are smaller. These results provide evidence that the price discontinuities estimated in our main analysis are not the result of self-selected properties that we could not identify. We discuss the behaviour of sellers who invest in EE before a sale in Section 6.1.

[42] We also find a statistically significant discontinuity at the B-A threshold of $21.22m^2$ without there being a statistically significant *price* discontinuity, which is most likely due to the limited amount of properties and the resulting erratic density around that threshold as discussed in Section 5.2.

[43] A regression with price per meter (log) as the dependent variable yields a coefficient of -0.02% per additional square meter at a significance level of 0.1%.

[44] The averages of the log transformation of price per square meter and total sale price at SAP rating 69 are also lower for properties that have increased their rating band, 7.71 compared to 7.79 and 12.16 compared to 12.22 respectively.

7.1.4 Counterfactual Scenario

While our analysis only uses sales between July 2012 and September 2019, recall that our full dataset contains sale transactions from October 2008 to September 2019. As explained in Section 2, from October 2008 to March 2012 the legislation in place could be interpreted as requiring sellers to provide the EPC to buyers before the sale was completed but not necessarily before a price was agreed (i.e. not necessarily as part of marketing materials). While self-selection may be present in these transactions in a small scale, where some sellers could advertise the EE rating of a property as a desirable feature, it also brings us close to a counterfactual scenario where the EE ratings would not play a significant role when negotiating the sale price.

We find that the relationship between sale price and SAP rating during this period is continuous across the range. We find no consistent or statistically significant discontinuities at rating band thresholds. Figure B6 shows the average price per square meter (log) for each SAP rating and Table B14 shows the results of the formal analysis.

Importantly, these results confirm our main assumption for the use a regression discontinuity design as our identification strategy (stated in Section 4), the distribution of properties with different characteristics across each SAP rating unit is as-good-as random, and in the absence of EE rating band information during the sale process there are no price discontinuities at the thresholds.

7.2 Seller Investment Behaviour

7.2.1 Empirical Specification and Placebo Tests

Our analysis of threshold effects on seller EE investment probability (Section 6.1) documents that results are robust to different bandwidth selection procedures and kernels for local linear regressions. We also perform the analysis using different ad-hoc bandwidths (Table C1) and show that the results do not change substantially, the size of the estimates is slightly larger when using smaller bandwidths. We run falsification and placebo tests (for up to three SAP rating units before and after the threshold and at 10 SAP rating unit intervals) and find no systematic discontinuities (Tables C2 and C3).

7.2.2 Balance of Baseline Covariates

Our analysis in Section 6.1 also includes various sets of baseline covariate controls as evidence that results are not driven by differences in the distribution of property characteristics, sale dates or geographic areas around the thresholds. Moreover, we check for discontinuities at the thresholds for each of the covariates by performing

separate local linear regression discontinuity tests. Note that the running variable, initial SAP rating before EE improvements, is not the same as the one used in the price discontinuity analysis, which is the final SAP rating after EE improvements. The results for geographic area (Figure C1 and Table C4) and sale date (Figures C2 and C3 and Table C5) show no systematic discontinuities at the thresholds. The results for property type show small but statistically significant discontinuities in the proportion of detached houses (Figure C4 and Table C6). Nonetheless, as our running variable is the *initial* SAP rating and our dependent variable is the proportion of properties that *will* make EE investments, a higher proportion of detached houses (to start with) does not represent a problem for our empirical strategy. If anything, it would be an indication that detached properties are more likely to have already made some EE investments (for example to reduce energy costs or improve comfort) during the time the previous owner was living in the property. We also repeat our analysis using post code areas instead of regions (as discussed in Section 7.1.2) and find largely the same results.

7.2.3 Counterfactual Scenario

Finally, we repeat our analysis using transactions between October 2008 and March 2012 as our close counter factual scenario (discussed in more detail in Section 7.1.4). While the graphical analysis does not show clear discontinuities at the thresholds (Figure C5), the results from local linear regressions show discontinuities at thresholds E-D, D-C and C-B (Table C8). These discontinuities do not suggest a consistent rating band threshold effect, for instance the sign for the discontinuities at E-D and C-B is negative (similar to the results from our main analysis) but positive for D-C. As mentioned above, during these period sellers could selectively advertise the rating band of a property as a desirable feature, so these noisy discontinuities may be the result of a small number of sellers who are making EE investments in an attempt to promote the property better.

8 Conclusion

We present evidence of limited attention in the housing market and study the effects of EE information on final sale prices and EE investments of residential properties in England and Wales. Our results show that the provision of simplified information in the form of EE rating bands, on top of the more informative SAP rating, leads to price discontinuities at the rating band thresholds. We estimate the price discontinuities to be between 0.8% at the D-C threshold (where most sales are recorded) and 2.5% at the G-F threshold (the most energy inefficient bands). Given the average sale prices around these thresholds, a back-of-the-envelope calculation

yields a price difference between £2,000 and £6,625 for crossing a rating band threshold, which in many cases (especially at the lower end of the scale) can be achieved by inexpensive EE improvements. We estimate that, compared to a counterfactual situation in which full attention is paid to the more informative SAP score, the provision of rating bands reduces this attention by anywhere between 12.5% (at the D-C threshold) and 34.2% (at the E-D threshold), with an average reduction of 25.3% across all thresholds for which we find price discontinuities.

We also show that the probability of observing last-minute EE investments before the property is marketed is considerably higher if an initial SAP rating falls just short of crossing a rating band threshold: We estimate that the probability of investing in EE is between 0.4% and 11% higher in the area just below a rating band threshold (depending on the specific rating band) relative to the total number of properties that made EE investments prior to a sale in our dataset. These results suggest that some sellers appear to be aware of the price discontinuities and are willing to bet on extracting the price premium by investing to take the property to a higher rating band.

This interpretation implies a certain level of agent sophistication in the British housing market. However, while it may be tempting to suggest that we are observing the behaviour of sophisticated sellers who – akin to the well-established winner's curse in auction theory – exploit the buyer with the highest degree of naivety in the market, we do not believe that the lesson to be learnt is that simple. After all, making a last-minute EE investment may be successful in snatching the price premium when re-selling one's home, but even more would have been gained, had the investment been made right after the *purchase* of the property (when the current seller was a fresh buyer herself): Not only would the realisation of the price premium merely be postponed, but – on top of that – the investment would also be compensated via reduced energy bills and increased living comfort while owning the modernised property. Given these considerations, one would expect that agents with the highest levels of savvy will have already made any expedient EE investments long before they could be detected by our data, which prevents us from studying the issue of agent sophistication with the degree of rigour we deem necessary. Future research involving randomized controlled trials will be better suited to discern whether last-minute EE investors are quasi-sophisticated[45] arbitrageurs seeking to exploit the biases of buyers or whether they are themselves overestimating the energy gains from crossing a threshold.

Irrespective of the issue of agent sophistication, we provide considerations for

[45]The mandatory EPC may have the effect of turning naive owners into sophisticated sellers, as it makes the mapping of energy investments into EPC rating bands salient at a time when they are preparing to present their property in its best possible light. Appendix E shows the first page of a sample EPC with estimated running energy costs and, importantly, EE improvement recommendations.

policy that can be extended to other settings where the provision of aggregate information creates reference thresholds. While letter colour-coded rating bands distract attention from the more informative SAP ratings, we do not advocate their removal as previous research suggests that letter colour-coded ratings draw attention, and hence decision weight, to energy efficiency (e.g. Newell & Siikamäki 2014, Stadelmann & Schubert 2018). We instead suggest that the design of policies and labels needs to account for selective attention. We find that threshold effects are stronger towards the lower end of the EE scale and put forward the notion that having more thresholds around this area can further incentivise EE investment as improvement costs are lower. As the housing stock moves towards higher EE, having dynamic rating bands as proposed by Comerford et al. (2020) can maintain the volume of transactions consistent at the lower rating bands. We do not find consistent discontinuities between rating bands A, B and C. We argue that this may be due to them being all shown as different shades of green in the EE label, as previous research (e.g. Waechter et al. 2016) suggests, increasing the salience of green (e.g. by using a more yellow hue for rating bands C and B) may trigger threshold effects around this range. We also find discontinuities for existing properties but not for newly built properties. This may be because both groups have very different distributions. The large majority of new properties are in rating band B due to building legislation and thus discrimination in terms of EE is made difficult by the current EPC design. Moreover, some existing buildings cannot reach the higher rating bands even after recommended EE improvements because their historical built characteristics physically limit their EE potential. We propose that having different scales for existing and new properties, either at the SAP rating or the rating bands, can distribute them across a much broader range of SAP scores and rating bands to leverage the threshold effects we document. Finally, we discuss the welfare implications of policies that aim at continuously promoting threshold effects in investment and asset markets, for example by having dynamic rating bands shifting upwards or ratings that are based on a measure that depreciates over time (e.g. increasing energy costs). In these scenarios, increasingly more expensive investments will be needed from owners to keep the asset over a threshold. This can create an unstable equilibrium, and as buyers can become sellers, there is a potential problem stemming from heterogeneity in agent sophistication when extracting threshold price premiums. Thus while the benefits or continuously promoting the policy objective (i.e. EE investments) using labels are clear, we suggest that the resulting welfare effects need to be assessed thoroughly.

We anticipate that inattention in the housing market may be related to inattention in other markets where labels are designed by simplifying detailed information into more salient but less precise categories. For instance, the EE ratings for home

appliances in the UK where the rating label follows the same EU colour-letter design, or the UK food label that uses a traffic light system to signal the healthiness of consumables. Our estimated degree of inattention (25.3% on average) can then be compared to that found in these other markets to asses the differences in attention. As the EPC requirement is relatively new, investigating if the price discontinuities are increasing or decreasing over time would provide an insight into the mechanisms of market learning under limited attention. List (2003, 2011) provides evidence that market learning reduces behavioural biases, although in low-value markets, where market participants seem to be less prone to different biases as they gain experience. The next step in this line of research, being studied in Sejas-Portillo (2020), is to investigate how the supply and demand sides of the market are reacting, signalled by changing magnitudes of the threshold effects in price and EE investment probability at different locations, property prices and across time.

References

Bartalotti, O. & Brummet, Q. (2017), 'Regression discontinuity designs with clustered data', *Regression Discontinuity Designs (Advances in Econometrics, Vol. 38)* pp. 383–420.

Bian, X. & Fabra, N. (2020), 'Incentives for information provision: Energy efficiency in the spanish rental market', *Energy Economics* **90**, 104813.

Bibby, P. (2013), 'Urban and rural area definitions for policy purposes in england and wales: Methodology (v1.0)', Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/239477/RUC11methodologypaperaug_28_Aug.pdf (Accessed: 20 Jan 2019).

BRE (2005), 'SAP 2005 - The government's standard assessment procedure for energy rating of dwellings', Available at: https://projects.bre.co.uk/sap2005/pdf/SAP2005.pdf (Accessed: 14 November 2019).

BRE (2014), 'SAP 2012 - The government's standard assessment procedure for energy rating of dwellings', Available at: https://www.bre.co.uk/filelibrary/SAP/2012/SAP-2012_9-92.pdf (Accessed: 14 November 2019).

Broberg, T., Egüez, A. & Kažukauskas, A. (2019), 'Effects of energy performance certificates on investment: A quasi-natural experiment approach', *Energy Economics* **84**, 104480.

Busse, M. R., Lacetera, N., Pope, D. G., Silva-Risso, J. & Sydnor, J. R. (2013), 'Estimating the effect of salience in wholesale and retail car markets', *American Economic Review* **103**(3), 575–79.

Calonico, S., Cattaneo, M. D. & Farrell, M. H. (2019), 'Optimal bandwidth choice for robust bias-corrected inference in regression discontinuity designs', *The Econometrics Journal* **23**(2), 192–210.

Calonico, S., Cattaneo, M. D., Farrell, M. H. & Titiunik, R. (2018), 'Regression discontinuity designs using covariates', *The Review of Economics and Statistics* **101**(3), 442–451.

Calonico, S., Cattaneo, M. D. & Titiunik, R. (2014), 'Robust nonparametric confidence intervals for regression-discontinuity designs', *Econometrica* **82**(6), 2295–2326.

Caplin, A. (2016), 'Measuring and modeling attention', *Annual Review of Economics* **8**(1), 379–403.

Chetty, R., Looney, A. & Kroft, K. (2009), 'Salience and taxation: Theory and evidence', *American Economic Review* **99**(4), 1145–77.

Comerford, D. A., Lange, I. & Moro, M. (2018), 'Proof of concept that requiring energy labels for dwellings can induce retrofitting', *Energy Economics* **69**, 204 – 212.

Comerford, D. A., Moro, M., Sejas-Portillo, R. & Stowasser, T. (2020), 'Leveraging the motivational effects of labels: Lessons from retrofitting', *University of Stirling Working Paper* .

DellaVigna, S. (2009), 'Psychology and economics: Evidence from the field', *Journal of Economic Literature* **47**(2), 315–72.

DellaVigna, S. & Pollet, J. M. (2009), 'Investor inattention and friday earnings announcements', *The Journal of Finance* **64**(2), 709–749.

Department for Communities and Local Government (2017), 'Energy performance certificates for the marketing, sale and let of dwellings', Available at: https://www.gov.uk/government/publications/energy-performance-certificates-for-the-construction-sale-and-let-of-dwellings (Accessed: 14 November 2019).

Department for Communities and Local Government (2019*a*), 'Energy performance certificates: opt-out of public disclosure', Available at:

https://www.gov.uk/guidance/energy-performance-certificates-opt-out-of-public-disclosure (Accessed: 21 November 2019).

Department for Communities and Local Government (2019*b*), 'Making better use of energy performance of buildings data - privacy notice', Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/522014/Privacy_Notice_-_final.pdf (Accessed: 14 November 2019).

Department of Health (2016), 'Guide to creating a front of pack (FoP) nutrition label for pre-packed products sold through retail outlets', Available at: https://www.gov.uk/government/publications/front-of-pack-nutrition-labelling-guidance (Accessed: 23 November 2019).

Energy Performance of Buildings (Certificates and Inspections) (England and Wales) (Amendment) Regulations 2011 (SI 2011/2452) (2011), Available at: http://www.legislation.gov.uk/uksi/2011/2452/contents/made (Accessed: 10 April 2018).

Energy Performance of Buildings (Certificates and Inspections) (England and Wales) (Amendment) Regulations 2012 (SI 2012/3118) (2012), Available at: http://www.legislation.gov.uk/uksi/2012/3118/contents/made (Accessed: 2 November 2018).

Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007 (SI 2007/991) (2007), Available at: http://www.legislation.gov.uk/uksi/2007/991/made (Accessed: 10 April 2018).

Englmaier, F., Schmöller, A. & Stowasser, T. (2018), 'Price discontinuities in an online market for used cars', *Management Science* **64**(6), 2754–2766.

Finkelstein, A. (2009), 'E-ztax: Tax salience and tax rates', *The Quarterly Journal of Economics* **124**(3), 969–1010.

Fuerst, F., McAllister, P., Nanda, A. & Wyatt, P. (2015), 'Does energy efficiency matter to home-buyers? an investigation of epc ratings and transaction prices in england', *Energy Economics* **48**, 145 – 156.

Gabaix, X. (2019), Chapter 4 - Behavioral inattention, *in* B. D. Bernheim, S. DellaVigna & D. Laibson, eds, 'Handbook of Behavioral Economics - Foundations and Applications 2', Vol. 2 of *Handbook of Behavioral Economics: Applications and Foundations 1*, North-Holland, pp. 261 – 343.

Gabaix, X., Laibson, D., Moloche, G. & Weinberg, S. (2006), 'Costly information acquisition: Experimental analysis of a boundedly rational model', *American Economic Review* **96**(4), 1043–1068.

Gelman, A. & Imbens, G. (2019), 'Why high-order polynomials should not be used in regression discontinuity designs', *Journal of Business & Economic Statistics* **37**(3), 447–456.

Gilbert, T., Kogan, S., Lochstoer, L. & Ozyildirim, A. (2012), 'Investor inattention and the market impact of summary statistics', *Management Science* **58**(2), 336–350.

Hirshleifer, D., Lim, S. S. & Teoh, S. H. (2009), 'Driven to distraction: Extraneous events and underreaction to earnings news', *The Journal of Finance* **64**(5), 2289–2325.

HM Government (2016), 'The buildings regulations 2010: Conservation of fuel and power', Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/540326/BR_PDF_AD__L1A__2013_with_2016_amendments.pdf (Accessed: 15 January 2019).

HM Land Registry (2019), 'Price paid data', Available at: https://www.gov.uk/government/statistical-data-sets/price-paid-data-downloads (Accessed: 14 November 2019).

Housing Act 2004 (2004), Available at: http://www.legislation.gov.uk/ukpga/2004/34/contents/made (Accessed: 10 April 2018).

Hyland, M., Alberini, A. & Lyons, S. (2016), The effect of energy efficiency labeling: Bunching and prices in the irish residential property market, Trinity Economics Papers tep0516, Trinity College Dublin, Department of Economics.

Imbens, G. & Kalyanaraman, K. (2012), 'Optimal bandwidth choice for the regression discontinuity estimator', *The Review of Economic Studies* **79**(3), 933–959.

Imbens, G. W. & Lemieux, T. (2008), 'Regression discontinuity designs: A guide to practice', *Journal of Econometrics* **142**(2), 615 – 635. The regression discontinuity design: Theory and applications.

Kolesár, M. & Rothe, C. (2018), 'Inference in regression discontinuity designs with a discrete running variable', *American Economic Review* **108**(8), 2277–2304.

Lacetera, N., Pope, D. G. & Sydnor, J. R. (2012), 'Heuristic thinking and limited attention in the car market', *American Economic Review* **102**(5), 2206–36.

Lee, D. S. & Card, D. (2008), 'Regression discontinuity inference with specification error', *Journal of Econometrics* **142**(2), 655 – 674. The regression discontinuity design: Theory and applications.

Lee, D. S. & Lemieux, T. (2010), 'Regression discontinuity designs in economics', *Journal of Economic Literature* **48**(2), 281–355.

List, J. A. (2003), 'Does market experience eliminate market anomalies?', *The Quarterly Journal of Economics* **118**(1), 41–71.

List, J. A. (2011), 'Does market experience eliminate market anomalies? the case of exogenous market experience', *American Economic Review* **101**(3), 313–317.

Mullainathan, S., Schwartzstein, J. & Shleifer, A. (2008), 'Coarse thinking and persuasion', *The Quarterly Journal of Economics* **123**(2), 577–619.

Newell, R. G. & Siikamäki, J. (2014), 'Nudging energy efficiency behavior: The role of information labels', *Journal of the Association of Environmental and Resource Economists* **1**(4), 555–598.

Pope, D. G. (2009), 'Reacting to rankings: Evidence from "america's best hospitals"', *Journal of Health Economics* **28**(6), 1154 – 1165.

Sejas-Portillo, R. (2020), 'The effect of simplified information in market learning: Evidence from energy-efficiency labels in the housing market', *University of Stirling Working Paper* .

Simon, H. A. (1955), 'A behavioral model of rational choice', *The Quarterly Journal of Economics* **69**(1), 99–118.

Stadelmann, M. & Schubert, R. (2018), 'How do different designs of energy labels influence purchases of household appliances? a field study in switzerland', *Ecological Economics* **144**, 112 – 123.

Stigler, G. J. (1961), 'The economics of information', *Journal of Political Economy* **69**(3), 213–225.

Tversky, A. & Kahneman, D. (1974), 'Judgment under uncertainty: Heuristics and biases', *Science* **185**(4157), 1124–1131.

Waechter, S., Sütterlin, B., Borghoff, J. & Siegrist, M. (2016), 'Letters, signs, and colors: How the display of energy-efficiency information influences consumer assessments of products', *Energy Research & Social Science* **15**, 86 – 95.

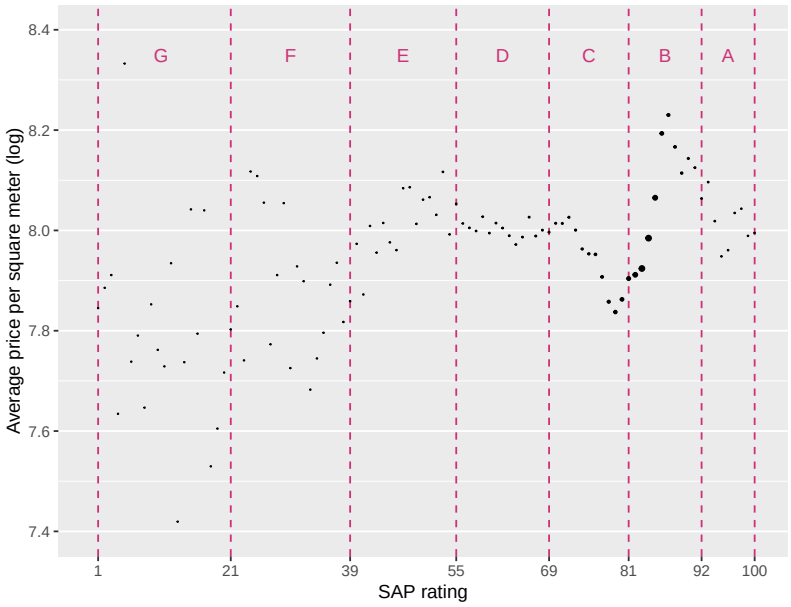
Appendix A New Buildings

The average price per meter (log) bins for SAP rating units for new properties are shown in Panel A of Figure A1. The price residuals after controlling for property characteristics (property type and tenure),[46] location (region and urban classification) and the sale year quarter are shown in Panel B of Figure A1. The discontinuities between rating bands G, F, E, D and C are not as clear because of the low frequencies of new properties within these bands. The discontinuity between rating bands C and B also disappears after controlling for covariates. New properties have to comply with minimum energy efficiency regulations and also in the UK housing market the final sale price can be agreed before construction is finished, thus it is expected that energy efficiency rating bands will have a much lower effect in the final sale price.

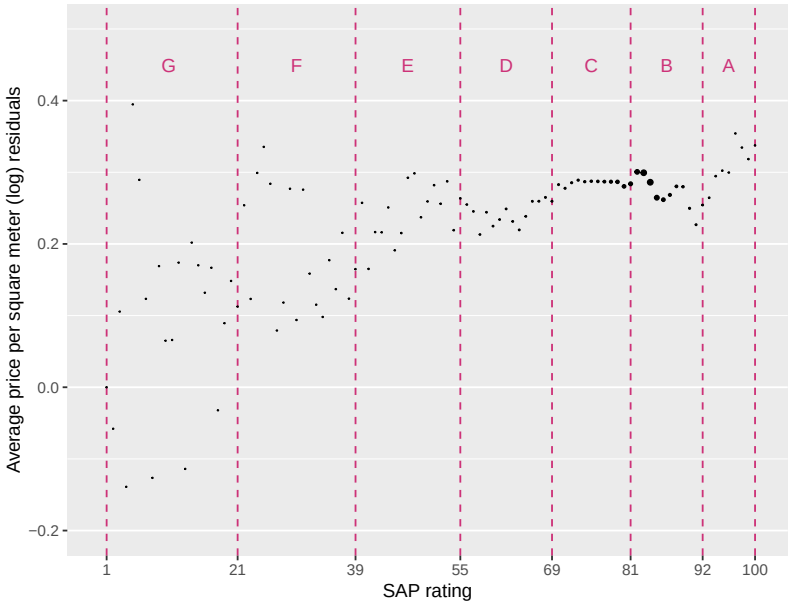
[46]The EPCs for new buildings do not generally include the number of rooms.

Figure A1: Price – SAP Rating for New Properties

Panel A. Price Per Square Meter (Log) – SAP Rating



Panel B. Price Per Square Meter (Log) Residuals – SAP Rating



Notes: N=893,534

Table A1: Local Linear RD Estimates for New Properties

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	0.215	0.001	0.185	0.164	0.049	0.140	-0.051*
	(0.100)	(0.031)	(0.097)	(0.101)	(0.038)	(0.113)	(0.038)
Robust 95% CI	-0.019|0.520	-0.381|0.279	-0.030|0.443	-0.137|0.502	-0.053|0.112	-0.162|0.439	-0.176|-0.013
Robust p-value	0.068	0.762	0.088	0.263	0.481	0.365	0.024
BW estimate (h)	6.898|6.898	2.975|2.975	6.861|5.536	5.564|5.564	4.706|4.706	6.757|6.757	4.425|4.425
BW bias (b)	11.772|11.772	6.378|6.378	13.380|8.829	9.830|9.830	6.619|6.619	10.705|10.705	6.726|6.726
Observations	299|1,061	299|1,061	299|1,061	299|1,061	299|1,061	299|1,061	299|1,061
Effective observations	112|244	39|88	112|202	83|202	72|152	112|244	72|152
E [SAP 39] τ	0.108***	0.201**	0.136***	0.125***	0.092*	0.091**	0.069
	(0.045)	(0.048)	(0.049)	(0.053)	(0.067)	(0.048)	(0.070)
Robust 95% CI	0.096|0.284	0.104|0.417	0.113|0.326	0.114|0.344	0.020|0.278	0.067|0.264	-0.031|0.248
Robust p-value	0.000	0.001	0.000	0.000	0.024	0.001	0.129
BW estimate (h)	3.757|3.757	2.937|2.937	3.392|7.646	3.389|3.389	4.455|4.455	3.889|3.889	5.203|5.203
BW bias (b)	6.291|6.291	5.559|5.559	6.163|9.947	5.927|5.927	6.642|6.642	6.444|6.444	7.405|7.405
Observations	1,061|5,340	1,061|5,340	1,061|5,340	1,061|5,340	1,061|5,340	1,061|5,340	1,061|5,340
Effective observations	320|664	218|471	320|1,638	320|664	419|896	320|664	485|1,119
D [SAP 55] τ	0.017	0.037	0.075	0.030	0.062	0.030	0.069*
	(0.052)	(0.062)	(0.048)	(0.053)	(0.036)	(0.049)	(0.030)
Robust 95% CI	-0.061|0.148	-0.051|0.198	0.000|0.239	-0.053|0.167	-0.009|0.179	-0.045|0.160	0.020|0.170
Robust p-value	0.419	0.248	0.050	0.307	0.077	0.269	0.013
BW estimate (h)	6.322|6.322	3.533|3.533	4.014|3.706	6.100|6.100	3.783|3.783	5.777|5.777	3.877|3.877
BW bias (b)	9.461|9.461	6.507|6.507	6.650|5.372	9.214|9.214	6.436|6.436	9.012|9.012	6.534|6.534
Observations	5,340|22,248	5,340|22,248	5,340|22,248	5,340|22,248	5,340|22,247	5,340|22,248	5,340|22,247
Effective observations	3,092|7,784	1,762|3,732	2,281|3,732	3,092|7,784	1,762|3,732	2,713|6,332	1,762|3,732
C [SAP 69] τ	0.009	0.019	-0.010	0.005	-0.011	0.011	-0.011
	(0.012)	(0.015)	(0.006)	(0.008)	(0.009)	(0.013)	(0.005)
Robust 95% CI	-0.033|0.068	-0.026|0.083	-0.061|0.046	-0.021|0.054	-0.027|0.004	-0.037|0.079	-0.029|0.005
Robust p-value	0.506	0.299	0.784	0.386	0.147	0.474	0.173
BW estimate (h)	3.860|3.860	3.489|3.489	2.599|4.506	3.525|3.525	4.695|4.695	3.705|3.705	4.216|4.216
BW bias (b)	5.618|5.618	5.373|5.373	5.723|4.976	5.556|5.556	5.915|5.915	5.666|5.666	6.263|6.263
Observations	22,248|177,930	22,248|177,930	22,248|177,930	22,248|177,930	22,247|177,924	22,248|177,930	22,247|177,924
Effective observations	7,058|14,347	7,058|14,347	4,962|19,943	7,058|14,347	9,080|19,943	7,058|14,347	9,080|19,943
B [SAP 81] τ	0.031	0.023	0.009	0.029***	0.029***	0.011	0.022***
	(0.031)	(0.042)	(0.018)	(0.005)	(0.004)	(0.034)	(0.007)
Robust 95% CI	-0.015|0.046	-0.017|0.075	-0.028|0.001	0.011|0.034	0.009|0.017	-0.015|0.036	0.012|0.020
Robust p-value	0.323	0.220	0.071	0.000	0.000	0.434	0.000
BW estimate (h)	6.183|6.183	5.127|5.127	3.291|4.686	4.681|4.681	3.844|3.844	6.830|6.830	5.448|5.448
BW bias (b)	6.834|6.834	6.294|6.294	5.091|5.589	7.460|7.460	5.059|5.059	6.735|6.735	5.690|5.690
Observations	177,930|680,640	177,930|680,640	177,930|680,640	177,930|680,640	177,924|680,629	177,930|680,640	177,924|680,629
Effective observations	151,062|647,921	141,651|623,553	111,081|575,031	128,873|575,031	111,077|471,801	151,062|647,921	141,645|623,542
A [SAP 92] τ	-0.065**	-0.032	-0.064***	-0.079***	0.047***	-0.066**	0.026***
	(0.021)	(0.014)	(0.022)	(0.004)	(0.010)	(0.021)	(0.006)
Robust 95% CI	-0.179|-0.045	-0.174|0.048	-0.179|-0.051	-0.152|-0.067	0.027|0.065	-0.172|-0.048	0.020|0.044
Robust p-value	0.001	0.264	0.000	0.000	0.000	0.001	0.000
BW estimate (h)	3.850|3.850	2.831|2.831	3.864|4.014	2.738|2.738	4.590|4.590	3.890|3.890	3.692|3.692
BW bias (b)	5.756|5.756	4.966|4.966	5.653|4.862	5.642|5.642	5.584|5.584	5.794|5.794	6.092|6.092
Observations	680,640|6,016	680,640|6,016	680,640|6,016	680,640|6,016	680,629|6,016	680,640|6,016	680,629|6,016
Effective observations	17,222|4,361	7,465|3,722	17,222|4,826	7,465|3,722	32,719|4,826	17,222|4,361	17,222|4,361
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the robust bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=893,534.

Appendix B Price Discontinuities Robustness Analysis Results

B.1 Empirical Specification

Table B1: Local Linear RD Estimates with Different Bandwidths

	BW = 2		BW = 3		BW = 4		BW = 5	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
F [SAP 21] τ	0.026***	0.035***	0.026***	0.032***	0.025***	0.023***	0.026***	0.020***
	(0.000)	(0.000)	(0.001)	(0.004)	(0.001)	(0.008)	(0.002)	(0.008)
Bias-corrected 95% CI	0.031|0.031	0.032|0.032	0.026|0.026	0.049|0.049	0.026|0.026	0.045|0.052	0.022|0.026	0.020|0.046
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	60,808|239,167	60,769|238,990	60,808|239,167	60,769|238,990	60,808|239,167	60,769|238,990	60,808|239,167	60,769|238,990
Effective observations	8,800|17,837	8,797|17,827	12,824|24,642	12,817|24,627	16,634|32,253	16,623|32,235	20,202|40,545	20,190|40,523
E [SAP 39] τ	0.026***	0.012***	0.028***	0.012***	0.021***	0.010***	0.019***	0.007***
	(0.000)	(0.000)	(0.002)	(0.000)	(0.004)	(0.001)	(0.004)	(0.002)
Bias-corrected 95% CI	0.022|0.022	0.011|0.011	0.040|0.040	0.017|0.017	0.039|0.043	0.017|0.018	0.022|0.039	0.016|0.017
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	239,167|990,784	238,990|989,983	239,167|990,784	238,990|989,983	239,167|990,784	238,990|989,983	239,167|990,784	238,990|989,983
Effective observations	50,486|101,503	50,457|101,433	72,323|141,765	72,278|141,657	92,187|185,700	92,128|185,553	110,618|233,133	110,541|232,960
D [SAP 55] τ	0.021***	0.014***	0.020***	0.013***	0.016***	0.012***	0.015***	0.010***
	(0.000)	(0.000)	(0.002)	(0.001)	(0.003)	(0.002)	(0.003)	(0.002)
Bias-corrected 95% CI	0.019|0.019	0.013|0.013	0.028|0.028	0.017|0.017	0.026|0.028	0.016|0.018	0.012|0.025	0.014|0.017
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	990,784|2,357,103	989,983|2,355,440	990,784|2,357,103	989,983|2,355,440	990,784|2,357,103	989,983|2,355,440	990,784|2,357,103	989,983|2,355,440
Effective observations	205,917|384,020	205,759|383,760	297,781|529,425	297,567|529,057	379,385|683,250	379,095|682,773	454,663|846,571	454,311|845,972
C [SAP 69] τ	0.007***	0.003***	0.007***	0.003***	0.008***	0.003***	0.005***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.002)	(0.001)
Bias-corrected 95% CI	0.006|0.006	0.004|0.004	0.004|0.004	0.002|0.002	0.004|0.004	0.002|0.002	0.006|0.016	0.003|0.008
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	2,357,103|1,139,132	2,355,440|1,135,285	2,357,103|1,139,132	2,355,440|1,135,285	2,357,103|1,139,132	2,355,440|1,135,285	2,357,103|1,139,132	2,355,440|1,135,285
Effective observations	394,801|504,167	394,502|503,689	593,851|629,750	593,389|629,103	788,324|734,771	787,720|733,939	978,811|821,323	978,087|820,266
B [SAP 81] τ	-0.001***	-0.005***	0.000***	-0.005***	0.001**	0.000***	0.004**	0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.002)	(0.002)	(0.003)	(0.002)
Bias-corrected 95% CI	0.011|0.011	-0.003|-0.003	-0.002|-0.002	-0.012|-0.012	-0.003|-0.001	-0.012|-0.012	-0.008|-0.001	-0.010|0.003
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.003	0.000	0.006	0.297
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	1,139,132|93,583	1,135,285|89,119	1,139,132|93,583	1,135,285|89,119	1,139,132|93,583	1,135,285|89,119	1,139,132|93,583	1,135,285|89,119
Effective observations	75,416|64,188	73,979|61,417	124,580|76,039	122,663|72,522	180,116|84,097	177,827|80,161	244,541|88,765	242,005|84,597
A [SAP 92] τ	0.051***	0.038***	0.053***	0.041***	0.072***	0.045***	0.109***	0.063***
	(0.000)	(0.000)	(0.002)	(0.004)	(0.010)	(0.003)	(0.026)	(0.007)
Bias-corrected 95% CI	0.042|0.042	0.038|0.038	0.019|0.019	0.050|0.050	0.018|0.022	0.047|0.058	0.005|0.017	0.016|0.050
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	93,583|714	89,119|679	93,583|714	89,119|679	93,583|714	89,119|679	93,583|714	89,119|679
Effective observations	740|488	700|457	1,325|571	1,253|538	2,431|631	2,283|597	4,818|654	4,522|620
BW selection	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics		Yes		Yes		Yes		Yes
Area FE		Yes		Yes		Yes		Yes
Date FE		Yes		Yes		Yes		Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=4,881,291.

Table B2: Local Linear RD Estimates for Existing Properties using Price per Meter

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	53.099***	56.081***	52.357***	41.847***	44.819*	51.868***	40.351**
	(5.076)	(6.383)	(5.174)	(7.368)	(21.016)	(5.371)	(18.736)
Bias-corrected 95% CI	38.808|74.855	41.117|93.928	38.831|73.787	20.236|58.677	8.906|94.187	37.188|76.087	11.917|83.884
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.018	0.000	0.009
BW estimate (h)	3.933|3.933	3.634|3.634	3.857|4.744	4.499|4.499	6.253|6.253	3.847|3.847	5.730|5.730
BW bias (b)	6.403|6.403	6.767|6.767	6.318|8.682	7.762|7.762	7.482|7.482	6.362|6.362	7.438|7.438
Observations	60,752|238,895	60,752|238,895	60,752|238,895	60,713|238,719	60,752|238,895	60,752|238,895	60,713|238,719
Effective observations	12,815|24,620	12,815|24,620	12,815|32,218	16,611|32,200	23,479|49,668	12,815|24,620	20,176|40,481
E [SAP 39] τ	48.412***	48.334***	47.579***	43.082***	38.308***	41.343***	23.515***
	(7.748)	(10.187)	(7.917)	(7.863)	(3.965)	(7.796)	(3.590)
Bias-corrected 95% CI	34.070|68.340	22.803|73.216	32.904|67.336	23.670|66.814	38.286|53.098	26.772|61.324	22.417|38.072
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	5.041|5.041	3.349|3.349	4.971|6.248	4.347|4.347	4.549|4.549	5.059|5.059	4.285|4.285
BW bias (b)	7.454|7.454	5.998|5.998	7.711|8.994	6.625|6.625	9.031|9.031	7.535|7.535	7.923|7.923
Observations	238,895|989,680	238,895|989,680	238,895|989,680	238,719|988,879	238,895|989,680	238,895|989,680	238,719|988,879
Effective observations	110,488|232,839	72,234|141,584	92,082|284,845	92,023|185,308	92,082|185,455	110,488|232,839	92,023|185,308
D [SAP 55] τ	40.624***	33.674**	39.239***	42.032***	33.958***	39.738***	31.576***
	(9.183)	(11.690)	(10.072)	(7.815)	(6.782)	(9.188)	(5.736)
Bias-corrected 95% CI	24.664|66.514	13.292|68.099	28.801|65.220	32.315|65.767	29.593|52.659	24.713|65.425	28.834|49.029
Bias-corrected p-value	0.000	0.004	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.894|3.894	3.019|3.019	3.810|4.244	3.700|3.700	4.268|4.268	3.881|3.881	3.970|3.970
BW bias (b)	5.559|5.559	5.065|5.065	6.384|5.302	5.329|5.329	6.868|6.868	5.539|5.539	6.518|6.518
Observations	989,680|2,355,356	989,680|2,355,356	989,680|2,355,356	988,879|2,353,694	989,680|2,355,356	989,680|2,355,356	988,879|2,353,694
Effective observations	297,480|528,971	297,480|528,971	297,480|682,660	297,266|528,603	378,985|682,660	297,480|528,971	297,266|528,603
C [SAP 69] τ	19.792**	8.426*	13.705**	21.265**	2.644	18.645**	2.023
	(3.589)	(6.536)	(4.693)	(3.836)	(2.383)	(3.682)	(2.675)
Bias-corrected 95% CI	10.112|41.468	2.848|28.554	7.435|35.621	10.100|40.267	-2.970|21.385	8.668|40.329	-5.993|15.287
Bias-corrected p-value	0.001	0.017	0.003	0.001	0.138	0.002	0.392
BW estimate (h)	3.831|3.831	4.202|4.202	3.144|5.073	4.105|4.105	3.532|3.532	3.876|3.876	3.208|3.208
BW bias (b)	5.933|5.933	6.047|6.047	5.598|5.207	5.896|5.896	5.847|5.847	5.932|5.932	5.822|5.822
Observations	2,355,356|1,138,060	2,355,356|1,138,060	2,355,356|1,138,060	2,353,694|1,134,244	2,355,356|1,138,060	2,355,356|1,138,060	2,353,694|1,134,244
Effective observations	593,465|629,272	787,800|734,182	593,465|820,645	787,196|733,350	593,465|629,272	593,465|629,272	593,003|628,625
B [SAP 81] τ	-1.339*	1.601	-0.876***	3.032	-26.328*	-1.994*	-29.795**
	(8.268)	(10.938)	(11.100)	(4.700)	(1.893)	(8.393)	(1.021)
Bias-corrected 95% CI	-35.485|-2.995	-42.852|10.192	-40.352|-13.841	-20.623|18.943	-62.324|-5.397	-35.630|-4.632	-57.953|-9.879
Bias-corrected p-value	0.020	0.228	0.000	0.934	0.020	0.011	0.006
BW estimate (h)	4.019|4.019	3.681|3.681	3.136|7.147	3.859|3.859	3.010|3.010	4.045|4.045	3.000|3.000
BW bias (b)	6.843|6.843	5.905|5.905	5.108|6.224	5.948|5.948	5.843|5.843	6.881|6.881	5.903|5.903
Observations	1,138,060|93,486	1,138,060|93,486	1,138,060|93,486	1,134,244|89,030	1,138,060|93,486	1,138,060|93,486	1,134,244|89,030
Effective observations	179,861|84,013	124,394|75,959	124,394|92,161	122,499|72,449	124,394|75,959	179,861|84,013	73,871|61,358
A [SAP 92] τ	190.360	182.129	177.653	194.569***	127.046***	190.692	132.141***
	(8.414)	(8.397)	(6.744)	(3.683)	(5.777)	(9.899)	(12.108)
Bias-corrected 95% CI	-51.239|353.311	-113.261|483.025	-12.233|159.971	150.652|424.379	71.448|169.673	-39.073|365.069	98.073|222.705
Bias-corrected p-value	0.143	0.224	0.093	0.000	0.000	0.114	0.000
BW estimate (h)	3.503|3.503	2.349|2.349	2.719|4.428	2.706|2.706	3.999|3.999	3.493|3.493	3.019|3.019
BW bias (b)	5.889|5.889	5.842|5.842	5.025|5.554	6.281|6.281	5.124|5.124	5.974|5.974	5.974|5.974
Observations	93,486|714	93,486|714	93,486|714	89,030|679	93,486|714	93,486|714	89,030|679
Effective observations	1,325|571	740|488	740|631	700|457	1,325|571	1,325|571	1,253|538
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: The distribution of price per meter is heavily right skewed, to avoid outliers from affecting the results we exclude properties with a price per meter of over £20,000 (4,348 properties). N=4,876,943.

Table B3: Local Linear RD Estimates for Existing Properties using Total Sale Price (Log)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	0.037***	0.036***	0.036***	0.022***	0.030***	0.037***	0.022***
	(0.006)	(0.007)	(0.007)	(0.003)	(0.005)	(0.006)	(0.006)
Bias-corrected 95% CI	0.022|0.058	0.022|0.051	0.018|0.056	0.013|0.030	0.020|0.047	0.022|0.059	0.013|0.037
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	4.131|4.131	5.585|5.585	3.369|4.741	4.567|4.567	4.179|4.179	4.226|4.226	4.936|4.936
BW bias (b)	6.067|6.067	8.310|8.310	6.100|6.211	7.533|7.533	5.815|5.815	6.131|6.131	6.593|6.593
Observations	60,808|239,167	60,808|239,167	60,808|239,167	60,769|238,990	60,808|239,167	60,808|239,167	60,769|238,990
Effective observations	16,634|32,253	20,202|40,545	12,824|32,253	16,623|32,235	16,634|32,253	16,634|32,253	16,623|32,235
E [SAP 39] τ	0.022***	0.019*	0.024***	0.018***	0.016***	0.019***	0.011***
	(0.006)	(0.008)	(0.005)	(0.004)	(0.004)	(0.006)	(0.001)
Bias-corrected 95% CI	0.019|0.038	0.004|0.038	0.020|0.038	0.013|0.033	0.015|0.031	0.015|0.036	0.012|0.018
Bias-corrected p-value	0.000	0.016	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	4.797|4.797	4.668|4.668	4.201|4.418	3.800|3.800	4.489|4.489	4.904|4.904	3.648|3.648
BW bias (b)	6.171|6.171	6.059|6.059	6.224|5.644	5.602|5.602	6.482|6.482	6.259|6.259	5.514|5.514
Observations	239,167|990,784	239,167|990,784	239,167|990,784	238,990|989,983	239,167|990,784	239,167|990,784	238,990|989,983
Effective observations	92,187|185,700	92,187|185,700	92,187|185,700	72,278|141,657	92,187|185,700	92,187|185,700	72,278|141,657
D [SAP 55] τ	0.024***	0.027***	0.023***	0.017***	0.020***	0.023***	0.014***
	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.002)
Bias-corrected 95% CI	0.021|0.034	0.023|0.036	0.021|0.034	0.014|0.026	0.020|0.029	0.021|0.033	0.013|0.020
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.706|3.706	2.882|2.882	3.716|4.314	3.665|3.665	4.082|4.082	3.694|3.694	3.579|3.579
BW bias (b)	5.239|5.239	5.006|5.006	5.460|5.315	5.414|5.414	6.801|6.801	5.234|5.234	5.622|5.622
Observations	990,784|2,357,103	990,784|2,357,103	990,784|2,357,103	989,983|2,355,440	990,784|2,357,103	990,784|2,357,103	989,983|2,355,440
Effective observations	297,781|529,425	205,917|384,020	297,781|683,250	297,567|529,057	379,385|683,250	297,781|529,425	297,567|529,057
C [SAP 69] τ	0.013***	0.013***	0.012***	0.008***	0.009***	0.012***	0.003***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)
Bias-corrected 95% CI	0.013|0.022	0.010|0.024	0.011|0.021	0.005|0.014	0.011|0.018	0.012|0.021	0.002|0.009
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.001
BW estimate (h)	3.432|3.432	3.059|3.059	4.071|4.518	3.309|3.309	3.148|3.148	3.459|3.459	3.700|3.700
BW bias (b)	5.474|5.474	5.312|5.312	6.624|5.241	5.963|5.963	5.026|5.026	5.486|5.486	5.092|5.092
Observations	2,357,103|1,139,132	2,357,103|1,139,132	2,357,103|1,139,132	2,355,440|1,135,285	2,357,103|1,139,132	2,357,103|1,139,132	2,355,440|1,135,285
Effective observations	593,851|629,750	593,851|629,750	788,324|734,771	593,389|629,103	593,851|629,750	593,851|629,750	593,389|629,103
B [SAP 81] τ	-0.003***	-0.012	-0.007***	0.004**	-0.004***	-0.004***	-0.001
	(0.005)	(0.009)	(0.009)	(0.002)	(0.005)	(0.005)	(0.001)
Bias-corrected 95% CI	0.006|0.019	-0.002|0.025	0.007|0.019	0.002|0.010	0.010|0.016	0.005|0.018	-0.002|0.005
Bias-corrected p-value	0.000	0.082	0.000	0.003	0.000	0.001	0.524
BW estimate (h)	4.342|4.342	4.148|4.148	3.562|7.298	3.638|3.638	4.356|4.356	4.330|4.330	3.617|3.617
BW bias (b)	6.732|6.732	6.038|6.038	5.888|5.669	6.157|6.157	6.837|6.837	6.774|6.774	6.691|6.691
Observations	1,139,132|93,583	1,139,132|93,583	1,139,132|93,583	1,135,285|89,119	1,139,132|93,583	1,139,132|93,583	1,135,285|89,119
Effective observations	180,116|84,097	180,116|84,097	124,580|92,258	122,663|72,522	180,116|84,097	180,116|84,097	122,663|72,522
A [SAP 92] τ	0.210***	0.223***	0.198***	0.076*	0.187***	0.206***	0.061***
	(0.015)	(0.030)	(0.013)	(0.005)	(0.011)	(0.014)	(0.005)
Bias-corrected 95% CI	0.167|0.365	0.177|0.384	0.158|0.372	0.024|0.181	0.144|0.357	0.162|0.357	0.069|0.081
Bias-corrected p-value	0.000	0.000	0.000	0.010	0.000	0.000	0.000
BW estimate (h)	2.648|2.648	2.436|2.436	2.479|4.926	2.834|2.834	2.747|2.747	2.648|2.648	3.343|3.343
BW bias (b)	5.869|5.869	5.784|5.784	5.136|5.733	6.597|6.597	5.661|5.661	5.930|5.930	6.080|6.080
Observations	93,583|714	93,583|714	93,583|714	89,119|679	93,583|714	93,583|714	89,119|679
Effective observations	740|488	740|488	740|631	700|457	740|488	740|488	1,253|538
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=4,881,291.

Table B4: Local Linear RD Estimates for Falsification Tests

	TH -3		TH -2		TH -1		TH +1		TH +2		TH +3	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
F [SAP 21] τ	-0.016	-0.006	-0.005	0.005	0.011*	0.001	-0.002	-0.011	-0.011	0.003	-0.003	0.009
	(0.006)	(0.003)	(0.006)	(0.005)	(0.009)	(0.009)	(0.010)	(0.011)	(0.006)	(0.009)	(0.006)	(0.007)
Bias-corrected 95% CI	-0.042|0.003	-0.016|0.005	-0.023|0.013	-0.001|0.019	0.002|0.030	-0.018|0.016	-0.027|0.014	-0.039|0.006	-0.029|0.001	-0.016|0.025	-0.018|0.014	-0.013|0.034
Bias-corrected p-value	0.086	0.300	0.569	0.066	0.022	0.882	0.537	0.152	0.071	0.684	0.783	0.381
BW estimate (h)	3.924|3.924	3.882|3.882	5.029|5.029	4.401|4.401	4.924|4.924	5.102|5.102	7.029|7.029	6.913|6.913	5.021|5.021	8.489|8.489	4.927|4.927	3.916|3.916
BW bias (b)	6.515|6.515	5.852|5.852	6.775|6.775	6.172|6.172	5.896|5.896	6.931|6.931	11.221|11.221	10.922|10.922	8.702|8.702	11.387|11.387	9.428|9.428	7.370|7.370
Observations	47,984|251,991	47,952|251,807	52,008|247,967	51,972|247,787	56,285|243,690	56,248|243,511	66,286|233,689	66,243|233,516	72,174|227,801	72,128|227,631	78,645|221,330	78,596|221,163
Effective observations	10,674|18,302	10,665|18,291	17,815|33,442	14,685|26,624	15,679|29,165	18,961|36,756	28,976|65,490	25,664|54,413	24,190|48,560	34,841|85,448	22,360|42,089	17,827|31,861
E [SAP 39] τ	0.008***	0.001	0.003	-0.002	-0.007**	-0.003	-0.001	0.001	-0.015***	-0.005*	0.001	0.000
	(0.002)	(0.002)	(0.005)	(0.002)	(0.004)	(0.002)	(0.006)	(0.003)	(0.003)	(0.001)	(0.004)	(0.001)
Bias-corrected 95% CI	0.010|0.019	-0.007|0.005	-0.006|0.018	-0.008|0.002	-0.020|-0.003	-0.009|0.002	-0.021|0.007	-0.005|0.007	-0.030|-0.010	-0.010|-0.001	-0.010|0.015	-0.004|0.005
Bias-corrected p-value	0.000	0.824	0.327	0.272	0.007	0.185	0.340	0.706	0.000	0.017	0.677	0.874
BW estimate (h)	3.013|3.013	5.144|5.144	3.942|3.942	5.035|5.035	3.947|3.947	4.900|4.900	4.082|4.082	6.790|6.790	4.130|4.130	4.204|4.204	4.214|4.214	4.206|4.206
BW bias (b)	5.645|5.645	8.910|8.910	5.736|5.736	8.373|8.373	6.263|6.263	6.932|6.932	6.895|6.895	9.821|9.821	8.160|8.160	8.518|8.518	7.647|7.647	7.394|7.394
Observations	166,844|1,063,107	166,712|1,062,261	188,681|1,041,270	188,533|1,040,440	213,120|1,016,831	212,955|1,016,018	269,948|960,003	269,748|959,225	303,738|926,213	303,515|925,458	340,670|889,281	340,423|888,550
Effective observations	54,829|103,104	83,638|173,711	60,132|115,057	91,726|192,114	66,140|127,550	84,506|167,692	103,104|202,352	141,299|310,537	115,057|220,621	114,982|220,446	127,550|240,058	127,468|239,862
D [SAP 55] τ	-0.007***	0.000	0.003	-0.002	0.003	0.000	-0.018***	-0.011***	0.011	0.000	0.002	-0.004
	(0.002)	(0.001)	(0.003)	(0.002)	(0.006)	(0.003)	(0.005)	(0.003)	(0.001)	(0.004)	(0.003)	(0.000)
Bias-corrected 95% CI	-0.011|-0.003	-0.003|0.002	-0.003|0.013	-0.007|0.001	-0.009|0.013	-0.006|0.005	-0.040|-0.016	-0.026|-0.009	-0.009|0.036	-0.011|0.010	-0.006|0.015	-0.010|0.005
Bias-corrected p-value	0.000	0.750	0.204	0.132	0.703	0.906	0.000	0.000	0.239	0.931	0.418	0.508
BW estimate (h)	4.887|4.887	6.450|6.450	3.724|3.724	4.668|4.668	4.897|4.897	4.440|4.440	3.423|3.423	3.366|3.366	2.898|2.898	3.942|3.942	3.354|3.354	2.765|2.765
BW bias (b)	8.064|8.064	9.445|9.445	5.317|5.317	7.006|7.006	6.537|6.537	5.856|5.856	5.349|5.349	5.535|5.535	5.437|5.437	7.025|7.025	6.307|6.307	5.985|5.985
Observations	693,003|2,654,884	692,416|2,653,007	784,867|2,563,020	784,224|2,561,199	884,788|2,463,099	884,077|2,461,346	1,111,731|2,236,156	1,110,842|2,234,581	1,238,660|2,109,227	1,237,683|2,107,740	1,374,804|1,973,083	1,373,743|1,971,680
Effective observations	291,711|545,657	407,445|826,624	248,746|453,793	318,012|589,519	348,667|635,421	348,405|634,963	326,864|562,303	326,618|561,914	247,876|435,374	353,606|598,272	384,020|632,413	262,901|462,212
C [SAP 69] τ	0.002***	0.001	-0.006***	-0.004***	-0.001	-0.001	-0.001	-0.004**	0.002	-0.002	0.005	-0.001
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)
Bias-corrected 95% CI	0.005|0.008	0.000|0.003	-0.011|-0.004	-0.007|-0.003	-0.004|0.006	-0.002|0.004	-0.008|0.003	-0.006|-0.001	-0.006|0.007	-0.004|0.005	0.000|0.007	-0.001|0.005
Bias-corrected p-value	0.000	0.151	0.000	0.000	0.775	0.641	0.432	0.003	0.914	0.925	0.070	0.248
BW estimate (h)	4.327|4.327	4.599|4.599	4.838|4.838	3.488|3.488	4.428|4.428	4.236|4.236	4.755|4.755	4.409|4.409	3.127|3.127	3.415|3.415	3.681|3.681	3.504|3.504
BW bias (b)	5.696|5.696	7.148|7.148	5.640|5.640	5.638|5.638	6.421|6.421	5.976|5.976	6.388|6.388	6.202|6.202	5.478|5.478	5.281|5.281	5.285|5.285	5.450|5.450
Observations	1,763,252|1,732,983	1,762,051|1,728,674	1,962,302|1,533,933	1,960,938|1,529,787	2,162,446|1,333,789	2,160,945|1,329,780	2,543,207|953,028	2,541,360|949,365	2,712,150|784,085	2,710,175|780,550	2,861,270|634,965	2,859,129|631,596
Effective observations	746,819|948,898	746,314|948,124	768,019|898,968	583,585|749,237	784,154|824,407	783,592|823,598	779,955|635,219	779,309|634,346	549,704|466,276	549,230|465,531	504,167|390,424	503,689|389,591
B [SAP 81] τ	-0.005***	-0.002	0.004	-0.006***	0.007	0.004***	-0.009***	0.001	-0.018***	0.000	0.003***	-0.002
	(0.000)	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)
Bias-corrected 95% CI	-0.015|-0.004	-0.004|0.000	-0.005|0.006	-0.008|-0.004	-0.003|0.007	0.003|0.010	-0.016|-0.009	-0.004|0.005	-0.018|-0.010	-0.004|0.002	0.008|0.019	-0.004|0.001
Bias-corrected p-value	0.000	0.065	0.841	0.000	0.396	0.000	0.000	0.876	0.000	0.603	0.000	0.270
BW estimate (h)	2.850|2.850	5.901|5.901	3.878|3.878	6.032|6.032	4.055|4.055	3.511|3.511	4.667|4.667	3.344|3.344	4.388|4.388	3.986|3.986	3.606|3.606	3.895|3.895
BW bias (b)	4.982|4.982	6.341|6.341	5.981|5.981	7.222|7.222	5.924|5.924	6.489|6.489	6.300|6.300	5.848|5.848	5.424|5.424	6.243|6.243	5.669|5.669	6.669|6.669
Observations	1,014,552|218,163	1,012,622|211,782	1,063,716|168,999	1,061,306|163,098	1,105,247|127,468	1,102,212|122,192	1,165,700|67,015	1,160,981|63,423	1,187,000|45,715	1,181,348|43,056	1,203,320|29,395	1,196,702|27,702
Effective observations	119,961|124,580	383,519|184,080	169,125|123,284	432,203|154,140	210,656|109,924	144,754|94,490	151,148|62,197	99,675|54,465	123,284|43,284	79,136|38,534	64,188|26,964	61,417|25,419
A [SAP 92] τ	-0.086***	-0.029**	0.039	0.029***	0.043*	0.014	-0.017***	-0.025	-0.015	0.019	-0.014	-0.063***
	(0.013)	(0.007)	(0.003)	(0.001)	(0.009)	(0.006)	(0.002)	(0.006)	(0.011)	(0.012)	(0.027)	(0.020)
Bias-corrected 95% CI	-0.103|-0.043	-0.057|-0.014	-0.008|0.136	0.046|0.060	0.016|0.129	0.000|0.036	-0.069|-0.045	-0.082|0.012	-0.095|0.010	-0.031|0.042	-0.099|0.032	-0.113|-0.039
Bias-corrected p-value	0.000	0.001	0.081	0.000	0.011	0.050	0.000	0.144	0.114	0.761	0.310	0.000
BW estimate (h)	3.287|3.287	3.146|3.146	2.548|2.548	2.082|2.082	3.055|3.055	3.912|3.912	2.475|2.475	2.645|2.645	2.988|2.988	3.351|3.351	4.630|4.630	4.127|4.127
BW bias (b)	5.128|5.128	5.490|5.490	5.560|5.560	4.938|4.938	6.037|6.037	6.385|6.385	5.643|5.643	5.750|5.750	5.893|5.893	6.484|6.484	6.666|6.666	6.476|6.476
Observations	92,258|2,039	87,866|1,932	92,843|1,454	88,419|1,379	93,276|1,021	88,829|969	93,814|483	89,337|461	93,954|343	89,472|326	94,071|226	89,576|222
Effective observations	8,161|1,556	7,705|1,471	1,691|971	1,583|918	2,124|795	1,993|747	538|340	508|320	371|260	643|267	795|211	747|207
BW selection	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics		Yes		Yes		Yes		Yes		Yes		Yes
Area FE		Yes		Yes		Yes		Yes		Yes		Yes
Date FE		Yes		Yes		Yes		Yes		Yes		Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=4,881,291.

Table B5: Local Linear RD Estimates for Placebo Tests

	(1)	(2)
SAP 10 τ	-0.021**	-0.001
	(0.009)	(0.006)
Bias-corrected 95% CI	-0.041|-0.006	-0.009|0.023
Bias-corrected p-value	0.010	0.371
BW estimate (h)	4.028|4.028	3.574|3.574
BW bias (b)	5.553|5.553	6.425|6.425
Observations	23,805|4,857,486	23,789|4,846,476
Effective observations	7,996|13,505	6,328|10,383
SAP 20 τ	0.011	0.001
	(0.009)	(0.009)
Bias-corrected 95% CI	-0.003|0.027	-0.019|0.017
Bias-corrected p-value	0.125	0.915
BW estimate (h)	5.129|5.129	6.057|6.057
BW bias (b)	6.769|6.769	8.434|8.434
Observations	56,285|4,825,006	56,248|4,814,017
Effective observations	18,975|36,776	22,076|45,044
SAP 30 τ	-0.007	-0.002
	(0.003)	(0.004)
Bias-corrected 95% CI	-0.012|0.001	-0.011|0.007
Bias-corrected p-value	0.126	0.692
BW estimate (h)	6.079|6.079	7.618|7.618
BW bias (b)	11.768|11.768	12.998|12.998
Observations	131,776|4,749,515	131,689|4,738,576
Effective observations	53,131|117,713	59,561|142,035
SAP 40 τ	0.007	0.002
	(0.007)	(0.003)
Bias-corrected 95% CI	-0.010|0.019	-0.005|0.007
Bias-corrected p-value	0.563	0.687
BW estimate (h)	7.280|7.280	7.436|7.436
BW bias (b)	10.258|10.258	10.779|10.779
Observations	330,756|4,550,535	330,517|4,539,748
Effective observations	157,933|370,511	157,823|370,209
SAP 50 τ	-0.003	-0.002
	(0.002)	(0.001)
Bias-corrected 95% CI	-0.009|0.003	-0.004|0.001
Bias-corrected p-value	0.330	0.266
BW estimate (h)	5.974|5.974	5.641|5.641
BW bias (b)	10.481|10.481	11.525|11.525
Observations	836,096|4,045,195	835,431|4,034,834
Effective observations	302,988|575,610	302,712|575,170
SAP 60 τ	0.004	0.002
	(0.002)	(0.002)
Bias-corrected 95% CI	-0.002|0.008	-0.003|0.004
Bias-corrected p-value	0.204	0.620
BW estimate (h)	5.295|5.295	5.431|5.431
BW bias (b)	8.126|8.126	11.799|11.799
Observations	1,974,009|2,907,282	1,972,515|2,897,750
Effective observations	683,250|1,080,002	682,773|1,079,278
SAP 70 τ	-0.000	-0.004*
	(0.003)	(0.001)
Bias-corrected 95% CI	-0.007|0.006	-0.006|-0.001
Bias-corrected p-value	0.942	0.012
BW estimate (h)	6.384|6.384	4.710|4.710
BW bias (b)	8.908|8.908	6.381|6.381
Observations	3,833,966|1,047,325	3,831,102|1,039,163
Effective observations	1,164,915|772,912	779,309|634,346
SAP 80 τ	0.008	0.002
	(0.003)	(0.002)
Bias-corrected 95% CI	-0.002|0.008	-0.002|0.009
Bias-corrected p-value	0.256	0.208
BW estimate (h)	4.873|4.873	4.541|4.541
BW bias (b)	7.336|7.336	8.755|8.755
Observations	4,753,109|128,182	4,747,394|122,871
Effective observations	210,656|109,924	208,932|105,595
SAP 90 τ	0.040	0.020
	(0.003)	(0.004)
Bias-corrected 95% CI	-0.007|0.136	-0.025|0.074
Bias-corrected p-value	0.075	0.325
BW estimate (h)	2.307|2.307	2.782|2.782
BW bias (b)	5.527|5.527	5.887|5.887
Observations	4,879,837|1,454	4,868,886|1,379
Effective observations	1,691|971	1,583|918
BW selection	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular
Property Characteristics		Yes
Area FE		Yes
Date FE		Yes

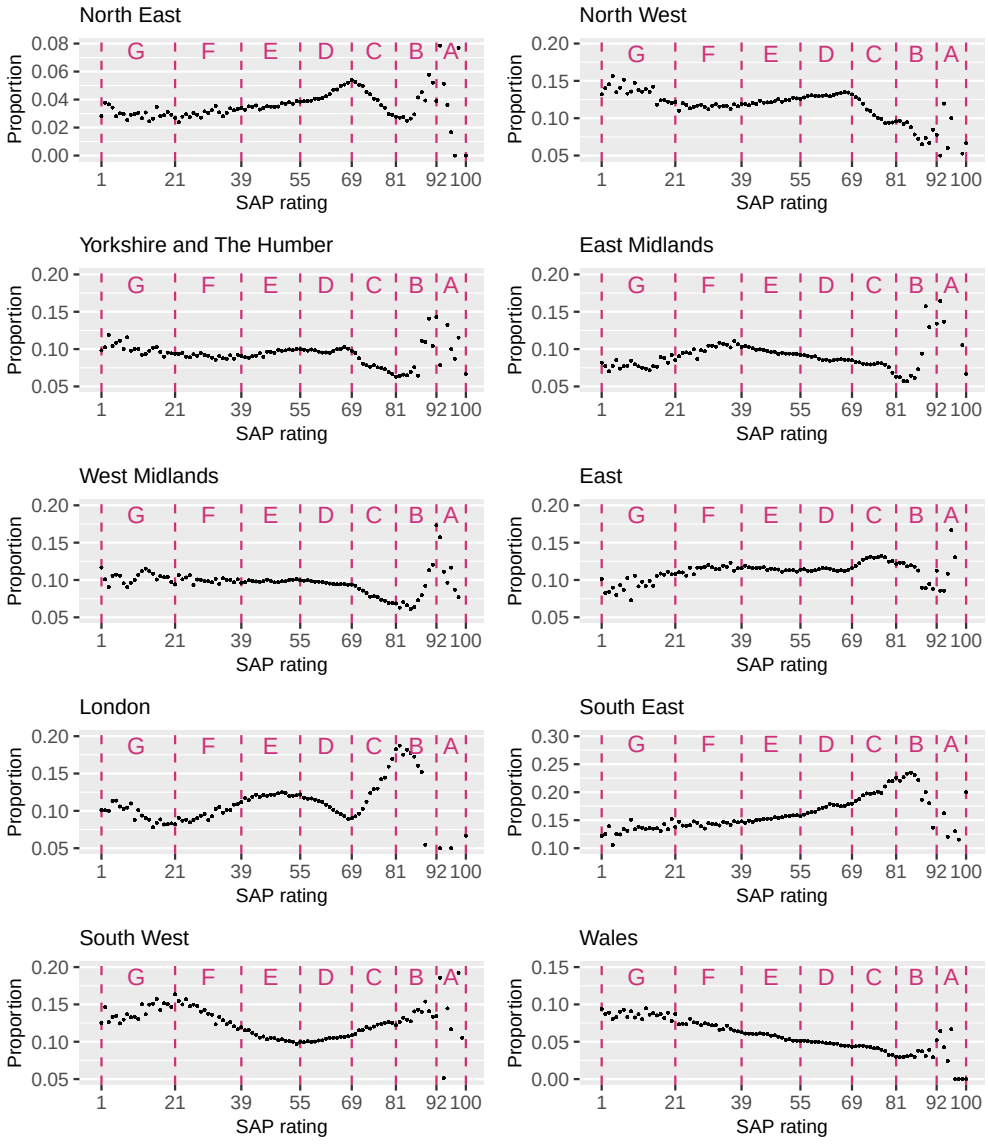
Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=4,881,291.

B.2 Baseline Covariates

B.2.1 Location

Figure B1: Region Proportion – SAP Rating



Notes: This figure plots average price per meter (log) bins for each *SAP rating unit.* N=4,881,291.

Table B6: Local Linear RD Estimates for Area Covariate Proportions

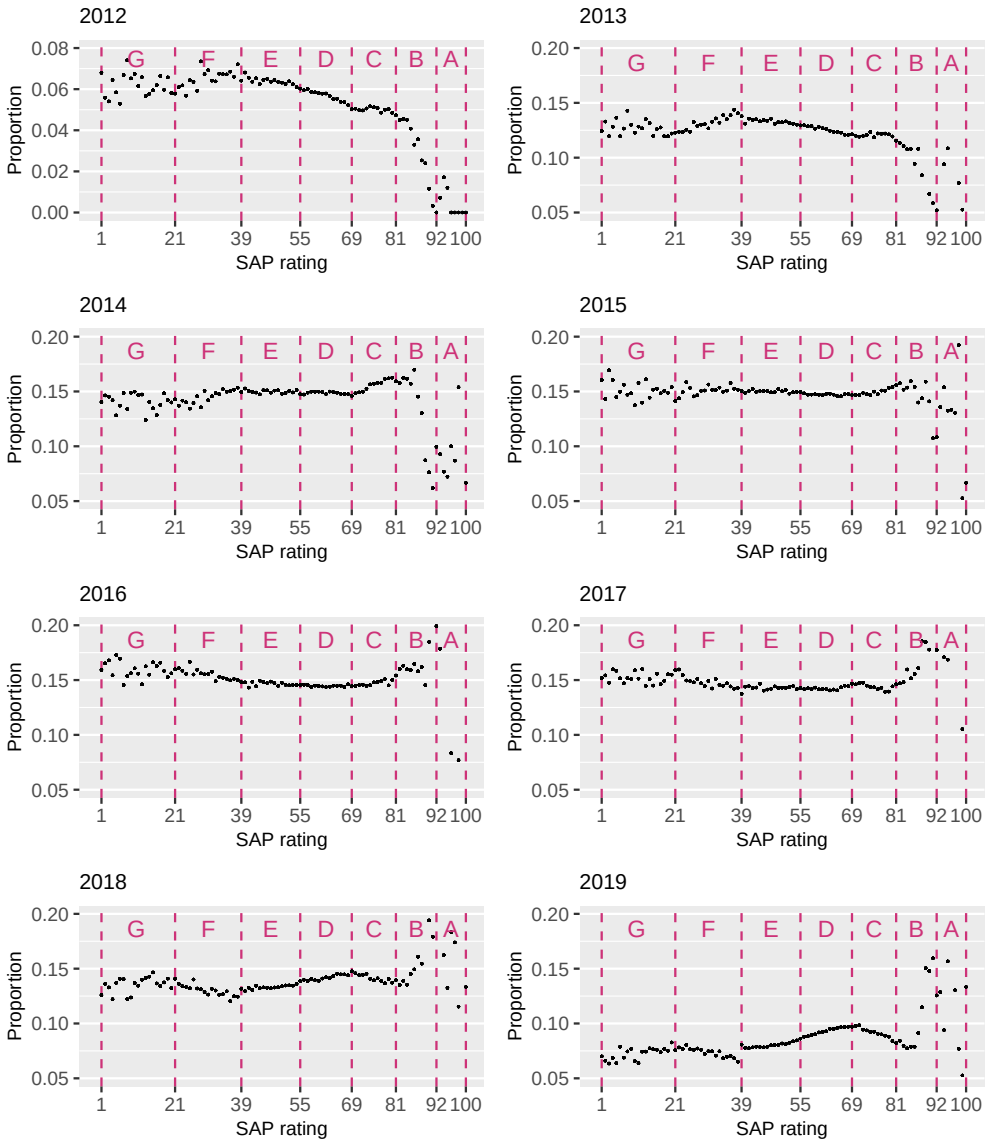
	North East	North West	Yorkshire and The Humber	East Midlands	West Midlands	East of England	London	South East	South West	Wales	Urban
F [SAP 21] τ	-0.004	-0.000	0.001	-0.008	0.002	0.002	0.003	-0.014**	0.013**	0.005	-0.010*
	(0.002)	(0.004)	(0.001)	(0.004)	(0.005)	(0.002)	(0.003)	(0.006)	(0.004)	(0.006)	(0.007)
Bias-corrected 95% CI	-0.008|0.001	-0.011|0.006	-0.003|0.006	-0.019|0.001	-0.007|0.011	-0.000|0.009	-0.004|0.011	-0.033|-0.006	0.004|0.023	-0.003|0.019	-0.026|-0.001
Bias-corrected p-value	0.109	0.569	0.418	0.092	0.646	0.055	0.392	0.004	0.004	0.166	0.039
BW estimate (h)	5.480|5.480	4.961|4.961	5.561|5.561	4.084|4.084	6.015|6.015	3.908|3.908	4.618|4.618	4.701|4.701	4.759|4.759	4.927|4.927	6.978|6.978
BW bias (b)	10.017|10.017	7.867|7.867	11.297|11.297	6.968|6.968	7.922|7.922	7.519|7.519	7.350|7.350	7.392|7.392	8.000|8.000	7.749|7.749	9.515|9.515
Observations	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167
Effective observations	20202|40545	16634|32253	20202|40545	16634|32253	23498|49718	12824|24642	16634|32253	16634|32253	16634|32253	16634|32253	23498|49718
E [SAP 39] τ	-0.000	0.002	-0.003	-0.005	-0.003	0.004	0.001	-0.000	0.007***	0.001	-0.010**
	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)
Bias-corrected 95% CI	-0.003|0.001	-0.003|0.006	-0.009|0.001	-0.014|0.002	-0.007|0.002	-0.001|0.012	-0.004|0.004	-0.004|0.004	0.005|0.013	-0.001|0.004	-0.018|-0.002
Bias-corrected p-value	0.489	0.588	0.113	0.174	0.229	0.088	0.950	0.908	0.000	0.336	0.011
BW estimate (h)	4.936|4.936	4.363|4.363	4.963|4.963	3.998|3.998	6.281|6.281	4.941|4.941	6.219|6.219	5.268|5.268	3.687|3.687	4.489|4.489	3.827|3.827
BW bias (b)	10.619|10.619	7.731|7.731	7.842|7.842	7.187|7.187	9.234|9.234	8.978|8.978	11.338|11.338	9.004|9.004	5.848|5.848	10.055|10.055	6.555|6.555
Observations	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784
Effective observations	92187|185700	92187|185700	92187|185700	72323|141765	127152|285192	92187|185700	127152|285192	110618|233133	72323|141765	92187|185700	72323|141765
D [SAP 55] τ	-0.001	-0.001	-0.001	-0.001***	-0.003***	0.005***	-0.000	-0.002***	0.005***	0.001	-0.002*
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Bias-corrected 95% CI	-0.004|0.000	-0.004|0.002	-0.003|0.000	-0.001|-0.001	-0.004|-0.002	0.005|0.007	-0.004|0.001	-0.003|-0.001	0.005|0.007	-0.001|0.002	-0.003|-0.000
Bias-corrected p-value	0.117	0.669	0.056	0.000	0.000	0.000	0.364	0.000	0.000	0.737	0.040
BW estimate (h)	3.382|3.382	3.825|3.825	3.722|3.722	3.973|3.973	4.938|4.938	3.051|3.051	3.797|3.797	4.065|4.065	3.555|3.555	3.762|3.762	4.927|4.927
BW bias (b)	5.988|5.988	5.598|5.598	6.898|6.898	5.740|5.740	7.078|7.078	5.377|5.377	6.374|6.374	6.277|6.277	5.376|5.376	7.027|7.027	6.127|6.127
Observations	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103
Effective observations	297781|529425	297781|529425	297781|529425	297781|529425	379385|683250	297781|529425	297781|529425	379385|683250	297781|529425	297781|529425	379385|683250
C [SAP 69] τ	0.001	-0.003***	-0.002	-0.001	0.001**	0.002	0.004***	-0.001***	0.001	-0.001**	0.001
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Bias-corrected 95% CI	-0.000|0.002	-0.003|-0.001	-0.004|0.003	-0.001|0.001	0.000|0.002	-0.001|0.003	0.004|0.006	-0.004|-0.002	-0.001|0.002	-0.003|-0.001	-0.001|0.004
Bias-corrected p-value	0.139	0.000	0.684	0.931	0.001	0.447	0.000	0.000	0.465	0.005	0.286
BW estimate (h)	4.653|4.653	4.456|4.456	3.632|3.632	3.981|3.981	4.617|4.617	4.075|4.075	4.162|4.162	3.155|3.155	3.877|3.877	3.774|3.774	3.992|3.992
BW bias (b)	6.904|6.904	6.683|6.683	5.576|5.576	5.150|5.150	5.686|5.686	6.071|6.071	5.490|5.490	5.270|5.270	5.428|5.428	6.563|6.563	6.341|6.341
Observations	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132
Effective observations	788324|734771	788324|734771	593851|629750	593851|629750	788324|734771	788324|734771	788324|734771	593851|629750	593851|629750	593851|629750	593851|629750
B [SAP 81] τ	0.001	0.001	0.000	0.000***	0.000	0.000	0.002	-0.000	-0.003**	0.000	-0.001***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.001|0.004	-0.004|0.002	-0.000|0.003	0.002|0.006	-0.004|0.002	-0.003|0.007	-0.008|0.005	-0.008|0.010	-0.004|-0.001	-0.003|0.005	-0.010|-0.005
Bias-corrected p-value	0.395	0.508	0.075	0.000	0.572	0.467	0.634	0.795	0.004	0.783	0.000
BW estimate (h)	4.056|4.056	3.825|3.825	4.216|4.216	3.823|3.823	4.795|4.795	4.293|4.293	3.902|3.902	3.526|3.526	4.483|4.483	4.067|4.067	4.170|4.170
BW bias (b)	6.495|6.495	6.197|6.197	7.296|7.296	6.864|6.864	6.301|6.301	6.548|6.548	6.860|6.860	5.816|5.816	6.341|6.341	6.837|6.837	6.840|6.840
Observations	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583
Effective observations	180116|84097	124580|76039	180116|84097	124580|76039	180116|84097	180116|84097	124580|76039	124580|76039	180116|84097	180116|84097	180116|84097
A [SAP 92] τ	-0.015	-0.019*	0.029	-0.094**	0.038***	0.018	0.010	-0.013	0.022	0.026***	0.047
	(0.011)	(0.010)	(0.024)	(0.031)	(0.004)	(0.007)	(0.006)	(0.009)	(0.015)	(0.006)	(0.014)
Bias-corrected 95% CI	-0.040|0.003	-0.047|-0.006	-0.016|0.100	-0.169|-0.033	0.022|0.047	-0.004|0.027	-0.081|0.103	-0.046|0.035	-0.003|0.065	0.012|0.041	-0.005|0.051
Bias-corrected p-value	0.087	0.012	0.158	0.004	0.000	0.150	0.812	0.779	0.073	0.000	0.112
BW estimate (h)	3.778|3.778	3.337|3.337	3.428|3.428	3.884|3.884	5.680|5.680	4.132|4.132	3.502|3.502	3.230|3.230	3.679|3.679	3.482|3.482	3.524|3.524
BW bias (b)	5.785|5.785	5.890|5.890	6.170|6.170	6.328|6.328	6.474|6.474	6.122|6.122	6.403|6.403	5.704|5.704	5.830|5.830	5.629|5.629	5.957|5.957
Observations	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714
Effective observations	1325|571	1325|571	1325|571	1325|571	4818|654	2431|631	1325|571	1325|571	1325|571	1325|571	1325|571
BW selection	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=4,881,291.

B.2.2 Sale Date

Figure B2: Sale Year Proportion – SAP Rating



Notes: This figure plots average price per meter (log) bins for each SAP rating unit. N=4,881,291.

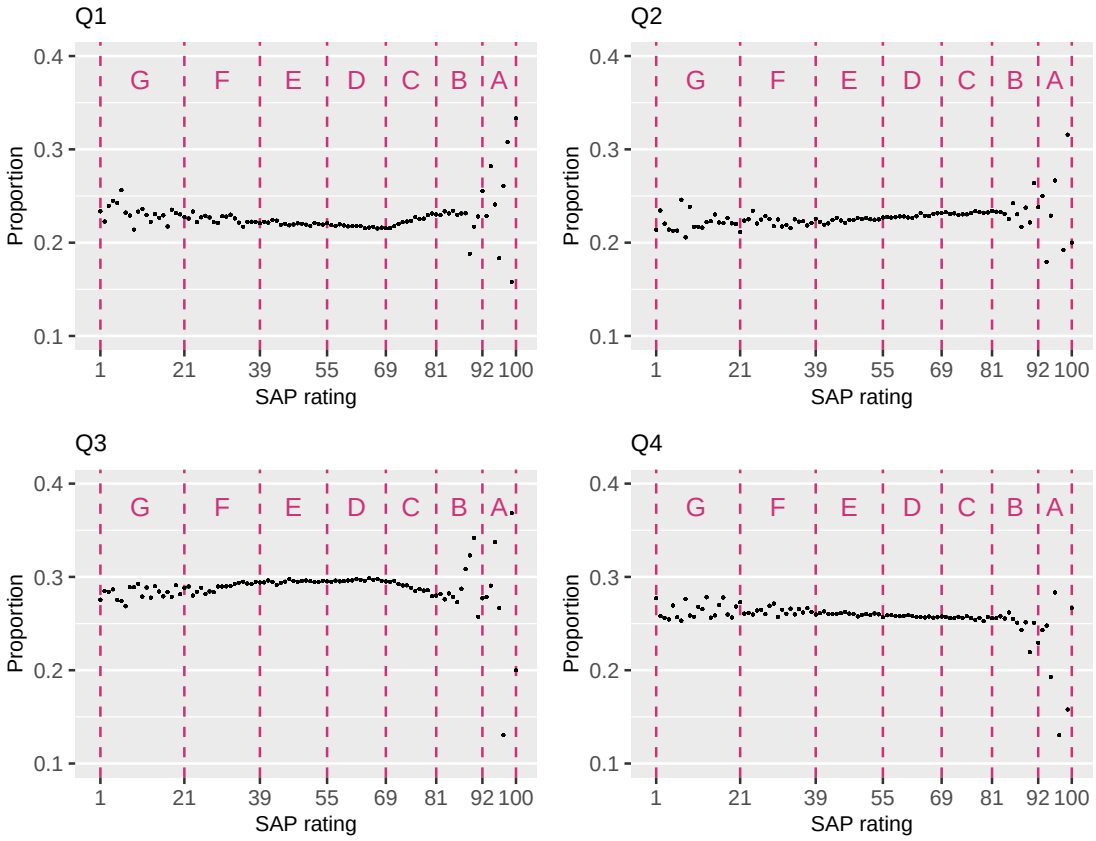


Figure B3: Sale Quarter Proportion – SAP Rating

Notes: This figure plots average price per meter (log) bins for each SAP rating unit. N=4,881,291.

Table B7: Local Linear RD Estimates for Date Covariate Proportions

	2012	2013	2014	2015	2016	2017	2018	2019	Q1	Q2	Q3	Q4
F [SAP 21] τ	0.002	0.001	0.001	-0.012***	0.008	0.003	0.005	-0.004	-0.003	-0.004	0.003	0.003
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.004)	(0.003)	(0.003)	(0.004)	(0.005)	(0.007)
Bias-corrected 95% CI	-0.003|0.012	-0.005|0.007	-0.008|0.012	-0.019|-0.007	0.000|0.018	-0.004|0.008	-0.004|0.014	-0.013|0.002	-0.014|0.007	-0.010|0.003	-0.007|0.014	-0.016|0.024
Bias-corrected p-value	0.249	0.817	0.681	0.000	0.050	0.463	0.287	0.176	0.491	0.266	0.554	0.688
BW estimate (h)	4.242|4.242	4.331|4.331	5.105|5.105	5.505|5.505	4.991|4.991	5.540|5.540	5.801|5.801	7.333|7.333	4.279|4.279	4.721|4.721	6.062|6.062	4.582|4.582
BW bias (b)	7.167|7.167	7.526|7.526	9.990|9.990	9.876|9.876	8.837|8.837	8.945|8.945	8.714|8.714	11.988|11.988	8.711|8.711	6.121|6.121	9.052|9.052	7.469|7.469
Observations	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167	60808|239167
Effective observations	16634|32253	16634|32253	20202|40545	20202|40545	16634|32253	20202|40545	20202|40545	26615|59926	16634|32253	16634|32253	23498|49718	16634|32253
E [SAP 39] τ	-0.006*	-0.008*	-0.004**	0.001	-0.002*	-0.002	0.005	0.015***	-0.001	0.005*	-0.001	-0.002
	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.000)	(0.002)	(0.001)	(0.002)
Bias-corrected 95% CI	-0.012|-0.001	-0.014|-0.001	-0.007|-0.001	-0.003|0.008	-0.004|-0.000	-0.006|0.001	-0.002|0.010	0.013|0.019	-0.004|0.002	0.001|0.011	-0.003|0.002	-0.006|0.004
Bias-corrected p-value	0.015	0.017	0.006	0.414	0.042	0.205	0.192	0.000	0.378	0.017	0.658	0.631
BW estimate (h)	6.053|6.053	7.322|7.322	5.070|5.070	3.784|3.784	4.293|4.293	4.734|4.734	3.959|3.959	5.831|5.831	3.969|3.969	4.718|4.718	4.389|4.389	4.720|4.720
BW bias (b)	8.617|8.617	10.671|10.671	7.584|7.584	7.466|7.466	6.214|6.214	6.396|6.396	8.066|8.066	10.589|10.589	6.151|6.151	8.353|8.353	7.591|7.591	7.549|7.549
Observations	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784	239167|990784
Effective observations	127152|285192	142289|341561	110618|233133	72323|141765	92187|185700	92187|185700	72323|141765	110618|233133	72323|141765	92187|185700	92187|185700	92187|185700
D [SAP 55] τ	0.000	0.000	-0.005**	-0.001	0.000	0.001	0.001	0.001	0.002	0.002***	-0.002***	-0.003*
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Bias-corrected 95% CI	-0.001|0.002	-0.000|0.001	-0.008|-0.002	-0.004|0.000	-0.001|0.001	-0.001|0.004	-0.001|0.002	-0.000|0.001	-0.000|0.004	0.001|0.002	-0.003|-0.002	-0.005|-0.000
Bias-corrected p-value	0.528	0.098	0.001	0.058	0.879	0.251	0.269	0.098	0.065	0.000	0.000	0.019
BW estimate (h)	4.860|4.860	4.541|4.541	3.587|3.587	3.572|3.572	3.581|3.581	5.219|5.219	3.083|3.083	4.071|4.071	3.906|3.906	3.308|3.308	3.308|3.308	3.869|3.869
BW bias (b)	8.834|8.834	6.154|6.154	5.569|5.569	5.788|5.788	6.946|6.946	8.137|8.137	5.554|5.554	6.866|6.866	7.094|7.094	5.234|5.234	5.651|5.651	5.622|5.622
Observations	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103	990784|2357103
Effective observations	379385|683250	379385|683250	297781|529425	297781|529425	297781|529425	454663|846571	297781|529425	379385|683250	297781|529425	297781|529425	297781|529425	297781|529425
C [SAP 69] τ	-0.001	0.001	-0.001***	-0.001*	-0.004***	0.001	0.004***	0.000	-0.001	-0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
Bias-corrected 95% CI	-0.001|0.000	-0.001|0.002	-0.002|-0.001	-0.004|-0.000	-0.008|-0.002	-0.001|0.003	0.004|0.005	-0.000|0.001	-0.003|0.002	-0.004|0.002	-0.001|0.003	-0.000|0.003
Bias-corrected p-value	0.387	0.339	0.000	0.043	0.000	0.356	0.000	0.400	0.571	0.492	0.242	0.104
BW estimate (h)	3.067|3.067	3.675|3.675	3.699|3.699	3.265|3.265	2.811|2.811	4.366|4.366	3.669|3.669	5.792|5.792	3.255|3.255	2.641|2.641	4.201|4.201	3.328|3.328
BW bias (b)	5.821|5.821	5.073|5.073	5.712|5.712	5.378|5.378	5.131|5.131	6.681|6.681	5.456|5.456	5.998|5.998	5.808|5.808	5.567|5.567	6.555|6.555	5.621|5.621
Observations	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132
Effective observations	593851|629750	593851|629750	593851|629750	593851|629750	394801|504167	788324|734771	593851|629750	978811|821323	593851|629750	394801|504167	788324|734771	593851|629750
B [SAP 81] τ	-0.001	-0.002***	-0.005***	0.001	0.004	-0.001	0.000	0.002**	-0.004***	0.002**	0.004**	-0.003
	(0.001)	(0.000)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.002)	(0.002)
Bias-corrected 95% CI	-0.003|0.001	-0.002|-0.001	-0.007|-0.002	-0.002|0.002	-0.005|0.011	-0.007|0.001	-0.003|0.005	0.001|0.005	-0.007|-0.003	0.001|0.003	0.002|0.010	-0.009|0.001
Bias-corrected p-value	0.406	0.000	0.000	0.785	0.484	0.181	0.530	0.006	0.000	0.007	0.008	0.117
BW estimate (h)	4.020|4.020	3.684|3.684	4.430|4.430	4.558|4.558	3.312|3.312	3.765|3.765	5.301|5.301	3.648|3.648	3.258|3.258	3.592|3.592	3.514|3.514	3.277|3.277
BW bias (b)	6.366|6.366	6.181|6.181	6.131|6.131	7.158|7.158	5.880|5.880	6.619|6.619	7.047|7.047	5.937|5.937	6.614|6.614	5.885|5.885	6.528|6.528	6.139|6.139
Observations	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1139132|93583
Effective observations	180116|84097	124580|76039	180116|84097	180116|84097	124580|76039	124580|76039	244541|88765	124580|76039	124580|76039	124580|76039	124580|76039	124580|76039
A [SAP 92] τ	0.008*	-0.001	0.063***	0.029	-0.024*	-0.066**	0.074***	-0.044**	0.013	-0.063**	0.087	-0.017
	(0.001)	(0.003)	(0.008)	(0.005)	(0.005)	(0.016)	(0.001)	(0.003)	(0.004)	(0.006)	(0.017)	(0.017)
Bias-corrected 95% CI	0.001|0.016	-0.057|0.027	0.039|0.083	-0.007|0.078	-0.065|-0.006	-0.117|-0.022	0.062|0.112	-0.053|-0.015	-0.022|0.023	-0.119|-0.025	-0.013|0.219	-0.062|0.020
Bias-corrected p-value	0.034	0.481	0.000	0.106	0.017	0.004	0.000	0.001	0.945	0.002	0.081	0.323
BW estimate (h)	3.811|3.811	2.418|2.418	4.875|4.875	3.411|3.411	2.573|2.573	3.494|3.494	2.439|2.439	2.945|2.945	2.348|2.348	2.913|2.913	3.045|3.045	3.493|3.493
BW bias (b)	5.857|5.857	5.686|5.686	6.531|6.531	6.528|6.528	5.634|5.634	6.176|6.176	5.516|5.516	5.674|5.674	5.988|5.988	5.767|5.767	6.886|6.886	6.463|6.463
Observations	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714	93583|714
Effective observations	1325|571	740|488	2431|631	1325|571	740|488	1325|571	740|488	740|488	740|488	740|488	1325|571	1325|571
BW selection	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=4,881,291.

Table B8: Local Linear RD Estimates Excluding Sales On or After April 2018

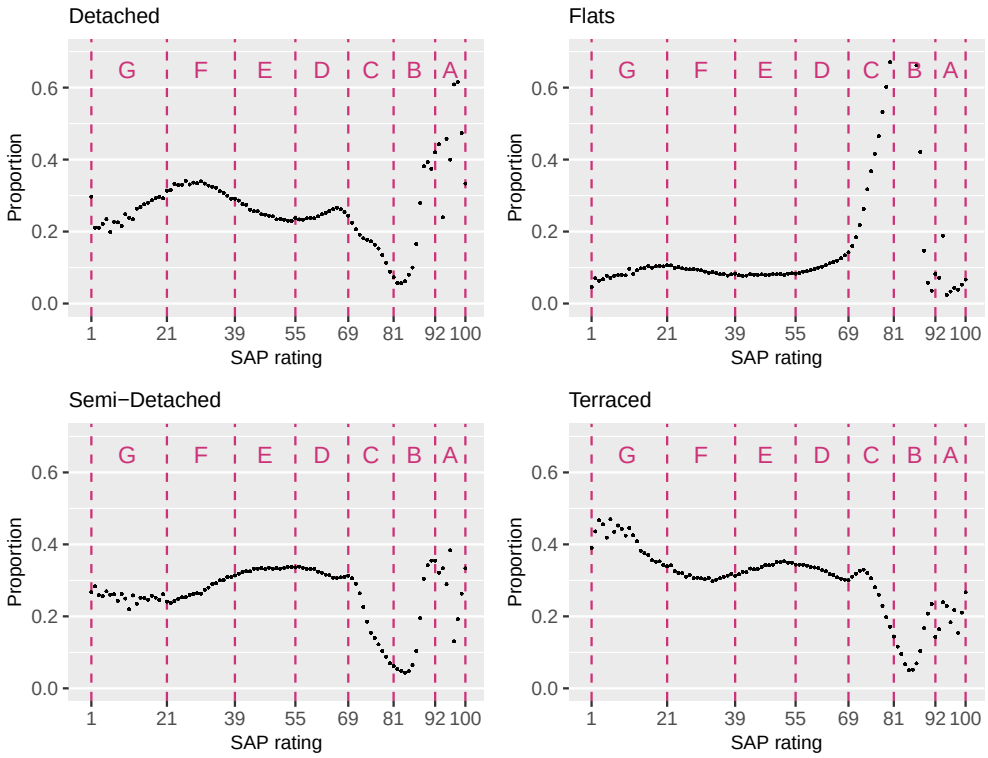
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	0.037***	0.034***	0.037***	0.031***	0.031***	0.036***	0.027***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.010)	(0.002)	(0.009)
Bias-corrected 95% CI	0.032|0.050	0.026|0.052	0.031|0.051	0.024|0.038	0.016|0.056	0.031|0.048	0.013|0.047
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.001
BW estimate (h)	3.499|3.499	3.063|3.063	3.531|4.396	5.613|5.613	5.753|5.753	3.444|3.444	5.661|5.661
BW bias (b)	8.008|8.008	7.483|7.483	7.553|8.639	11.160|11.160	9.051|9.051	8.005|8.005	8.568|8.568
Observations	50,165|198,495	50,165|198,495	50,165|198,495	50,132|198,347	50,165|198,495	50,165|198,495	50,132|198,347
Effective observations	10,469|20,150	10,469|20,150	10,469|26,401	16,534|33,161	16,546|33,176	10,469|20,150	16,534|33,161
E [SAP 39] τ	0.019***	0.020***	0.020***	0.018***	0.013***	0.019***	0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.003)	(0.001)
Bias-corrected 95% CI	0.015|0.027	0.013|0.028	0.015|0.027	0.013|0.028	0.013|0.020	0.014|0.026	0.010|0.017
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	4.921|4.921	3.748|3.748	4.670|4.189	3.924|3.924	3.632|3.632	4.922|4.922	3.331|3.331
BW bias (b)	6.273|6.273	5.342|5.342	6.286|5.353	5.881|5.881	5.876|5.876	6.358|6.358	5.351|5.351
Observations	198,495|807,968	198,495|807,968	198,495|807,968	198,347|807,310	198,495|807,968	198,495|807,968	198,347|807,310
Effective observations	77,126|152,149	60,623|116,291	77,126|152,149	60,584|116,196	60,623|116,291	77,126|152,149	60,584|116,196
D [SAP 55] τ	0.016***	0.014***	0.015***	0.015***	0.014***	0.015***	0.012***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
Bias-corrected 95% CI	0.013|0.022	0.010|0.023	0.014|0.022	0.014|0.021	0.014|0.018	0.013|0.022	0.013|0.017
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	4.303|4.303	3.033|3.033	4.085|4.371	3.989|3.989	3.925|3.925	4.215|4.215	3.698|3.698
BW bias (b)	6.054|6.054	5.131|5.131	7.240|5.310	5.558|5.558	5.574|5.574	6.014|6.014	5.494|5.494
Observations	807,968|1,874,238	807,968|1,874,238	807,968|1,874,238	807,310|1,872,890	807,968|1,874,238	807,968|1,874,238	807,310|1,872,890
Effective observations	308,082|548,194	241,655|425,139	308,082|548,194	241,465|424,829	241,655|425,139	308,082|548,194	241,465|424,829
C [SAP 69] τ	0.007***	0.007***	0.005***	0.008***	0.001**	0.007***	0.002**
	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)	(0.001)	(0.000)
Bias-corrected 95% CI	0.008|0.016	0.007|0.017	0.006|0.014	0.007|0.014	0.002|0.008	0.008|0.016	0.001|0.007
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.002	0.000	0.002
BW estimate (h)	3.715|3.715	3.376|3.376	4.181|5.142	3.434|3.434	3.710|3.710	3.748|3.748	3.575|3.575
BW bias (b)	5.274|5.274	5.452|5.452	7.072|5.142	5.806|5.806	5.181|5.181	5.282|5.282	5.217|5.217
Observations	1,874,238|903,600	1,874,238|903,600	1,874,238|903,600	1,872,890|900,545	1,874,238|903,600	1,874,238|903,600	1,872,890|900,545
Effective observations	468,540|496,590	468,540|496,590	622,001|648,866	468,164|496,071	468,540|496,590	468,540|496,590	468,164|496,071
B [SAP 81] τ	0.004	0.004	0.004	0.006***	0.000	0.003	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)
Bias-corrected 95% CI	-0.002|0.002	-0.003|0.001	-0.002|0.002	0.004|0.012	-0.008|0.004	-0.002|0.001	-0.006|0.004
Bias-corrected p-value	0.831	0.561	0.978	0.000	0.559	0.712	0.721
BW estimate (h)	4.053|4.053	3.897|3.897	3.742|6.972	4.871|4.871	3.676|3.676	4.113|4.113	3.883|3.883
BW bias (b)	6.654|6.654	6.048|6.048	5.301|6.159	6.822|6.822	6.277|6.277	6.608|6.608	6.528|6.528
Observations	903,600|75,592	903,600|75,592	903,600|75,592	900,545|72,089	903,600|75,592	903,600|75,592	900,545|72,089
Effective observations	144,734|68,219	100,269|61,728	100,269|73,839	142,941|65,120	100,269|61,728	144,734|68,219	98,771|58,967
A [SAP 92] τ	0.068	0.052	0.053	0.070**	0.066***	0.067	0.062***
	(0.010)	(0.005)	(0.005)	(0.003)	(0.007)	(0.011)	(0.010)
Bias-corrected 95% CI	-0.029|0.138	-0.151|0.286	-0.032|0.084	0.029|0.148	0.025|0.096	-0.027|0.139	0.026|0.094
Bias-corrected p-value	0.202	0.543	0.381	0.004	0.001	0.186	0.000
BW estimate (h)	3.283|3.283	2.567|2.567	2.828|4.253	2.945|2.945	3.169|3.169	3.268|3.268	3.268|3.268
BW bias (b)	6.001|6.001	6.481|6.481	5.120|5.629	6.308|6.308	5.950|5.950	5.956|5.956	5.904|5.904
Observations	75,592|515	75,592|515	75,592|515	72,089|487	75,592|515	75,592|515	72,089|487
Effective observations	905|412	511|349	511|451	478|324	905|412	905|412	852|386
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N= 3,910,573.

B.2.3 Property Type

Figure B4: Property Type Proportion – SAP Rating



Notes: This figure plots average price per meter (log) bins for each SAP rating unit. N=4,881,291.

Table B9: Local Linear RD Estimates for Property Covariate Proportions

	Detached	Flat	Semi-Detached	Terraced	Number of Rooms	Leasehold
F [SAP 21] τ	0.017***	0.002*	-0.021**	0.003	0.047	-0.005***
	(0.004)	(0.002)	(0.007)	(0.004)	(0.028)	(0.001)
Bias-corrected 95% CI	0.016|0.028	0.000|0.007	-0.039|-0.008	-0.008|0.012	-0.024|0.101	-0.011|-0.003
Bias-corrected p-value	0.000	0.025	0.003	0.692	0.232	0.000
BW estimate (h)	5.714|5.714	4.993|4.993	5.725|5.725	4.257|4.257	5.354|5.354	4.123|4.123
BW bias (b)	6.937|6.937	10.116|10.116	8.514|8.514	5.894|5.894	9.074|9.074	7.550|7.550
Observations	60808|239167	60808|239167	60808|239167	60808|239167	60769|238990	60808|239167
Effective observations	20202|40545	16634|32253	20202|40545	16634|32253	20190|40523	16634|32253
E [SAP 39] τ	0.008***	0.001	0.001	-0.009***	0.004	0.000
	(0.001)	(0.002)	(0.002)	(0.001)	(0.011)	(0.003)
Bias-corrected 95% CI	0.007|0.013	-0.005|0.004	-0.003|0.007	-0.012|-0.009	-0.014|0.040	-0.010|0.005
Bias-corrected p-value	0.000	0.791	0.482	0.000	0.353	0.473
BW estimate (h)	4.359|4.359	4.281|4.281	4.624|4.624	5.068|5.068	5.004|5.004	4.274|4.274
BW bias (b)	8.614|8.614	5.994|5.994	6.765|6.765	6.393|6.393	7.531|7.531	6.101|6.101
Observations	239167|990784	239167|990784	239167|990784	239167|990784	238990|989983	239167|990784
Effective observations	92187|185700	92187|185700	92187|185700	110618|233133	110541|232960	92187|185700
D [SAP 55] τ	0.007***	-0.002	-0.002	-0.004	0.017**	-0.000
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.000)
Bias-corrected 95% CI	0.004|0.010	-0.005|0.000	-0.006|0.001	-0.005|0.001	0.007|0.037	-0.005|0.005
Bias-corrected p-value	0.000	0.051	0.210	0.269	0.003	0.974
BW estimate (h)	5.776|5.776	4.953|4.953	4.381|4.381	4.707|4.707	3.060|3.060	3.012|3.012
BW bias (b)	7.008|7.008	8.720|8.720	6.006|6.006	6.482|6.482	5.524|5.524	5.340|5.340
Observations	990784|2357103	990784|2357103	990784|2357103	990784|2357103	989983|2355440	990784|2357103
Effective observations	454663|846571	379385|683250	379385|683250	379385|683250	297567|529057	297781|529425
C [SAP 69] τ	-0.004***	-0.006	0.005	0.004	0.022***	-0.008***
	(0.001)	(0.008)	(0.003)	(0.002)	(0.012)	(0.008)
Bias-corrected 95% CI	0.002|0.007	-0.004|0.001	-0.004|0.000	-0.004|0.002	0.009|0.024	-0.005|-0.002
Bias-corrected p-value	0.000	0.254	0.067	0.575	0.000	0.000
BW estimate (h)	3.655|3.655	7.460|7.460	4.210|4.210	5.518|5.518	7.652|7.652	7.184|7.184
BW bias (b)	4.876|4.876	5.853|5.853	5.231|5.231	6.677|6.677	6.421|6.421	5.828|5.828
Observations	2357103|1139132	2357103|1139132	2357103|1139132	2357103|1139132	2355440|1135285	2357103|1139132
Effective observations	593851|629750	1340670|959016	788324|734771	978811|821323	1339703|957458	1340670|959016
B [SAP 81] τ	0.001***	-0.012***	0.006***	0.001	-0.014***	-0.006***
	(0.005)	(0.007)	(0.003)	(0.002)	(0.025)	(0.009)
Bias-corrected 95% CI	0.012|0.017	-0.040|-0.023	0.005|0.014	-0.003|0.009	0.060|0.090	-0.032|-0.018
Bias-corrected p-value	0.000	0.000	0.000	0.291	0.000	0.000
BW estimate (h)	4.591|4.591	4.980|4.980	7.352|7.352	5.630|5.630	4.341|4.341	5.362|5.362
BW bias (b)	6.784|6.784	6.133|6.133	7.269|7.269	5.392|5.392	6.965|6.965	6.073|6.073
Observations	1139132|93583	1139132|93583	1139132|93583	1139132|93583	1135285|89119	1139132|93583
Effective observations	180116|84097	180116|84097	404361|92258	244541|88765	177827|80161	244541|88765
A [SAP 92] τ	0.075***	0.061	-0.016**	-0.142***	0.513**	0.071
	(0.015)	(0.010)	(0.003)	(0.011)	(0.009)	(0.010)
Bias-corrected 95% CI	0.092|0.162	-0.072|0.006	0.005|0.033	-0.198|-0.117	0.260|1.338	-0.056|0.022
Bias-corrected p-value	0.000	0.093	0.009	0.000	0.004	0.389
BW estimate (h)	2.624|2.624	2.990|2.990	2.991|2.991	5.199|5.199	2.760|2.760	2.994|2.994
BW bias (b)	5.703|5.703	5.289|5.289	5.244|5.244	6.324|6.324	5.328|5.328	5.316|5.316
Observations	93583|714	93583|714	93583|714	93583|714	89119|679	93583|714
Effective observations	740|488	740|488	740|488	4818|654	700|457	740|488
BW selection	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=4,881,291.

Table B10: Local Linear RD Estimates Excluding Detached Properties

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	0.022***	0.024***	0.025***	0.024**	0.014**	0.021***	0.016***
	(0.004)	(0.004)	(0.004)	(0.006)	(0.005)	(0.004)	(0.004)
Bias-corrected 95% CI	0.013|0.034	0.019|0.039	0.017|0.037	0.008|0.038	0.005|0.026	0.014|0.032	0.008|0.028
Bias-corrected p-value	0.000	0.000	0.000	0.003	0.003	0.000	0.000
BW estimate (h)	4.688|4.688	3.486|3.486	4.190|6.722	5.576|5.576	6.333|6.333	4.606|4.606	6.342|6.342
BW bias (b)	7.755|7.755	6.254|6.254	7.596|9.429	9.580|9.580	8.826|8.826	7.795|7.795	9.219|9.219
Observations	44,655|162,919	44,655|162,919	44,655|162,919	44,626|162,792	44,655|162,919	44,655|162,919	44,626|162,792
Effective observations	11,772|21,779	9,055|16,677	11,772|33,384	14,335|27,228	16,730|33,384	11,772|21,779	16,721|33,361
E [SAP 39] τ	0.019***	0.019**	0.019***	0.018***	0.017***	0.018**	0.013***
	(0.005)	(0.006)	(0.005)	(0.005)	(0.002)	(0.005)	(0.002)
Bias-corrected 95% CI	0.009|0.031	0.006|0.032	0.009|0.030	0.009|0.032	0.016|0.028	0.007|0.030	0.014|0.025
Bias-corrected p-value	0.000	0.005	0.000	0.001	0.000	0.001	0.000
BW estimate (h)	4.472|4.472	3.129|3.129	4.716|4.438	4.309|4.309	3.386|3.386	4.489|4.489	3.181|3.181
BW bias (b)	6.436|6.436	5.738|5.738	7.676|5.551	6.174|6.174	5.859|5.859	6.424|6.424	5.457|5.457
Observations	162,919|746,919	162,919|746,919	162,919|746,919	162,792|746,259	162,919|746,919	162,919|746,919	162,792|746,259
Effective observations	64,358|134,353	50,693|101,880	64,358|134,353	64,317|134,239	50,693|101,880	64,358|134,353	50,664|101,797
D [SAP 55] τ	0.019***	0.023***	0.018***	0.020***	0.015***	0.019***	0.014***
	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)
Bias-corrected 95% CI	0.013|0.030	0.017|0.032	0.014|0.028	0.017|0.030	0.012|0.021	0.013|0.029	0.013|0.021
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.797|3.797	2.913|2.913	3.754|4.295	3.610|3.610	4.008|4.008	3.799|3.799	4.191|4.191
BW bias (b)	5.514|5.514	5.024|5.024	6.414|5.249	5.239|5.239	6.290|6.290	5.500|5.500	6.938|6.938
Observations	746,919|1,770,856	746,919|1,770,856	746,919|1,770,856	746,259|1,769,453	746,919|1,770,856	746,919|1,770,856	746,259|1,769,453
Effective observations	229,006|404,895	158,561|293,918	229,006|522,065	228,823|404,574	291,440|522,065	229,006|404,895	291,194|521,653
C [SAP 69] τ	0.010***	0.010***	0.009***	0.011***	0.004**	0.010***	0.004***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.000)
Bias-corrected 95% CI	0.008|0.018	0.007|0.020	0.008|0.018	0.008|0.018	0.002|0.008	0.008|0.018	0.002|0.008
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.001	0.000	0.000
BW estimate (h)	3.851|3.851	3.185|3.185	3.512|4.638	3.604|3.604	3.862|3.862	3.862|3.862	3.508|3.508
BW bias (b)	5.509|5.509	5.585|5.585	5.671|5.069	5.636|5.636	5.552|5.552	5.516|5.516	5.190|5.190
Observations	1,770,856|920,637	1,770,856|920,637	1,770,856|920,637	1,769,453|917,682	1,770,856|920,637	1,770,856|920,637	1,769,453|917,682
Effective observations	439,041|491,591	439,041|491,591	439,041|577,589	438,653|491,038	439,041|491,591	439,041|491,591	438,653|491,038
B [SAP 81] τ	0.004	0.005	0.003	0.007***	0.001	0.003	0.000
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
Bias-corrected 95% CI	-0.002|0.006	-0.002|0.013	-0.002|0.004	0.005|0.015	-0.004|0.006	-0.002|0.005	-0.003|0.007
Bias-corrected p-value	0.267	0.170	0.592	0.000	0.780	0.454	0.349
BW estimate (h)	5.123|5.123	4.828|4.828	3.376|7.502	4.296|4.296	4.611|4.611	5.469|5.469	4.059|4.059
BW bias (b)	6.639|6.639	5.613|5.613	5.220|6.445	6.195|6.195	6.660|6.660	6.626|6.626	6.467|6.467
Observations	920,637|86,455	920,637|86,455	920,637|86,455	917,682|83,003	920,637|86,455	920,637|86,455	917,682|83,003
Effective observations	211,199|82,848	157,311|78,647	110,267|85,638	155,592|75,592	157,311|78,647	211,199|82,848	155,592|75,592
A [SAP 92] τ	0.104	0.024	0.092	0.030*	0.083*	0.106	0.097***
	(0.036)	(0.004)	(0.037)	(0.001)	(0.021)	(0.038)	(0.013)
Bias-corrected 95% CI	-0.056|0.296	-0.305|0.406	-0.066|0.179	0.002|0.087	0.010|0.150	-0.051|0.298	0.070|0.146
Bias-corrected p-value	0.180	0.781	0.366	0.040	0.024	0.164	0.000
BW estimate (h)	3.686|3.686	2.327|2.327	3.226|4.933	2.914|2.914	3.704|3.704	3.654|3.654	3.418|3.418
BW bias (b)	6.206|6.206	6.502|6.502	5.277|5.951	6.773|6.773	6.109|6.109	6.251|6.251	6.178|6.178
Observations	86,455|421	86,455|421	86,455|421	83,003|392	86,455|421	86,455|421	83,003|392
Effective observations	817|346	455|301	817|382	426|273	817|346	817|346	763|318
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N= 3,732,862.

Table B11: Local Linear RD Estimates Using Postcode Area Fixed Effects

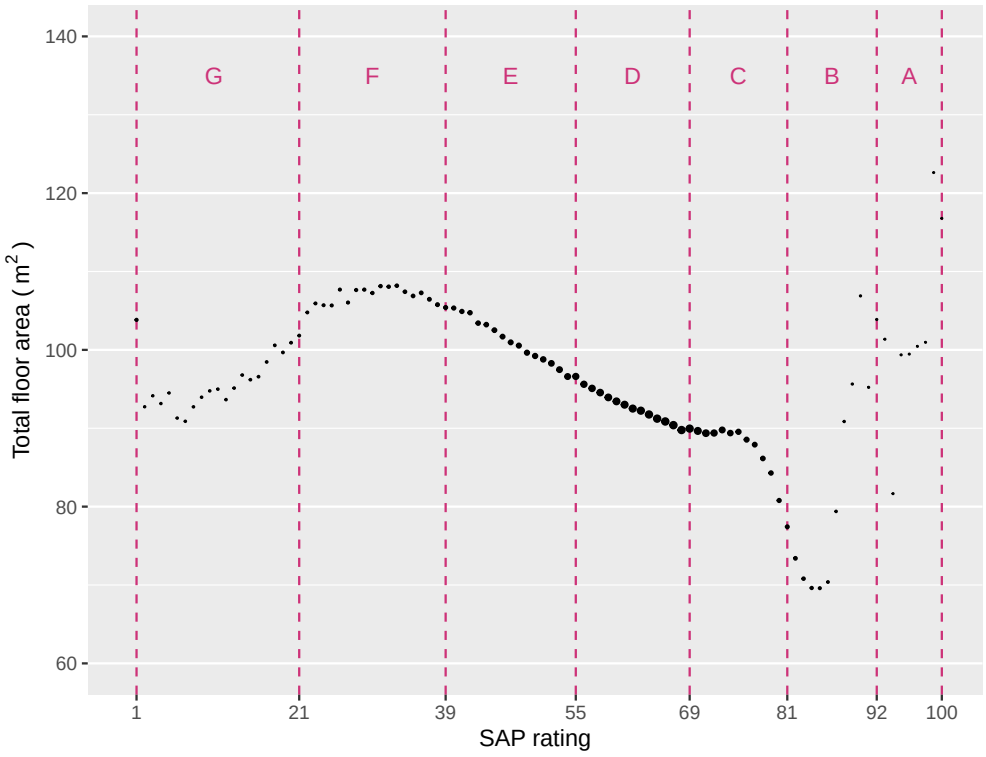
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	0.025***	0.026***	0.025***	0.021***	0.014*	0.025***	0.012*
	(0.001)	(0.002)	(0.001)	(0.002)	(0.006)	(0.001)	(0.005)
Bias-corrected 95% CI	0.020|0.035	0.021|0.035	0.021|0.033	0.016|0.026	0.003|0.031	0.020|0.035	0.003|0.025
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.016	0.000	0.012
BW estimate (h)	3.697|3.697	4.443|4.443	3.769|4.472	5.582|5.582	6.688|6.688	3.689|3.689	7.138|7.138
BW bias (b)	6.924|6.924	7.077|7.077	7.403|7.728	8.803|8.803	11.309|11.309	6.797|6.797	11.847|11.847
Observations	60,808|239,167	60,808|239,167	60,808|239,167	60,769|238,990	60,808|239,167	60,808|239,167	60,769|238,990
Effective observations	12,824|24,642	16,634|32,253	12,824|32,253	20,190|40,523	23,498|49,718	12,824|24,642	26,597|59,887
E [SAP 39] τ	0.020***	0.019***	0.020***	0.017***	0.015***	0.017***	0.010***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.003)	(0.004)	(0.002)
Bias-corrected 95% CI	0.013|0.030	0.009|0.030	0.013|0.029	0.010|0.030	0.010|0.025	0.010|0.027	0.006|0.018
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	4.391|4.391	3.417|3.417	4.448|4.439	3.741|3.741	4.193|4.193	4.529|4.529	3.640|3.640
BW bias (b)	6.263|6.263	5.660|5.660	6.510|5.765	5.979|5.979	6.397|6.397	6.364|6.364	5.895|5.895
Observations	239,167|990,784	239,167|990,784	239,167|990,784	238,990|989,983	239,167|990,784	239,167|990,784	238,990|989,983
Effective observations	92,187|185,700	72,323|141,765	92,187|185,700	72,278|141,657	92,187|185,700	92,187|185,700	72,278|141,657
D [SAP 55] τ	0.016***	0.019***	0.016***	0.016***	0.012***	0.016***	0.011***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
Bias-corrected 95% CI	0.012|0.024	0.015|0.026	0.014|0.023	0.013|0.023	0.010|0.017	0.012|0.024	0.010|0.016
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.936|3.936	2.954|2.954	4.256|4.311	3.672|3.672	4.337|4.337	3.915|3.915	3.529|3.529
BW bias (b)	5.743|5.743	5.197|5.197	7.434|5.307	5.421|5.421	6.290|6.290	5.725|5.725	5.806|5.806
Observations	990,784|2,357,103	990,784|2,357,103	990,784|2,357,103	989,983|2,355,440	990,784|2,357,103	990,784|2,357,103	989,983|2,355,440
Effective observations	297,781|529,425	205,917|384,020	379,385|683,250	297,567|529,057	379,385|683,250	297,781|529,425	297,567|529,057
C [SAP 69] τ	0.008***	0.007***	0.006***	0.008***	0.003***	0.007***	0.004***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.000)
Bias-corrected 95% CI	0.007|0.015	0.006|0.016	0.006|0.014	0.006|0.014	0.005|0.010	0.006|0.014	0.004|0.008
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.866|3.866	3.452|3.452	3.576|5.067	3.960|3.960	3.654|3.654	3.906|3.906	3.557|3.557
BW bias (b)	5.548|5.548	5.755|5.755	5.784|5.054	6.089|6.089	5.219|5.219	5.561|5.561	4.916|4.916
Observations	2,357,103|1,139,132	2,357,103|1,139,132	2,357,103|1,139,132	2,355,440|1,135,285	2,357,103|1,139,132	2,357,103|1,139,132	2,355,440|1,135,285
Effective observations	593,851|629,750	593,851|629,750	593,851|821,323	593,389|629,103	593,851|629,750	593,851|629,750	593,389|629,103
B [SAP 81] τ	0.002	0.002	0.002	0.004*	0.004	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Bias-corrected 95% CI	-0.006|0.001	-0.007|0.001	-0.007|0.000	0.000|0.009	-0.002|0.009	-0.006|0.001	-0.002|0.007
Bias-corrected p-value	0.214	0.180	0.050	0.038	0.167	0.099	0.302
BW estimate (h)	4.177|4.177	3.971|3.971	3.494|7.352	4.325|4.325	4.046|4.046	4.226|4.226	3.837|3.837
BW bias (b)	6.942|6.942	6.107|6.107	5.183|6.283	6.354|6.354	6.393|6.393	6.946|6.946	6.504|6.504
Observations	1,139,132|93,583	1,139,132|93,583	1,139,132|93,583	1,135,285|89,119	1,139,132|93,583	1,139,132|93,583	1,135,285|89,119
Effective observations	180,116|84,097	124,580|76,039	124,580|92,258	177,827|80,161	180,116|84,097	180,116|84,097	122,663|72,522
A [SAP 92] τ	0.071*	0.054	0.073*	0.057***	0.001	0.071*	0.030*
	(0.009)	(0.003)	(0.010)	(0.005)	(0.002)	(0.010)	(0.002)
Bias-corrected 95% CI	0.007|0.103	-0.112|0.253	0.008|0.092	0.068|0.110	-0.064|0.068	0.008|0.111	0.004|0.064
Bias-corrected p-value	0.025	0.451	0.018	0.000	0.952	0.023	0.027
BW estimate (h)	3.769|3.769	2.529|2.529	3.630|4.511	3.034|3.034	2.776|2.776	3.760|3.760	3.602|3.602
BW bias (b)	5.706|5.706	6.188|6.188	5.321|5.471	6.077|6.077	5.819|5.819	5.953|5.953	6.401|6.401
Observations	93,583|714	93,583|714	93,583|714	89,119|679	93,583|714	93,583|714	89,119|679
Effective observations	1,325|571	740|488	1,325|631	1,253|538	740|488	1,325|571	1,253|538
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=4,881,291.

B.2.4 Total Floor Area

Figure B5: Total Floor Area (m^2) – SAP Rating



Notes: This figure plots average total floor area (m^2) bins for each SAP rating unit. N=4,881,291.

Table B12: Local Linear RD Estimates for Total Floor Area

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	1.304	1.947*	0.922	-0.336	1.068	1.293	-0.354
	(0.849)	(1.009)	(0.823)	(0.264)	(0.855)	(0.852)	(0.269)
Bias-corrected 95% CI	-0.375|3.004	0.185|5.371	-0.688|1.746	-1.016|0.472	-0.689|2.712	-0.400|3.016	-1.056|0.493
Bias-corrected p-value	0.127	0.036	0.394	0.474	0.244	0.133	0.476
BW estimate (h)	5.156|5.156	3.217|3.217	6.083|4.741	4.799|4.799	5.047|5.047	5.147|5.147	4.719|4.719
BW bias (b)	7.731|7.731	5.980|5.980	11.256|6.353	7.240|7.240	7.704|7.704	7.724|7.724	7.260|7.260
Observations	60,808|239,167	60,808|239,167	60,808|239,167	60,769|238,990	60,808|239,167	60,808|239,167	60,769|238,990
Effective observations	20,202|40,545	12,824|24,642	23,498|32,253	16,623|32,235	20,202|40,545	20,202|40,545	16,623|32,235
E [SAP 39] τ	0.235	0.464	0.211	0.049	-0.015	0.259	-0.069*
	(0.256)	(0.080)	(0.242)	(0.069)	(0.260)	(0.255)	(0.068)
Bias-corrected 95% CI	-0.258|1.010	-0.006|1.525	-0.270|0.836	-0.163|0.187	-0.375|0.650	-0.239|1.036	-0.256|-0.010
Bias-corrected p-value	0.245	0.052	0.316	0.889	0.599	0.220	0.034
BW estimate (h)	5.177|5.177	3.805|3.805	4.922|4.293	5.174|5.174	6.357|6.357	5.161|5.161	4.188|4.188
BW bias (b)	7.329|7.329	5.469|5.469	8.784|5.970	9.821|9.821	9.797|9.797	7.344|7.344	7.879|7.879
Observations	239,167|990,784	239,167|990,784	239,167|990,784	238,990|989,983	239,167|990,784	239,167|990,784	238,990|989,983
Effective observations	110,618|233,133	72,323|141,765	92,187|185,700	110,541|232,960	127,152|285,192	110,618|233,133	92,128|185,553
D [SAP 55] τ	0.783***	0.809***	0.728***	0.310***	0.738***	0.787***	0.295***
	(0.096)	(0.099)	(0.129)	(0.096)	(0.085)	(0.096)	(0.091)
Bias-corrected 95% CI	0.903|1.184	0.806|1.215	0.858|1.193	0.222|0.718	0.807|1.167	0.909|1.191	0.243|0.700
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.350|3.350	2.635|2.635	3.476|4.916	3.387|3.387	3.281|3.281	3.342|3.342	3.342|3.342
BW bias (b)	4.913|4.913	4.880|4.880	5.053|5.689	5.044|5.044	4.968|4.968	4.915|4.915	5.029|5.029
Observations	990,784|2,357,103	990,784|2,357,103	990,784|2,357,103	989,983|2,355,440	990,784|2,357,103	990,784|2,357,103	989,983|2,355,440
Effective observations	297,781|529,425	205,917|384,020	297,781|683,250	297,567|529,057	297,781|529,425	297,781|529,425	297,567|529,057
C [SAP 69] τ	0.752***	0.439***	0.721***	0.427***	0.818***	0.747***	0.392***
	(0.038)	(0.164)	(0.047)	(0.159)	(0.055)	(0.036)	(0.152)
Bias-corrected 95% CI	0.770|0.978	0.394|0.862	0.757|0.958	0.420|0.510	0.795|1.118	0.768|0.969	0.381|0.498
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.203|3.203	4.400|4.400	3.434|3.929	6.144|6.144	3.167|3.167	3.201|3.201	6.029|6.029
BW bias (b)	5.475|5.475	5.053|5.053	5.655|5.640	5.821|5.821	5.510|5.510	5.461|5.461	5.734|5.734
Observations	2,357,103|1,139,132	2,357,103|1,139,132	2,357,103|1,139,132	2,355,440|1,135,285	2,357,103|1,139,132	2,357,103|1,139,132	2,355,440|1,135,285
Effective observations	593,851|629,750	788,324|734,771	593,851|629,750	1,161,978|893,280	593,851|629,750	593,851|629,750	1,161,978|893,280
B [SAP 81] τ	-1.615	-2.629	-1.911	-1.128***	-1.648	-1.646	-1.142***
	(0.727)	(1.113)	(1.099)	(0.297)	(0.705)	(0.728)	(0.298)
Bias-corrected 95% CI	-0.479|0.930	-1.043|1.175	-0.217|1.219	-2.222|-0.991	-0.782|0.750	-0.512|0.883	-2.206|-1.035
Bias-corrected p-value	0.530	0.907	0.172	0.000	0.967	0.602	0.000
BW estimate (h)	4.425|4.425	4.198|4.198	3.717|7.389	5.168|5.168	4.483|4.483	4.427|4.427	5.260|5.260
BW bias (b)	6.825|6.825	6.126|6.126	5.204|5.686	7.456|7.456	6.804|6.804	6.863|6.863	7.425|7.425
Observations	1,139,132|93,583	1,139,132|93,583	1,139,132|93,583	1,135,285|89,119	1,139,132|93,583	1,139,132|93,583	1,135,285|89,119
Effective observations	180,116|84,097	180,116|84,097	124,580|92,258	242,005|84,597	180,116|84,097	180,116|84,097	242,005|84,597
A [SAP 92] τ	21.220**	22.124*	19.463**	10.090*	20.148**	21.149**	9.250*
	(1.137)	(2.260)	(1.249)	(0.441)	(1.010)	(1.084)	(0.369)
Bias-corrected 95% CI	8.193|45.984	6.016|48.762	8.579|45.720	2.684|20.799	7.932|44.044	7.539|45.851	1.424|18.873
Bias-corrected p-value	0.005	0.012	0.004	0.011	0.005	0.006	0.023
BW estimate (h)	2.680|2.680	2.601|2.601	2.502|5.153	2.678|2.678	2.679|2.679	2.672|2.672	2.846|2.846
BW bias (b)	5.686|5.686	5.752|5.752	5.293|5.799	5.824|5.824	5.623|5.623	5.725|5.725	5.877|5.877
Observations	93,583|714	93,583|714	93,583|714	89,119|679	93,583|714	93,583|714	89,119|679
Effective observations	740|488	740|488	740|654	700|457	740|488	740|488	700|457
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=4,881,291.

B.3 EE Rating Band Increases Before a Sale

Table B13: Local Linear RD Estimates for Price Discontinuities Including Properties with Rating Band Increases

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	0.024***	0.026***	0.024***	0.020***	0.020**	0.023***	0.018**
	(0.000)	(0.001)	(0.000)	(0.002)	(0.009)	(0.001)	(0.007)
Bias-corrected 95% CI	0.020|0.034	0.020|0.034	0.021|0.031	0.015|0.025	0.006|0.041	0.019|0.033	0.008|0.036
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.010	0.000	0.002
BW estimate (h)	3.704|3.704	4.454|4.454	3.769|3.977	5.534|5.534	5.709|5.709	3.725|3.725	5.481|5.481
BW bias (b)	6.871|6.871	7.073|7.073	7.403|7.590	8.752|8.752	7.535|7.535	6.747|6.747	7.798|7.798
Observations	60,808|240,746	60,808|240,746	60,808|240,746	60,769|240,568	60,808|240,746	60,808|240,746	60,769|240,568
Effective observations	12,824|25,014	16,634|32,719	12,824|25,014	20,190|41,066	20,202|41,088	12,824|25,014	20,190|41,066
E [SAP 39] τ	0.017***	0.017**	0.017***	0.015***	0.015***	0.014***	0.009***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.002)	(0.004)	(0.001)
Bias-corrected 95% CI	0.010|0.028	0.007|0.028	0.010|0.027	0.007|0.027	0.013|0.023	0.007|0.024	0.008|0.016
Bias-corrected p-value	0.000	0.001	0.000	0.001	0.000	0.000	0.000
BW estimate (h)	4.535|4.535	3.434|3.434	4.516|4.596	3.787|3.787	3.968|3.968	4.653|4.653	3.473|3.473
BW bias (b)	6.370|6.370	5.619|5.619	6.629|5.926	6.003|6.003	6.187|6.187	6.467|6.467	5.622|5.622
Observations	240,746|1,002,156	240,746|1,002,156	240,746|1,002,156	240,568|1,001,354	240,746|1,002,156	240,746|1,002,156	240,568|1,001,354
Effective observations	92,488|189,285	72,551|144,673	92,488|189,285	72,505|144,564	72,551|144,673	92,488|189,285	72,505|144,564
D [SAP 55] τ	0.012***	0.014***	0.011***	0.011***	0.011***	0.011***	0.009***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
Bias-corrected 95% CI	0.008|0.019	0.011|0.021	0.009|0.018	0.010|0.018	0.011|0.016	0.008|0.019	0.010|0.014
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.913|3.913	2.905|2.905	3.922|4.295	3.699|3.699	3.935|3.935	3.883|3.883	3.549|3.549
BW bias (b)	5.661|5.661	5.174|5.174	7.069|5.303	5.404|5.404	6.043|6.043	5.636|5.636	5.551|5.551
Observations	1,002,156|2,411,210	1,002,156|2,411,210	1,002,156|2,411,210	1,001,354|2,409,527	1,002,156|2,411,210	1,002,156|2,411,210	1,001,354|2,409,527
Effective observations	300,081|546,924	207,462|397,112	300,081|705,010	299,867|546,550	300,081|546,924	300,081|546,924	299,867|546,550
C [SAP 69] τ	0.005***	0.005***	0.004***	0.006***	0.001***	0.004***	0.001**
	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)	(0.001)	(0.000)
Bias-corrected 95% CI	0.005|0.012	0.004|0.014	0.004|0.012	0.004|0.011	0.003|0.008	0.003|0.011	0.001|0.005
Bias-corrected p-value	0.000	0.001	0.000	0.000	0.000	0.000	0.005
BW estimate (h)	3.858|3.858	3.434|3.434	3.659|5.089	4.019|4.019	3.651|3.651	3.912|3.912	3.404|3.404
BW bias (b)	5.533|5.533	5.622|5.622	5.858|5.156	6.152|6.152	5.275|5.275	5.545|5.545	5.125|5.125
Observations	2,411,210|1,185,556	2,411,210|1,185,556	2,411,210|1,185,556	2,409,527|1,181,650	2,411,210|1,185,556	2,411,210|1,185,556	2,409,527|1,181,650
Effective observations	602,818|662,430	602,818|662,430	602,818|861,361	800,151|770,953	602,818|662,430	602,818|662,430	602,353|661,765
B [SAP 81] τ	0.000*	0.002	-0.001**	0.001	-0.001	-0.001**	-0.002
	(0.003)	(0.003)	(0.003)	(0.001)	(0.002)	(0.003)	(0.002)
Bias-corrected 95% CI	-0.009|-0.001	-0.011|0.002	-0.010|-0.002	-0.003|0.006	-0.007|0.004	-0.009|-0.002	-0.007|0.003
Bias-corrected p-value	0.016	0.189	0.001	0.440	0.578	0.005	0.523
BW estimate (h)	4.377|4.377	4.219|4.219	3.430|7.391	4.119|4.119	3.873|3.873	4.467|4.467	3.809|3.809
BW bias (b)	6.880|6.880	6.091|6.091	5.200|6.126	6.270|6.270	6.348|6.348	6.877|6.877	6.299|6.299
Observations	1,185,556|98,920	1,185,556|98,920	1,185,556|98,920	1,181,650|94,401	1,185,556|98,920	1,185,556|98,920	1,181,650|94,401
Effective observations	182,935|88,396	182,935|88,396	126,386|97,273	180,622|84,417	126,386|79,904	182,935|88,396	124,452|76,351
A [SAP 92] τ	0.037	0.020	0.038	0.030***	0.034**	0.036	0.029***
	(0.009)	(0.002)	(0.010)	(0.000)	(0.008)	(0.009)	(0.002)
Bias-corrected 95% CI	-0.029|0.064	-0.144|0.210	-0.027|0.053	0.031|0.072	0.008|0.058	-0.027|0.065	0.017|0.044
Bias-corrected p-value	0.453	0.717	0.511	0.000	0.010	0.425	0.000
BW estimate (h)	3.560|3.560	2.770|2.770	3.435|4.528	2.963|2.963	3.773|3.773	3.512|3.512	3.679|3.679
BW bias (b)	5.938|5.938	6.606|6.606	5.397|6.056	6.665|6.665	5.899|5.899	5.896|5.896	5.913|5.913
Observations	98,920|967	98,920|967	98,920|967	94,401|930	98,920|967	98,920|967	94,401|930
Effective observations	1,647|773	900|664	1,647|855	857|632	1,647|773	1,647|773	1,570|738
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

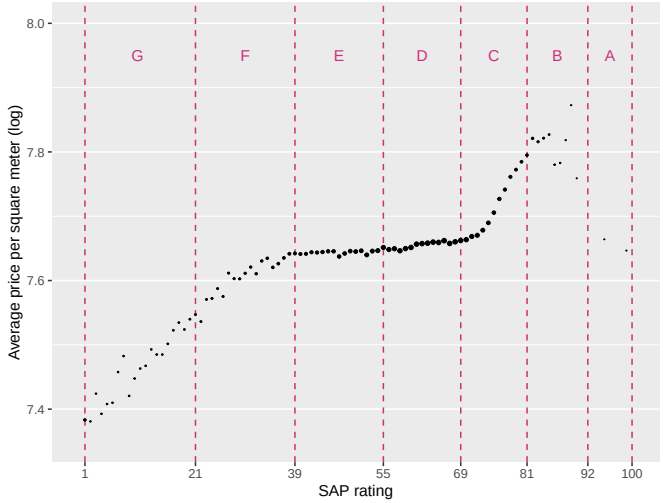
Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=5,000,363.

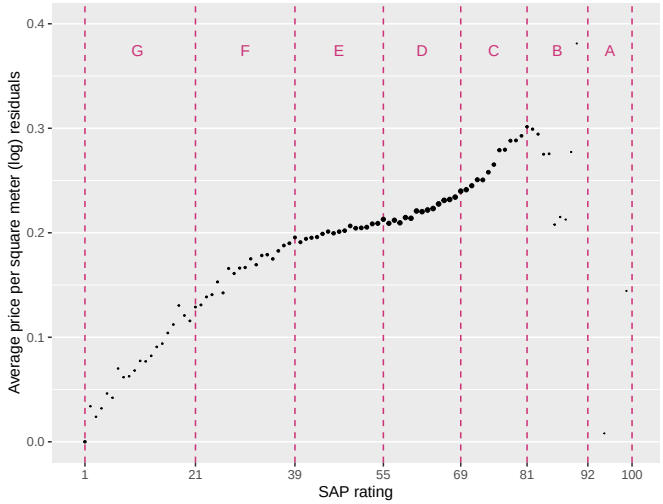
B.4 Counter Factual Scenario

Figure B6: Price Per Square Meter (Log) – SAP Rating Sale Transactions Before April 2012

Panel A. Price per Meter Log – SAP Rating for Existing Properties



Panel B. Price Residuals – SAP Rating for Existing Properties



Notes: This figure plots average price per square meter (log) bins for each SAP rating unit for sales between October 2008 and March 2012. N=1,418,826.

Table B14: Local Linear RD Estimates for Sale Transactions Before April 2012

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	-0.003	-0.002	-0.002	-0.003	0.018***	-0.002	0.020***
	(0.008)	(0.010)	(0.009)	(0.007)	(0.005)	(0.009)	(0.003)
Bias-corrected 95% CI	-0.019|0.021	-0.020|0.025	-0.023|0.024	-0.021|0.016	0.022|0.040	-0.020|0.022	0.020|0.043
Bias-corrected p-value	0.932	0.845	0.966	0.791	0.000	0.910	0.000
BW estimate (h)	5.795|5.795	4.293|4.293	3.858|7.332	5.561|5.561	4.138|4.138	5.902|5.902	3.845|3.845
BW bias (b)	8.371|8.371	7.853|7.853	7.112|10.968	8.651|8.651	6.297|6.297	8.448|8.448	6.217|6.217
Observations	34,001|110,343	34,001|110,343	34,001|110,343	33,901|109,982	34,001|110,343	34,001|110,343	33,901|109,982
Effective observations	10,016|20,023	8,272|15,989	6,385|29,300	9,984|19,961	8,272|15,989	10,016|20,023	6,366|12,249
E [SAP 39] τ	-0.007***	-0.006**	-0.007***	-0.008***	0.002	-0.007***	0.000
	(0.001)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.017|-0.007	-0.016|-0.003	-0.018|-0.006	-0.019|-0.010	-0.008|0.009	-0.018|-0.006	-0.007|0.002
Bias-corrected p-value	0.000	0.002	0.000	0.000	0.872	0.000	0.292
BW estimate (h)	3.219|3.219	2.709|2.709	3.137|5.906	3.392|3.392	3.433|3.433	3.215|3.215	4.234|4.234
BW bias (b)	6.891|6.891	6.941|6.941	6.979|8.194	6.518|6.518	6.006|6.006	6.930|6.930	6.335|6.335
Observations	110,343|356,128	110,343|356,128	110,343|356,128	109,982|354,970	110,343|356,128	110,343|356,128	109,982|354,970
Effective observations	32,091|59,463	22,299|42,828	32,091|96,558	31,963|59,268	32,091|59,463	32,091|59,463	40,858|77,102
D [SAP 55] τ	0.002	0.003	0.002	0.000	0.003	0.002	0.002
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Bias-corrected 95% CI	-0.005|0.006	-0.010|0.011	-0.002|0.008	-0.007|0.007	-0.003|0.007	-0.005|0.006	-0.003|0.007
Bias-corrected p-value	0.873	0.969	0.250	0.931	0.410	0.800	0.458
BW estimate (h)	4.321|4.321	2.315|2.315	4.543|4.889	4.102|4.102	4.029|4.029	4.318|4.318	4.337|4.337
BW bias (b)	6.721|6.721	4.881|4.881	9.083|5.524	6.593|6.593	6.081|6.081	6.618|6.618	6.741|6.741
Observations	356,128|591,972	356,128|591,972	356,128|591,972	354,970|590,040	356,128|591,972	356,128|591,972	354,970|590,040
Effective observations	120,053|191,479	63,256|110,235	120,053|191,479	119,640|190,852	120,053|191,479	120,053|191,479	119,640|190,852
C [SAP 69] τ	0.002	0.002	-0.003	0.002	0.000	0.002	0.002**
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.003|0.008	-0.001|0.008	-0.008|0.005	-0.003|0.006	-0.001|0.005	-0.003|0.007	0.001|0.006
Bias-corrected p-value	0.329	0.106	0.644	0.594	0.197	0.345	0.001
BW estimate (h)	4.803|4.803	4.762|4.762	2.824|7.113	3.725|3.725	4.221|4.221	4.882|4.882	4.160|4.160
BW bias (b)	5.496|5.496	5.888|5.888	5.205|5.245	5.462|5.462	6.321|6.321	5.515|5.515	6.427|6.427
Observations	591,972|299,130	591,972|299,130	591,972|299,130	590,040|297,568	591,972|299,130	591,972|299,130	590,040|297,568
Effective observations	179,738|179,452	179,738|179,452	87,921|246,535	133,274|150,069	179,738|179,452	179,738|179,452	179,126|178,863
B [SAP 81] τ	0.000	0.003	0.006	0.000	0.004***	-0.001	0.005***
	(0.008)	(0.009)	(0.007)	(0.002)	(0.006)	(0.008)	(0.004)
Bias-corrected 95% CI	-0.003|0.007	-0.003|0.010	-0.003|0.008	0.000|0.010	0.003|0.012	-0.003|0.007	0.005|0.013
Bias-corrected p-value	0.334	0.303	0.351	0.061	0.001	0.470	0.000
BW estimate (h)	6.584|6.584	5.670|5.670	2.866|7.049	4.016|4.016	6.267|6.267	6.665|6.665	5.480|5.480
BW bias (b)	6.390|6.390	6.157|6.157	5.085|6.237	6.866|6.866	6.603|6.603	6.396|6.396	6.566|6.566
Observations	299,130|27,230	299,130|27,230	299,130|27,230	297,568|26,445	299,130|27,230	299,130|27,230	297,568|26,445
Effective observations	94,066|27,003	71,772|26,531	21,949|27,176	51,955|24,634	94,066|27,003	94,066|27,003	71,017|25,753
A [SAP 92] τ	-2.033***	-1.988**	-1.328***	-2.056***	0.309	-0.596***	-0.090
	(0.023)	(0.075)	(0.039)	(0.078)	(0.114)	(0.000)	(0.000)
Bias-corrected 95% CI	-3.174|-1.073	-3.292|-0.741	-1.617|-0.899	-3.353|-0.918	-0.631|1.443	-0.796|-0.308	-0.475|0.347
Bias-corrected p-value	0.000	0.002	0.000	0.001	0.443	0.000	0.759
BW estimate (h)	2.275|2.275	2.140|2.140	1.584|3.405	2.305|2.305	2.594|2.594	1.807|1.807	1.851|1.851
BW bias (b)	5.654|5.654	5.672|5.672	5.367|4.565	5.318|5.318	5.343|5.343	5.445|5.445	5.124|5.124
Observations	27,230|22	27,230|22	27,230|22	26,445|19	27,230|22	27,230|22	26,445|19
Effective observations	27|17	27|17	9|18	26|14	27|17	9|14	9|11
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=1,406,436. The results for the threshold B-A are not included as there is only 22 properties with rating band A.

Appendix C Seller Investment Behaviour Robustness Analysis Results

C.1 Empirical Specification

Table C1: Local Linear RD Estimates with Different Bandwidths

	BW = 2		BW = 3		BW = 4		BW = 5	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
F [SAP 21] τ	0.012***	0.012***	0.011***	0.012***	0.001***	0.001***	-0.001	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.005)	(0.005)	(0.005)	(0.005)
Bias-corrected 95% CI	0.006|0.006	0.006|0.006	0.030|0.030	0.031|0.031	0.029|0.031	0.030|0.031	-0.008|0.025	-0.010|0.026
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.323	0.401
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	55,552|212,881	55,509|212,715	55,552|212,881	55,509|212,715	55,552|212,881	55,509|212,715	55,552|212,881	55,509|212,715
Effective observations	7,779|15,863	7,777|15,854	11,334|21,889	11,326|21,877	14,758|28,710	14,746|28,695	17,942|36,069	17,929|36,051
E [SAP 39] τ	-0.009***	-0.009***	-0.009***	-0.009***	-0.008***	-0.008***	-0.008***	-0.008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.008|-0.008	-0.008|-0.008	-0.012|-0.012	-0.012|-0.012	-0.012|-0.011	-0.012|-0.011	-0.011|-0.005	-0.011|-0.005
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	212,881|847,082	212,715|846,397	212,881|847,082	212,715|846,397	212,881|847,082	212,715|846,397	212,881|847,082	212,715|846,397
Effective observations	45,126|89,316	45,099|89,250	64,682|124,591	64,639|124,490	82,257|162,878	82,202|162,746	98,713|204,104	98,639|203,945
D [SAP 55] τ	-0.005***	-0.005***	-0.005***	-0.005***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.005|-0.005	-0.005|-0.005	-0.008|-0.008	-0.008|-0.008	-0.008|-0.007	-0.008|-0.007	-0.007|-0.004	-0.007|-0.004
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	847,082|1,901,099	846,397|1,899,716	847,082|1,901,099	846,397|1,899,716	847,082|1,901,099	846,397|1,899,716	847,082|1,901,099	846,397|1,899,716
Effective observations	172,065|322,499	171,924|322,271	249,402|442,979	249,205|442,659	318,459|569,763	318,205|569,363	382,441|703,551	382,133|703,053
C [SAP 69] τ	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bias-corrected 95% CI	-0.002|-0.002	-0.003|-0.003	-0.001|-0.001	-0.001|-0.001	-0.001|-0.001	-0.001|-0.001	-0.001|0.000	-0.001|0.000
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.061	0.028
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	1,901,099|906,395	1,899,716|903,313	1,901,099|906,395	1,899,716|903,313	1,901,099|906,395	1,899,716|903,313	1,901,099|906,395	1,899,716|903,313
Effective observations	307,644|402,117	307,398|401,721	463,988|501,905	463,607|501,370	617,403|585,021	616,903|584,337	768,864|653,892	768,261|653,019
B [SAP 81] τ	0.001***	0.001***	0.002***	0.001***	0.000***	0.000***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	0.000|0.000	0.000|0.000	0.004|0.004	0.004|0.004	0.004|0.004	0.004|0.004	-0.001|0.004	-0.001|0.003
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.174	0.233
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	906,395|75,629	903,313|72,126	906,395|75,629	903,313|72,126	906,395|75,629	903,313|72,126	906,395|75,629	903,313|72,126
Effective observations	59,917|52,496	58,802|50,319	99,068|62,095	97,569|59,333	143,176|68,490	141,381|65,390	194,278|72,136	192,276|68,864
A [SAP 92] τ	-0.032***	-0.032***	-0.031***	-0.028***	-0.028***	-0.023***	-0.027***	-0.021***
	(0.000)	(0.000)	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
Bias-corrected 95% CI	-0.026|-0.026	-0.026|-0.026	-0.038|-0.038	-0.037|-0.037	-0.039|-0.036	-0.038|-0.034	-0.036|-0.025	-0.034|-0.021
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
BW bias (b)	2.000|2.000	2.000|2.000	3.000|3.000	3.000|3.000	4.000|4.000	4.000|4.000	5.000|5.000	5.000|5.000
Observations	75,629|515	72,126|487	75,629|515	72,126|487	75,629|515	72,126|487	75,629|515	72,126|487
Effective observations	487|349	454|324	864|413	812|387	1,677|452	1,562|425	3,493|468	3,262|441
BW selection	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics		Yes		Yes		Yes		Yes
Area FE		Yes		Yes		Yes		Yes
Date FE		Yes		Yes		Yes		Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N= 3,999,155.

Table C2: Local Linear RD Estimates for Falsification Tests

	TH -3		TH -2		TH -1		TH +1		TH +2		TH +3	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
F [SAP 21] τ	-0.010*	-0.013*	0.009*	0.009*	-0.006	-0.006	-0.010**	-0.009**	0.001	0.001	0.015***	0.015***
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Bias-corrected 95% CI	-0.026|-0.001	-0.031|-0.004	0.001|0.021	0.002|0.022	-0.022|0.003	-0.022|0.004	-0.018|-0.004	-0.017|-0.004	-0.004|0.012	-0.004|0.012	0.012|0.026	0.012|0.025
Bias-corrected p-value	0.037	0.013	0.025	0.021	0.122	0.162	0.002	0.001	0.352	0.382	0.000	0.000
BW estimate (h)	3.305|3.305	3.213|3.213	4.159|4.159	4.380|4.380	4.404|4.404	4.337|4.337	5.584|5.584	6.618|6.618	4.742|4.742	4.683|4.683	4.192|4.192	4.188|4.188
BW bias (b)	6.021|6.021	5.871|5.871	7.198|7.198	7.490|7.490	6.595|6.595	6.728|6.728	9.784|9.784	12.068|12.068	6.769|6.769	6.749|6.749	6.984|6.984	6.892|6.892
Observations	44,218|224,215	44,183|224,041	47,773|220,660	47,732|220,492	51,571|216,862	51,530|216,694	60,454|207,979	60,408|207,816	65,687|202,746	65,638|202,586	71,415|197,018	71,363|196,861
Effective observations	9,529|16,236	9,520|16,225	13,084|23,642	13,069|23,631	13,961|25,870	13,950|25,856	19,660|39,304	22,828|48,304	17,914|34,071	17,906|34,053	19,844|37,374	19,833|37,349
E [SAP 39] τ	0.003**	0.003**	-0.001	-0.001	-0.003	-0.003	0.002*	0.002**	0.004	0.004	-0.002*	-0.001*
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	0.001|0.004	0.001|0.004	-0.005|0.002	-0.006|0.002	-0.008|0.001	-0.008|0.001	0.002|0.012	0.002|0.012	0.000|0.011	0.000|0.011	-0.006|0.000	-0.006|0.000
Bias-corrected p-value	0.009	0.002	0.289	0.273	0.168	0.164	0.011	0.010	0.054	0.072	0.027	0.043
BW estimate (h)	4.765|4.765	4.532|4.532	6.085|6.085	6.034|6.034	7.720|7.720	7.634|7.634	3.389|3.389	3.411|3.411	3.613|3.613	3.578|3.578	2.839|2.839	2.897|2.897
BW bias (b)	7.466|7.466	7.174|7.174	7.480|7.480	7.543|7.543	10.196|10.196	10.061|10.061	5.183|5.183	5.187|5.187	5.332|5.332	5.297|5.297	5.615|5.615	5.664|5.664
Observations	148,199|911,764	148,076|911,036	167,755|892,208	167,616|891,496	189,563|870,400	189,408|869,704	239,966|819,997	239,780|819,332	269,722|790,241	269,515|789,597	302,197|757,766	301,965|757,147
Effective observations	62,097|121,523	62,039|121,439	93,839|208,004	93,754|207,845	115,647|272,521	115,546|272,313	72,211|135,793	72,164|135,681	80,159|147,263	80,107|147,145	62,231|114,788	62,185|114,695
D [SAP 55] τ	-0.001	-0.001	-0.001	-0.001	0.001	0.001	0.002*	0.002*	0.000	0.000	0.001	0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Bias-corrected 95% CI	-0.003|0.000	-0.002|0.000	-0.002|0.002	-0.002|0.002	-0.001|0.004	-0.001|0.004	0.001|0.005	0.001|0.005	-0.004|0.003	-0.003|0.003	-0.002|0.002	-0.002|0.002
Bias-corrected p-value	0.173	0.169	0.840	0.837	0.222	0.176	0.010	0.015	0.816	0.989	0.745	0.725
BW estimate (h)	4.146|4.146	4.680|4.680	3.734|3.734	3.732|3.732	5.020|5.020	4.786|4.786	4.600|4.600	5.000|5.000	3.710|3.710	4.318|4.318	2.766|2.766	2.790|2.790
BW bias (b)	6.880|6.880	7.573|7.573	5.441|5.441	5.468|5.468	8.429|8.429	8.055|8.055	7.208|7.208	7.921|7.921	6.937|6.937	7.438|7.438	5.896|5.896	5.874|5.874
Observations	597,680|2,150,501	597,192|2,148,921	675,017|2,073,164	674,473|2,071,640	758,600|1,989,581	757,995|1,988,118	949,405|1,798,776	948,636|1,797,477	1,055,995|1,692,186	1,055,148|1,690,965	1,169,581|1,578,600	1,168,668|1,577,445
Effective observations	248,485|458,315	248,275|457,956	210,376|380,978	210,209|380,675	353,414|658,245	293,731|531,061	351,725|601,228	420,444|738,670	297,395|494,638	380,675|632,158	220,176|381,052	220,032|380,782
C [SAP 69] τ	0.000	0.000	0.000	0.000	0.000	0.000	0.002***	0.001***	0.002*	0.001*	0.000*	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bias-corrected 95% CI	-0.001|0.001	-0.001|0.001	-0.001|0.001	-0.001|0.001	0.000|0.001	0.000|0.001	0.001|0.003	0.001|0.002	0.000|0.002	0.000|0.002	-0.002|0.000	-0.002|0.000
Bias-corrected p-value	0.678	0.762	0.604	0.833	0.439	0.457	0.000	0.000	0.046	0.022	0.029	0.036
BW estimate (h)	4.563|4.563	4.404|4.404	3.945|3.945	3.947|3.947	4.636|4.636	4.377|4.377	3.872|3.872	3.841|3.841	4.212|4.212	4.406|4.406	3.813|3.813	3.786|3.786
BW bias (b)	6.198|6.198	6.246|6.246	5.695|5.695	6.217|6.217	5.926|5.926	6.060|6.060	5.575|5.575	5.690|5.690	6.372|6.372	6.993|6.993	6.350|6.350	6.572|6.572
Observations	1,437,111|1,370,383	1,436,109|1,366,920	1,593,455|1,214,039	1,592,318|1,210,711	1,749,597|1,057,897	1,748,347|1,054,682	2,050,042|757,452	2,048,504|754,525	2,184,698|622,796	2,183,059|619,970	2,303,216|504,278	2,301,437|501,592
Effective observations	595,621|747,587	595,200|746,950	461,220|591,243	460,863|590,741	617,362|653,407	616,892|652,739	456,587|436,078	456,186|435,549	591,243|428,518	590,741|427,694	402,117|310,000	401,721|309,316
B [SAP 81] τ	0.000	0.000	0.001***	0.001***	-0.002***	-0.002***	0.001**	0.001*	-0.002***	-0.002***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.001|0.001	-0.001|0.001	0.001|0.002	0.001|0.002	-0.003|-0.001	-0.003|-0.001	0.001|0.004	0.000|0.003	-0.004|-0.001	-0.004|-0.001	-0.001|0.003	-0.001|0.002
Bias-corrected p-value	0.669	0.803	0.000	0.000	0.000	0.001	0.005	0.013	0.000	0.000	0.589	0.474
BW estimate (h)	3.819|3.819	3.837|3.837	2.982|2.982	2.776|2.776	3.953|3.953	4.069|4.069	3.888|3.888	3.778|3.778	3.244|3.244	3.435|3.435	4.332|4.332	4.379|4.379
BW bias (b)	5.224|5.224	5.337|5.337	5.600|5.600	5.645|5.645	6.380|6.380	6.321|6.321	6.322|6.322	6.220|6.220	5.534|5.534	5.567|5.567	6.036|6.036	6.641|6.641
Observations	807,327|174,697	805,744|169,695	846,478|135,546	844,511|130,928	879,457|102,567	877,031|98,408	928,242|53,782	924,455|50,984	945,666|36,358	941,137|34,302	958,891|23,133	953,632|21,807
Effective observations	153,435|120,915	152,725|118,711	83,259|81,764	82,579|79,944	116,238|79,434	165,994|85,615	81,764|46,643	79,944|44,248	66,209|32,865	64,106|31,040	79,434|22,269	76,601|20,995
A [SAP 92] τ	0.006	0.001	-0.002*	0.000	0.000	0.003	0.026*	0.032**	0.000	-0.016	0.015	0.015*
	(0.002)	(0.001)	(0.003)	(0.002)	(0.006)	(0.005)	(0.002)	(0.002)	(0.008)	(0.006)	(0.005)	(0.006)
Bias-corrected 95% CI	-0.004|0.011	-0.006|0.008	-0.010|0.000	-0.006|0.002	-0.010|0.004	-0.001|0.007	0.007|0.062	0.013|0.070	-0.017|0.028	-0.039|0.013	0.000|0.038	0.002|0.035
Bias-corrected p-value	0.342	0.710	0.050	0.243	0.413	0.139	0.013	0.005	0.619	0.330	0.056	0.031
BW estimate (h)	3.543|3.543	3.527|3.527	2.958|2.958	3.065|3.065	5.333|5.333	6.032|6.032	2.380|2.380	2.176|2.176	3.309|3.309	3.053|3.053	3.681|3.681	3.444|3.444
BW bias (b)	6.907|6.907	6.730|6.730	5.163|5.163	5.148|5.148	6.079|6.079	6.198|6.198	5.477|5.477	5.158|5.158	6.362|6.362	6.177|6.177	6.649|6.649	6.659|6.659
Observations	74,765|1,379	71,314|1,299	75,142|1,002	71,672|941	75,427|717	71,938|675	75,790|354	72,278|335	75,887|257	72,371|242	75,978|166	72,450|163
Effective observations	6,275|1,025	5,924|964	1,190|648	2,808|699	6,937|654	12,605|629	363|252	340|235	460|210	433|196	349|141	324|139
BW selection	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics		Yes		Yes		Yes		Yes		Yes		Yes
Area FE		Yes		Yes		Yes		Yes		Yes		Yes
Date FE		Yes		Yes		Yes		Yes		Yes		Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N= 3,999,155.

Table C3: Local Linear RD Estimates for Placebo Tests

	(1)	(2)
SAP 10 τ	0.007	0.004
	(0.003)	(0.003)
Bias-corrected 95% CI	-0.008|0.019	-0.010|0.017
Bias-corrected p-value	0.401	0.632
BW estimate (h)	3.170|3.170	3.164|3.164
BW bias (b)	5.395|5.395	5.376|5.376
Observations	22,435|3,976,718	22,418|3,967,845
Effective observations	5,820|9,460	5,818|9,453
SAP 20 τ	-0.007	-0.007
	(0.004)	(0.004)
Bias-corrected 95% CI	-0.020|0.002	-0.020|0.002
Bias-corrected p-value	0.097	0.126
BW estimate (h)	4.916|4.916	4.952|4.952
BW bias (b)	7.242|7.242	7.446|7.446
Observations	51,571|3,947,582	51,530|3,938,733
Effective observations	13,961|25,870	13,950|25,856
SAP 30 τ	-0.002	-0.002
	(0.002)	(0.002)
Bias-corrected 95% CI	-0.006|0.001	-0.006|0.001
Bias-corrected p-value	0.125	0.121
BW estimate (h)	6.316|6.316	5.520|5.520
BW bias (b)	16.304|16.304	13.223|13.223
Observations	118,667|3,880,486	118,580|3,871,683
Effective observations	47,252|104,640	41,194|85,005
SAP 40 τ	-0.003	-0.003
	(0.003)	(0.003)
Bias-corrected 95% CI	-0.007|0.005	-0.007|0.005
Bias-corrected p-value	0.663	0.722
BW estimate (h)	7.501|7.501	7.347|7.347
BW bias (b)	10.857|10.857	10.811|10.811
Observations	295,518|3,703,635	295,289|3,694,974
Effective observations	140,431|322,110	140,326|321,852
SAP 50 τ	-0.001	-0.001
	(0.001)	(0.001)
Bias-corrected 95% CI	-0.002|0.001	-0.002|0.001
Bias-corrected p-value	0.445	0.507
BW estimate (h)	6.471|6.471	7.043|7.043
BW bias (b)	10.898|10.898	12.161|12.161
Observations	733,074|3,266,079	732,488|3,257,775
Effective observations	301,763|591,354	339,774|704,404
SAP 60 τ	0.000	0.000
	(0.000)	(0.000)
Bias-corrected 95% CI	-0.001|0.000	-0.001|0.001
Bias-corrected p-value	0.401	0.680
BW estimate (h)	3.990|3.990	4.275|4.275
BW bias (b)	6.834|6.834	7.410|7.410
Observations	1,685,278|2,313,875	1,683,984|2,306,279
Effective observations	360,850|562,472	467,124|713,450
SAP 70 τ	0.002***	0.001***
	(0.000)	(0.000)
Bias-corrected 95% CI	0.001|0.003	0.001|0.002
Bias-corrected p-value	0.000	0.000
BW estimate (h)	3.983|3.983	3.945|3.945
BW bias (b)	5.796|5.796	5.850|5.850
Observations	3,165,557|833,596	3,163,125|827,138
Effective observations	456,587|436,078	456,186|435,549
SAP 80 τ	-0.001**	-0.001*
	(0.000)	(0.000)
Bias-corrected 95% CI	-0.003|-0.001	-0.002|0.000
Bias-corrected p-value	0.002	0.014
BW estimate (h)	5.191|5.191	5.129|5.129
BW bias (b)	7.143|7.143	7.124|7.124
Observations	3,896,071|103,082	3,891,368|98,895
Effective observations	225,565|95,428	224,012|91,672
SAP 90 τ	-0.002	0.000
	(0.003)	(0.002)
Bias-corrected 95% CI	-0.010|0.001	-0.007|0.003
Bias-corrected p-value	0.117	0.433
BW estimate (h)	2.987|2.987	3.060|3.060
BW bias (b)	5.859|5.859	5.976|5.976
Observations	3,998,151|1,002	3,989,322|941
Effective observations	1,190|648	2,808|699
BW selection	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular
Property Characteristics		Yes
Area FE		Yes
Date FE		Yes

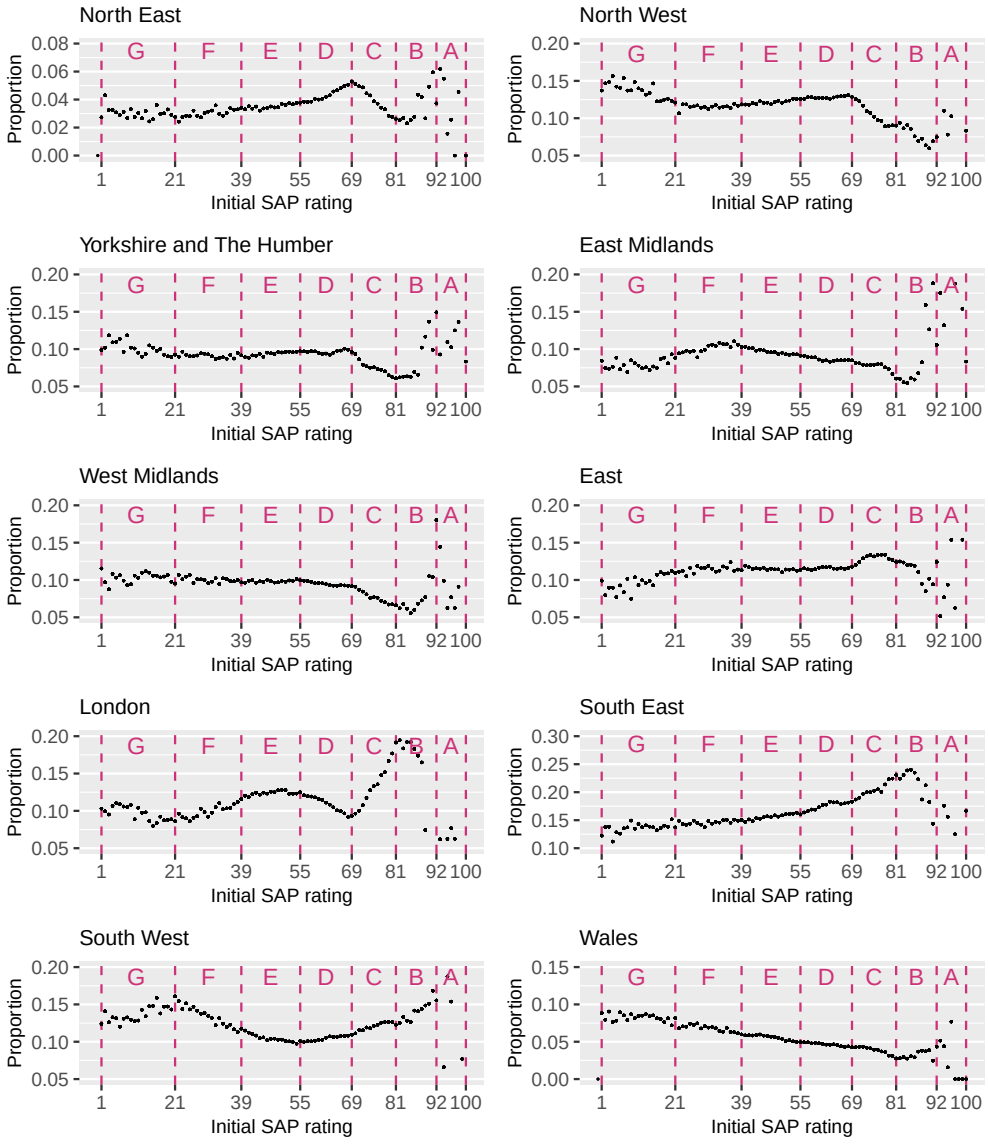
Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N= 3,999,155.

C.2 Baseline Covariates

C.2.1 Location

Figure C1: Region Proportion – SAP Rating



Notes: N=3,999,155.

Table C4: Local Linear RD Estimates for Area Covariate Proportions

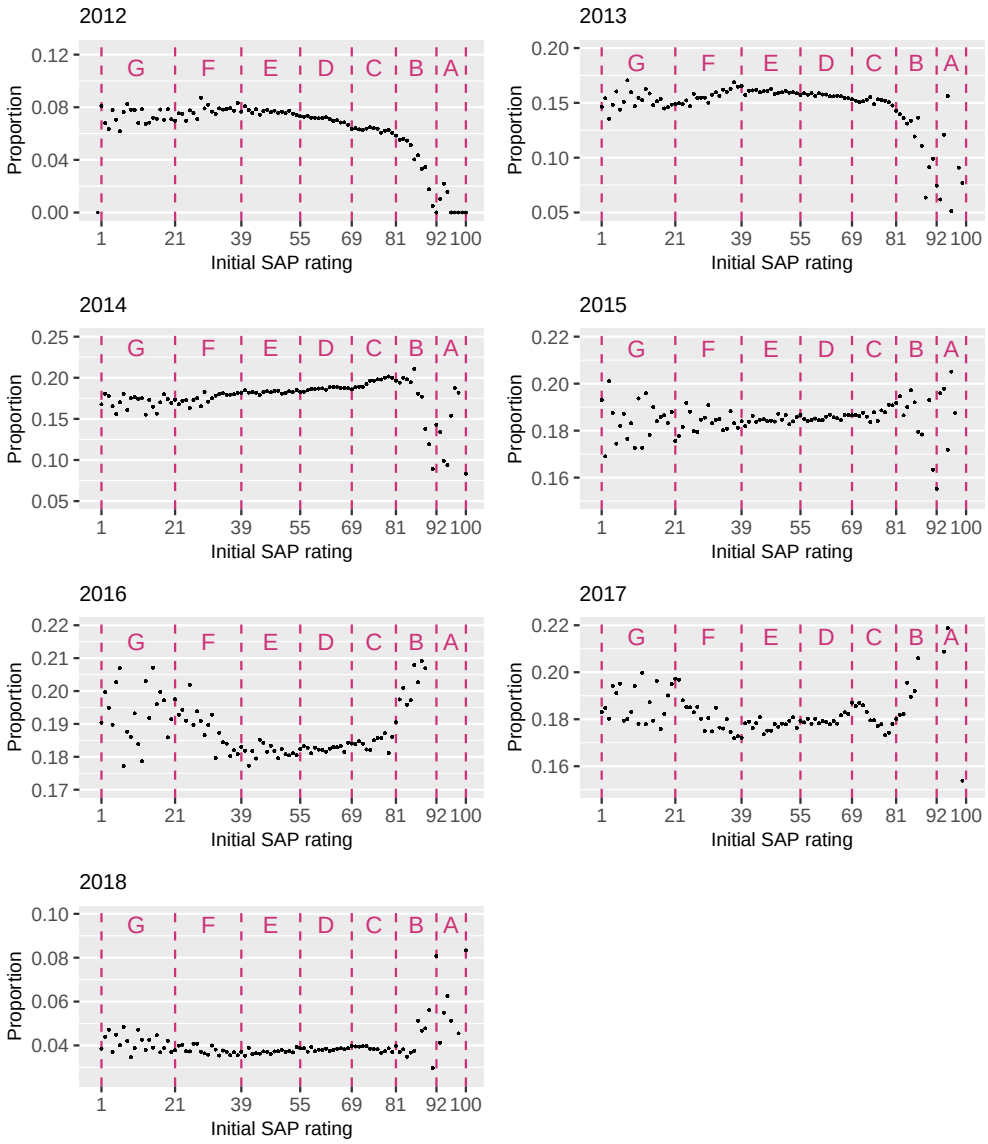
	North East	North West	Yorkshire and The Humber	East Midlands	West Midlands	East of England	London	South East	South West	Wales	Urban
F [SAP 21] τ	-0.003	-0.008	0.006*	-0.003	0.001	-0.003	0.002	-0.015***	0.014***	0.007	-0.014***
	(0.002)	(0.005)	(0.002)	(0.004)	(0.005)	(0.001)	(0.004)	(0.005)	(0.003)	(0.005)	(0.005)
Bias-corrected 95% CI	-0.008|0.003	-0.022|0.001	0.000|0.010	-0.015|0.006	-0.005|0.012	-0.006|0.002	-0.006|0.013	-0.030|-0.010	0.006|0.025	-0.000|0.019	-0.030|-0.009
Bias-corrected p-value	0.359	0.069	0.046	0.409	0.477	0.351	0.469	0.000	0.001	0.058	0.000
BW estimate (h)	6.041|6.041	5.228|5.228	4.585|4.585	4.543|4.543	5.939|5.939	4.460|4.460	4.556|4.556	4.400|4.400	4.737|4.737	4.450|4.450	5.538|5.538
BW bias (b)	10.565|10.565	8.314|8.314	6.653|6.653	7.282|7.282	7.288|7.288	9.111|9.111	7.906|7.906	6.547|6.547	8.218|8.218	7.103|7.103	7.594|7.594
Observations	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881
Effective observations	20,863|44,206	17,942|36,069	14,758|28,710	14,758|28,710	17,942|36,069	14,758|28,710	14,758|28,710	14,758|28,710	14,758|28,710	14,758|28,710	17,942|36,069
E [SAP 39] τ	0.001	-0.000	-0.006*	-0.004	-0.002	0.005	0.001	-0.001	0.009***	-0.000	-0.010**
	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)	(0.004)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Bias-corrected 95% CI	-0.003|0.003	-0.004|0.003	-0.015|-0.001	-0.012|0.004	-0.005|0.001	-0.004|0.018	-0.004|0.001	-0.006|0.005	0.007|0.015	-0.003|0.002	-0.015|-0.002
Bias-corrected p-value	0.822	0.637	0.028	0.344	0.209	0.227	0.228	0.794	0.000	0.833	0.006
BW estimate (h)	4.315|4.315	5.178|5.178	4.247|4.247	3.654|3.654	5.623|5.623	3.715|3.715	3.616|3.616	4.166|4.166	3.332|3.332	4.292|4.292	3.420|3.420
BW bias (b)	9.256|9.256	9.099|9.099	6.794|6.794	6.669|6.669	9.720|9.720	6.391|6.391	7.789|7.789	7.243|7.243	5.969|5.969	10.616|10.616	5.864|5.864
Observations	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082
Effective observations	82,257|162,878	98,713|204,104	82,257|162,878	64,682|124,591	98,713|204,104	64,682|124,591	64,682|124,591	82,257|162,878	64,682|124,591	82,257|162,878	64,682|124,591
D [SAP 55] τ	0.000	-0.001	0.001	-0.001*	-0.003***	0.001	0.001	-0.004***	0.005***	0.001	-0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Bias-corrected 95% CI	-0.001|0.002	-0.002|0.002	-0.000|0.002	-0.003|-0.000	-0.005|-0.002	-0.002|0.004	-0.003|0.003	-0.006|-0.003	0.004|0.006	-0.001|0.002	-0.001|0.002
Bias-corrected p-value	0.757	0.770	0.132	0.017	0.000	0.403	0.941	0.000	0.000	0.427	0.747
BW estimate (h)	3.811|3.811	3.848|3.848	4.761|4.761	3.161|3.161	3.839|3.839	5.710|5.710	3.794|3.794	3.404|3.404	3.831|3.831	3.276|3.276	5.066|5.066
BW bias (b)	6.660|6.660	5.485|5.485	7.768|7.768	5.732|5.732	6.260|6.260	9.430|9.430	6.363|6.363	5.985|5.985	5.815|5.815	7.307|7.307	6.521|6.521
Observations	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099
Effective observations	249,402|442,979	249,402|442,979	318,459|569,763	249,402|442,979	249,402|442,979	382,441|703,551	249,402|442,979	249,402|442,979	249,402|442,979	249,402|442,979	382,441|703,551
C [SAP 69] τ	0.001***	-0.002***	-0.003	-0.002***	0.000	0.001	0.005***	0.000*	0.001	-0.002***	0.002
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Bias-corrected 95% CI	0.001|0.002	-0.003|-0.002	-0.004|0.001	-0.002|-0.001	-0.000|0.001	-0.001|0.002	0.006|0.008	-0.003|-0.000	-0.000|0.002	-0.003|-0.002	-0.000|0.005
Bias-corrected p-value	0.000	0.000	0.334	0.000	0.222	0.560	0.000	0.012	0.194	0.000	0.104
BW estimate (h)	6.781|6.781	5.125|5.125	3.670|3.670	5.471|5.471	5.451|5.451	4.247|4.247	3.462|3.462	3.109|3.109	4.265|4.265	3.017|3.017	3.396|3.396
BW bias (b)	8.329|8.329	6.303|6.303	5.653|5.653	5.226|5.226	5.777|5.777	5.952|5.952	5.357|5.357	5.477|5.477	5.888|5.888	5.363|5.363	5.560|5.560
Observations	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395
Effective observations	916,239|712,117	768,864|653,892	463,988|501,905	768,864|653,892	768,864|653,892	617,403|585,021	463,988|501,905	463,988|501,905	617,403|585,021	463,988|501,905	463,988|501,905
B [SAP 81] τ	0.001	-0.000	0.003***	-0.002	-0.001	0.001	0.003	-0.001	-0.004***	-0.001	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.000)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.000|0.004	-0.007|0.002	0.002|0.006	-0.001|0.003	-0.004|0.001	-0.001|0.007	-0.005|0.006	-0.010|0.009	-0.004|-0.002	-0.003|0.003	-0.010|-0.005
Bias-corrected p-value	0.106	0.278	0.000	0.408	0.213	0.170	0.901	0.968	0.000	0.811	0.000
BW estimate (h)	4.660|4.660	3.938|3.938	4.086|4.086	4.050|4.050	3.762|3.762	3.879|3.879	3.889|3.889	3.624|3.624	4.140|4.140	3.809|3.809	4.270|4.270
BW bias (b)	7.140|7.140	6.768|6.768	6.595|6.595	7.409|7.409	6.256|6.256	5.758|5.758	6.767|6.767	5.948|5.948	6.619|6.619	6.578|6.578	7.004|7.004
Observations	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629
Effective observations	143,176|68,490	99,068|62,095	143,176|68,490	143,176|68,490	99,068|62,095	99,068|62,095	99,068|62,095	99,068|62,095	143,176|68,490	99,068|62,095	143,176|68,490
A [SAP 92] τ	-0.033***	-0.003	0.047	-0.084*	0.061***	0.011	0.004	-0.025	-0.005	0.034***	0.145**
	(0.004)	(0.010)	(0.021)	(0.027)	(0.007)	(0.018)	(0.007)	(0.006)	(0.020)	(0.001)	(0.034)
Bias-corrected 95% CI	-0.058|-0.017	-0.028|0.015	-0.005|0.121	-0.158|-0.021	0.041|0.078	-0.021|0.029	-0.070|0.055	-0.062|0.025	-0.049|0.029	0.023|0.051	0.054|0.237
Bias-corrected p-value	0.000	0.549	0.069	0.011	0.000	0.748	0.813	0.409	0.630	0.000	0.002
BW estimate (h)	3.090|3.090	3.860|3.860	3.565|3.565	3.733|3.733	5.923|5.923	4.476|4.476	3.110|3.110	3.131|3.131	4.575|4.575	2.984|2.984	3.506|3.506
BW bias (b)	6.187|6.187	5.739|5.739	6.360|6.360	6.285|6.285	6.899|6.899	5.738|5.738	5.815|5.815	5.642|5.642	5.890|5.890	5.652|5.652	5.868|5.868
Observations	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515
Effective observations	864|413	864|413	864|413	864|413	3,493|468	1,677|452	864|413	864|413	1,677|452	487|349	864|413
BW selection	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes:3,999,155.

C.2.2 Sale Date

Figure C2: Sale Year Proportion – Initial SAP Rating



N=3,999,155.

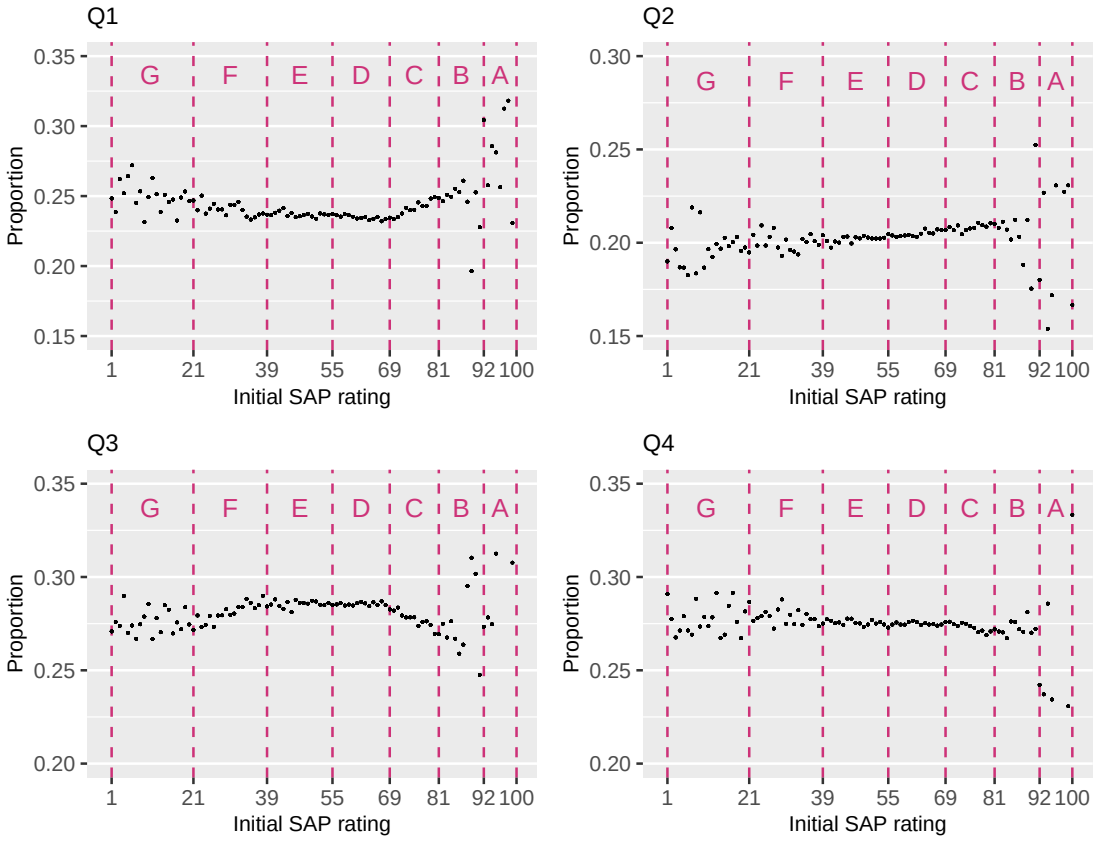


Figure C3: Sale Quarter Proportion – Initial SAP Rating

Notes: N=3,999,155.

Table C5: Local Linear RD Estimates for Date Covariate Proportions

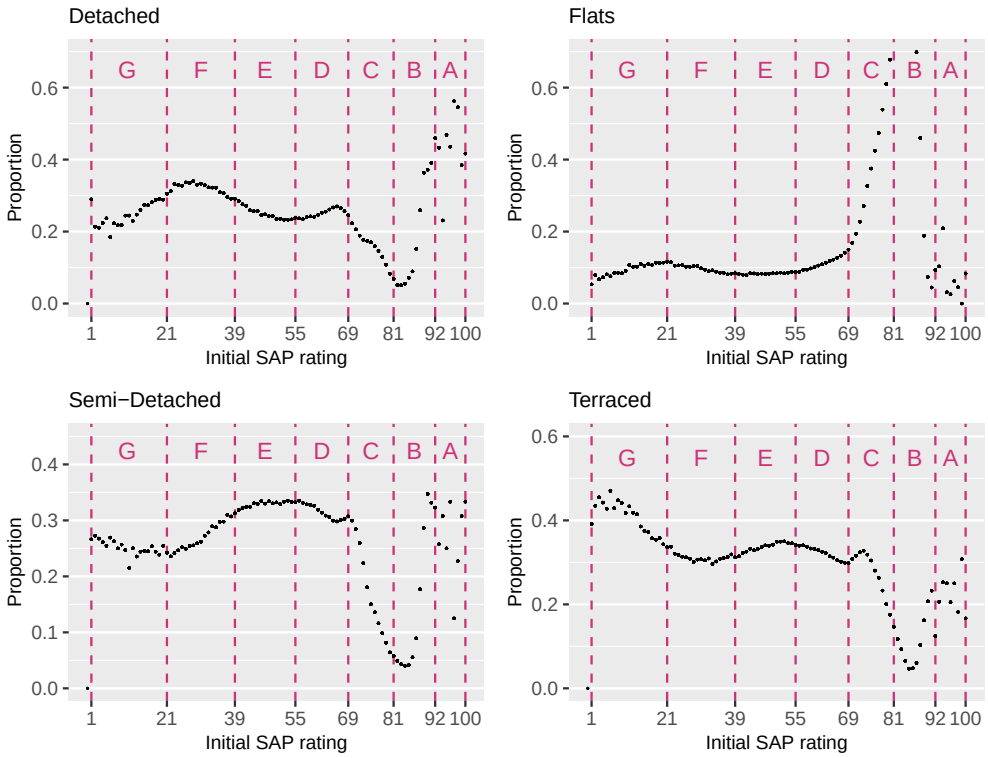
	2012	2013	2014	2015	2016	2017	2018	Q1	Q2	Q3	Q4
F [SAP 21] τ	0.001	0.001	0.004	-0.008**	0.009*	-0.004*	0.001	-0.006	0.002	-0.003	0.007
	(0.003)	(0.002)	(0.003)	(0.003)	(0.004)	(0.001)	(0.002)	(0.005)	(0.003)	(0.004)	(0.009)
Bias-corrected 95% CI	-0.005|0.011	-0.007|0.006	-0.004|0.017	-0.015|-0.002	0.000|0.023	-0.015|-0.000	-0.004|0.007	-0.022|0.006	-0.005|0.010	-0.013|0.008	-0.012|0.030
Bias-corrected p-value	0.488	0.878	0.244	0.009	0.044	0.037	0.552	0.260	0.467	0.611	0.421
BW estimate (h)	4.903|4.903	4.373|4.373	4.693|4.693	7.747|7.747	5.503|5.503	4.880|4.880	5.728|5.728	5.802|5.802	4.676|4.676	7.973|7.973	5.075|5.075
BW bias (b)	8.472|8.472	7.341|7.341	9.057|9.057	12.803|12.803	10.468|10.468	8.007|8.007	9.269|9.269	10.599|10.599	6.742|6.742	12.573|12.573	8.779|8.779
Observations	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881
Effective observations	14,758|28,710	14,758|28,710	14,758|28,710	23,657|53,237	17,942|36,069	14,758|28,710	17,942|36,069	17,942|36,069	14,758|28,710	23,657|53,237	17,942|36,069
E [SAP 39] τ	-0.005*	-0.006	-0.000	0.005	0.002	0.003	0.001	-0.003***	0.007***	-0.004	0.004***
	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Bias-corrected 95% CI	-0.012|-0.002	-0.013|0.002	-0.004|0.001	-0.000|0.013	-0.002|0.005	-0.002|0.007	-0.000|0.004	-0.006|-0.002	0.007|0.013	-0.011|0.001	0.002|0.009
Bias-corrected p-value	0.012	0.134	0.169	0.055	0.397	0.272	0.089	0.001	0.000	0.075	0.000
BW estimate (h)	5.127|5.127	7.822|7.822	3.630|3.630	3.820|3.820	4.072|4.072	4.396|4.396	4.925|4.925	4.622|4.622	3.394|3.394	5.718|5.718	4.326|4.326
BW bias (b)	7.907|7.907	11.009|11.009	6.670|6.670	7.511|7.511	5.875|5.875	6.300|6.300	7.579|7.579	5.459|5.459	5.585|5.585	9.316|9.316	7.271|7.271
Observations	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082
Effective observations	98,713|204,104	126,779|297,839	64,682|124,591	64,682|124,591	82,257|162,878	82,257|162,878	82,257|162,878	82,257|162,878	64,682|124,591	98,713|204,104	82,257|162,878
D [SAP 55] τ	0.000	-0.001	-0.004***	-0.001*	0.002**	0.005***	-0.002***	0.001	0.002	-0.002	-0.001
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Bias-corrected 95% CI	-0.001|0.003	-0.002|0.001	-0.008|-0.002	-0.005|-0.001	0.001|0.004	0.004|0.011	-0.005|-0.002	-0.002|0.003	0.001|0.002	-0.004|-0.002	-0.002|0.001
Bias-corrected p-value	0.179	0.745	0.000	0.013	0.003	0.000	0.000	0.546	0.000	0.000	0.584
BW estimate (h)	3.787|3.787	4.030|4.030	3.670|3.670	3.593|3.593	3.389|3.389	3.379|3.379	3.298|3.298	3.517|3.517	5.432|5.432	2.838|2.838	3.880|3.880
BW bias (b)	7.123|7.123	5.841|5.841	5.278|5.278	5.800|5.800	5.624|5.624	5.664|5.664	5.276|5.276	7.558|7.558	7.668|7.668	5.713|5.713	5.573|5.573
Observations	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099
Effective observations	249,402|442,979	318,459|569,763	249,402|442,979	249,402|442,979	249,402|442,979	249,402|442,979	249,402|442,979	249,402|442,979	382,441|703,551	172,065|322,499	249,402|442,979
C [SAP 69] τ	-0.002*	-0.000	-0.001*	0.000	-0.003*	0.003**	0.001	0.000	0.001	-0.002	0.002*
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Bias-corrected 95% CI	-0.003|-0.000	-0.001|0.001	-0.002|-0.000	-0.003|0.002	-0.008|-0.001	0.001|0.006	-0.000|0.002	-0.003|0.005	-0.003|0.003	-0.004|0.001	0.000|0.002
Bias-corrected p-value	0.027	0.808	0.044	0.912	0.012	0.005	0.100	0.754	0.977	0.368	0.028
BW estimate (h)	3.710|3.710	3.969|3.969	4.311|4.311	2.915|2.915	2.665|2.665	4.377|4.377	3.059|3.059	3.215|3.215	2.791|2.791	3.565|3.565	3.700|3.700
BW bias (b)	6.586|6.586	5.048|5.048	5.761|5.761	5.095|5.095	5.077|5.077	6.814|6.814	5.281|5.281	5.601|5.601	5.895|5.895	6.036|6.036	5.950|5.950
Observations	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395
Effective observations	463,988|501,905	463,988|501,905	617,403|585,021	307,644|402,117	307,644|402,117	617,403|585,021	463,988|501,905	463,988|501,905	307,644|402,117	463,988|501,905	463,988|501,905
B [SAP 81] τ	-0.002	-0.002*	-0.005**	0.000	0.004	-0.001	0.002	-0.004**	-0.000	0.003*	0.002
	(0.001)	(0.000)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Bias-corrected 95% CI	-0.005|0.001	-0.002|-0.000	-0.006|-0.001	-0.003|0.003	-0.005|0.011	-0.007|0.001	-0.000|0.004	-0.009|-0.002	-0.003|0.003	0.000|0.008	-0.001|0.003
Bias-corrected p-value	0.190	0.023	0.006	0.989	0.447	0.105	0.115	0.005	0.962	0.049	0.410
BW estimate (h)	3.914|3.914	3.439|3.439	4.128|4.128	4.948|4.948	3.276|3.276	3.769|3.769	5.676|5.676	3.916|3.916	4.289|4.289	4.602|4.602	4.593|4.593
BW bias (b)	6.287|6.287	6.187|6.187	6.107|6.107	7.360|7.360	5.967|5.967	6.228|6.228	7.369|7.369	6.980|6.980	6.625|6.625	7.044|7.044	7.196|7.196
Observations	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629
Effective observations	99,068|62,095	99,068|62,095	143,176|68,490	143,176|68,490	99,068|62,095	99,068|62,095	194,278|72,136	99,068|62,095	143,176|68,490	143,176|68,490	143,176|68,490
A [SAP 92] τ	0.010**	-0.035***	0.081***	0.023	-0.033**	-0.084**	0.074***	0.098*	-0.144**	0.075**	-0.030***
	(0.001)	(0.003)	(0.004)	(0.002)	(0.005)	(0.022)	(0.004)	(0.005)	(0.007)	(0.006)	(0.005)
Bias-corrected 95% CI	0.003|0.023	-0.088|-0.022	0.072|0.111	-0.004|0.078	-0.083|-0.011	-0.142|-0.025	0.043|0.118	0.002|0.170	-0.261|-0.060	0.028|0.153	-0.040|-0.013
Bias-corrected p-value	0.009	0.001	0.000	0.074	0.011	0.005	0.000	0.044	0.002	0.004	0.000
BW estimate (h)	3.300|3.300	2.292|2.292	4.167|4.167	2.545|2.545	2.793|2.793	3.527|3.527	2.957|2.957	2.594|2.594	2.488|2.488	3.032|3.032	3.205|3.205
BW bias (b)	5.897|5.897	5.715|5.715	6.100|6.100	6.063|6.063	5.682|5.682	5.792|5.792	5.347|5.347	5.915|5.915	5.675|5.675	6.310|6.310	5.855|5.855
Observations	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515	75,629|515
Effective observations	864|413	487|349	1,677|452	487|349	487|349	864|413	487|349	487|349	487|349	864|413	864|413
BW selection	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes:3,999,155.

C.2.3 Property Type

Figure C4: Property Type Proportion – Initial SAP Rating



N=3,999,155.

Table C6: Local Linear RD Estimates for Property Covariate Proportions

	Detached	Flat	Semi-Detached	Terraced	Number of Rooms	Leasehold
F [SAP 21] τ	0.015***	0.003	-0.014	-0.001	0.054	-0.007*
	(0.005)	(0.001)	(0.008)	(0.005)	(0.026)	(0.002)
Bias-corrected 95% CI	0.011|0.023	-0.001|0.008	-0.034|0.000	-0.012|0.013	-0.012|0.106	-0.017|-0.002
Bias-corrected p-value	0.000	0.086	0.055	0.971	0.116	0.012
BW estimate (h)	6.284|6.284	3.639|3.639	5.010|5.010	4.523|4.523	4.874|4.874	3.955|3.955
BW bias (b)	6.883|6.883	5.807|5.807	7.615|7.615	6.551|6.551	7.618|7.618	6.055|6.055
Observations	55,552|212,881	55,552|212,881	55,552|212,881	55,552|212,881	55,509|212,715	55,552|212,881
Effective observations	20,863|44,206	11,334|21,889	17,942|36,069	14,758|28,710	14,746|28,695	11,334|21,889
E [SAP 39] τ	0.007***	0.002	0.001	-0.010***	0.005	0.001
	(0.001)	(0.001)	(0.003)	(0.001)	(0.010)	(0.002)
Bias-corrected 95% CI	0.005|0.013	-0.004|0.004	-0.004|0.008	-0.015|-0.007	-0.019|0.043	-0.007|0.004
Bias-corrected p-value	0.000	0.917	0.546	0.000	0.454	0.655
BW estimate (h)	4.188|4.188	4.383|4.383	7.386|7.386	5.282|5.282	4.640|4.640	4.086|4.086
BW bias (b)	9.213|9.213	6.086|6.086	10.195|10.195	6.618|6.618	7.280|7.280	5.877|5.877
Observations	212,881|847,082	212,881|847,082	212,881|847,082	212,881|847,082	212,715|846,397	212,881|847,082
Effective observations	82,257|162,878	82,257|162,878	126,779|297,839	98,713|204,104	82,202|162,746	82,257|162,878
D [SAP 55] τ	0.004**	-0.002	-0.001	-0.001	0.019***	-0.003**
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	0.001|0.005	-0.004|0.000	-0.004|0.004	-0.004|0.002	0.017|0.031	-0.005|-0.001
Bias-corrected p-value	0.003	0.118	0.923	0.627	0.000	0.003
BW estimate (h)	5.887|5.887	5.817|5.817	5.316|5.316	4.822|4.822	3.140|3.140	3.838|3.838
BW bias (b)	6.119|6.119	9.119|9.119	6.508|6.508	5.642|5.642	5.166|5.166	5.843|5.843
Observations	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	846,397|1,899,716	847,082|1,901,099
Effective observations	382,441|703,551	382,441|703,551	382,441|703,551	318,459|569,763	249,205|442,659	249,402|442,979
C [SAP 69] τ	-0.005**	-0.006	0.005	0.005	0.022***	-0.007
	(0.001)	(0.008)	(0.003)	(0.002)	(0.011)	(0.007)
Bias-corrected 95% CI	0.001|0.005	-0.004|0.001	-0.004|0.001	-0.003|0.002	0.010|0.025	-0.006|0.001
Bias-corrected p-value	0.004	0.335	0.188	0.806	0.000	0.124
BW estimate (h)	3.769|3.769	7.396|7.396	4.208|4.208	5.436|5.436	7.309|7.309	6.991|6.991
BW bias (b)	4.860|4.860	5.870|5.870	5.195|5.195	6.830|6.830	6.082|6.082	5.902|5.902
Observations	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,899,716|903,313	1,901,099|906,395
Effective observations	463,988|501,905	1,059,609|763,219	617,403|585,021	768,864|653,892	1,058,807|761,932	916,239|712,117
B [SAP 81] τ	0.003***	-0.013***	0.010***	0.001	0.002***	-0.009***
	(0.005)	(0.007)	(0.004)	(0.003)	(0.008)	
Bias-corrected 95% CI	0.013|0.016	-0.041|-0.025	0.008|0.015	-0.005|0.012	0.075|0.103	-0.035|-0.021
Bias-corrected p-value	0.000	0.000	0.000	0.456	0.000	0.000
BW estimate (h)	4.659|4.659	4.820|4.820	8.077|8.077	4.992|4.992	4.417|4.417	5.114|5.114
BW bias (b)	6.744|6.744	6.334|6.334	7.241|7.241	5.269|5.269	7.075|7.075	6.300|6.300
Observations	906,395|75,629	906,395|75,629	906,395|75,629	906,395|75,629	903,313|72,126	906,395|75,629
Effective observations	143,176|68,490	143,176|68,490	404,490|75,142	143,176|68,490	141,381|65,390	194,278|72,136
A [SAP 92] τ	0.060***	0.102	-0.000	-0.149***	0.297	0.120
	(0.013)	(0.022)	(0.009)	(0.019)	(0.050)	(0.022)
Bias-corrected 95% CI	0.053|0.151	-0.075|0.052	-0.032|0.107	-0.203|-0.125	-0.026|1.102	-0.047|0.071
Bias-corrected p-value	0.000	0.725	0.289	0.000	0.062	0.679
BW estimate (h)	2.894|2.894	3.142|3.142	2.965|2.965	5.407|5.407	3.012|3.012	3.160|3.160
BW bias (b)	5.754|5.754	5.369|5.369	5.406|5.406	6.115|6.115	5.581|5.581	5.394|5.394
Observations	75,629|515	75,629|515	75,629|515	75,629|515	72,126|487	75,629|515
Effective observations	487|349	864|413	487|349	3,493|468	812|387	864|413
BW selection	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Triangular	Triangular	Triangular	Triangular	Triangular

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=3,999,155.

Table C7: Local Linear RD Estimates Using Postcode Area Fixed Effects

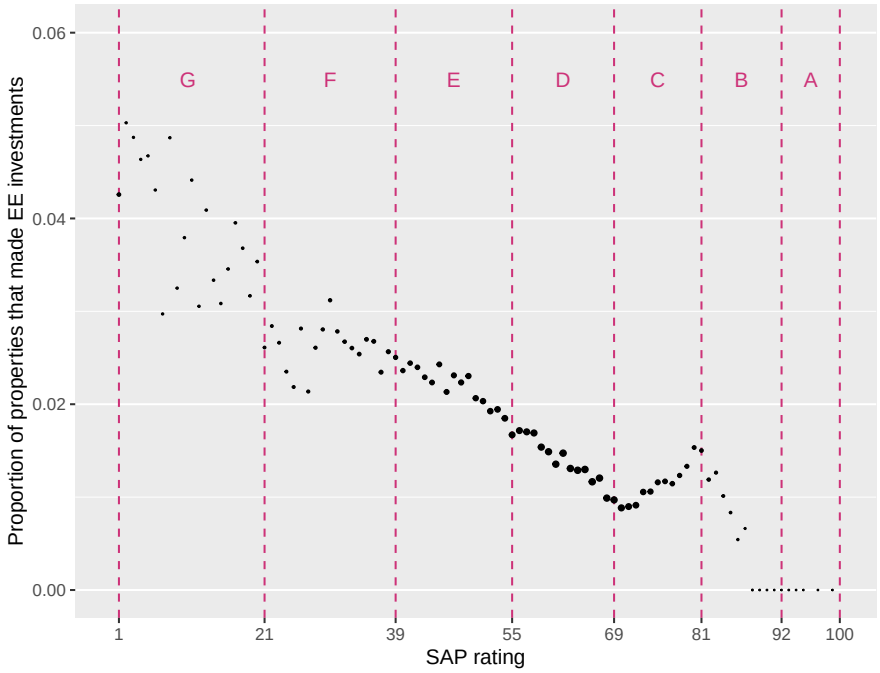
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	0.000	0.011	-0.002	-0.001	0.000	0.000	-0.001
	(0.005)	(0.001)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
Bias-corrected 95% CI	-0.010|0.012	0.000|0.028	-0.010|0.009	-0.012|0.012	-0.011|0.013	-0.010|0.013	-0.012|0.012
Bias-corrected p-value	0.854	0.053	0.877	0.979	0.859	0.849	0.989
BW estimate (h)	4.524|4.524	2.533|2.533	6.855|4.401	4.758|4.758	4.272|4.272	4.548|4.548	4.542|4.542
BW bias (b)	7.274|7.274	5.452|5.452	11.015|6.614	7.579|7.579	7.125|7.125	7.316|7.316	7.385|7.385
Observations	55,552|212,881	55,552|212,881	55,552|212,881	55,509|212,715	55,552|212,881	55,552|212,881	55,509|212,715
Effective observations	14,758|28,710	7,779|15,863	20,863|28,710	14,746|28,695	14,758|28,710	14,758|28,710	14,746|28,695
E [SAP 39] τ	-0.008***	-0.007***	-0.008***	-0.008***	-0.007***	-0.008***	-0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.010|-0.006	-0.010|-0.004	-0.011|-0.006	-0.010|-0.005	-0.010|-0.005	-0.011|-0.006	-0.010|-0.005
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	4.085|4.085	3.613|3.613	3.686|4.985	3.992|3.992	3.813|3.813	4.117|4.117	3.867|3.867
BW bias (b)	6.376|6.376	5.404|5.404	6.122|8.189	6.338|6.338	6.167|6.167	6.424|6.424	6.238|6.238
Observations	212,881|847,082	212,881|847,082	212,881|847,082	212,715|846,397	212,881|847,082	212,881|847,082	212,715|846,397
Effective observations	82,257|162,878	64,682|124,591	64,682|162,878	64,639|124,490	64,682|124,591	82,257|162,878	64,639|124,490
D [SAP 55] τ	-0.003**	-0.002*	-0.003***	-0.003*	-0.003*	-0.003**	-0.003*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.005|-0.001	-0.005|0.000	-0.006|-0.002	-0.004|-0.001	-0.004|0.000	-0.005|-0.001	-0.004|0.000
Bias-corrected p-value	0.006	0.038	0.000	0.011	0.015	0.004	0.014
BW estimate (h)	6.182|6.182	4.022|4.022	3.922|4.916	6.592|6.592	6.428|6.428	6.074|6.074	6.590|6.590
BW bias (b)	9.124|9.124	6.385|6.385	6.612|5.771	9.615|9.615	9.696|9.696	9.037|9.037	9.897|9.897
Observations	847,082|1,901,099	847,082|1,901,099	847,082|1,901,099	846,397|1,899,716	847,082|1,901,099	847,082|1,901,099	846,397|1,899,716
Effective observations	441,896|841,490	318,459|569,763	249,402|569,763	441,534|840,909	441,896|841,490	441,896|841,490	441,534|840,909
C [SAP 69] τ	-0.001**	-0.001**	-0.001	-0.001**	-0.001***	-0.001**	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bias-corrected 95% CI	-0.001|0.000	-0.002|0.000	-0.001|0.000	-0.001|0.000	-0.001|0.000	-0.001|0.000	-0.001|0.000
Bias-corrected p-value	0.002	0.004	0.097	0.001	0.001	0.001	0.001
BW estimate (h)	4.935|4.935	4.551|4.551	3.801|6.524	4.440|4.440	4.857|4.857	5.004|5.004	4.436|4.436
BW bias (b)	5.377|5.377	5.134|5.134	8.280|5.849	5.415|5.415	5.403|5.403	5.355|5.355	5.402|5.402
Observations	1,901,099|906,395	1,901,099|906,395	1,901,099|906,395	1,899,716|903,313	1,901,099|906,395	1,901,099|906,395	1,899,716|903,313
Effective observations	617,403|585,021	617,403|585,021	463,988|712,117	616,903|584,337	617,403|585,021	768,864|653,892	616,903|584,337
B [SAP 81] τ	0.000	0.000	0.002	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.001|0.002	-0.002|0.002	0.000|0.004	-0.001|0.002	-0.001|0.002	-0.001|0.002	-0.001|0.002
Bias-corrected p-value	0.751	0.924	0.098	0.782	0.796	0.746	0.828
BW estimate (h)	4.508|4.508	4.379|4.379	2.948|6.038	4.687|4.687	4.553|4.553	4.504|4.504	4.646|4.646
BW bias (b)	6.509|6.509	6.353|6.353	5.365|5.877	6.337|6.337	6.528|6.528	6.507|6.507	6.311|6.311
Observations	906,395|75,629	906,395|75,629	906,395|75,629	903,313|72,126	906,395|75,629	906,395|75,629	903,313|72,126
Effective observations	143,176|68,490	143,176|68,490	59,917|73,952	141,381|65,390	143,176|68,490	143,176|68,490	141,381|65,390
A [SAP 92] τ	-0.027***	-0.027***	-0.028***	-0.027***	-0.029***	-0.028***	-0.028***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Bias-corrected 95% CI	-0.033|-0.024	-0.033|-0.017	-0.034|-0.025	-0.037|-0.024	-0.033|-0.025	-0.033|-0.022	-0.035|-0.024
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	4.806|4.806	4.157|4.157	4.234|4.375	3.372|3.372	4.787|4.787	4.768|4.768	3.644|3.644
BW bias (b)	5.532|5.532	5.234|5.234	5.122|5.086	5.579|5.579	5.860|5.860	5.487|5.487	5.694|5.694
Observations	75,629|515	75,629|515	75,629|515	72,126|487	75,629|515	75,629|515	72,126|487
Effective observations	1,677|452	1,677|452	1,677|452	812|387	1,677|452	1,677|452	812|387
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=3,999,155.

C.3 Counter Factual Scenario

Figure C5: Proportion of Properties that Made EE Investments – Initial SAP Rating for Existing Properties
Sale Transactions Before April 2012



Notes: N=1,418,826.

Table C8: Local Linear RD Estimates for Sale Transactions Before April 2012

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F [SAP 21] τ	-0.006	-0.008**	-0.007**	-0.006	-0.006	-0.006	-0.006
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Bias-corrected 95% CI	-0.011|0.001	-0.015|-0.003	-0.012|-0.002	-0.011|0.001	-0.011|0.001	-0.011|0.001	-0.011|0.000
Bias-corrected p-value	0.093	0.004	0.004	0.083	0.096	0.073	0.065
BW estimate (h)	5.413|5.413	6.419|6.419	7.151|5.714	5.247|5.247	5.375|5.375	5.560|5.560	5.372|5.372
BW bias (b)	9.824|9.824	11.212|11.212	12.399|7.819	9.089|9.089	9.370|9.370	9.797|9.797	8.843|8.843
Observations	35,191|112,306	35,191|112,306	35,191|112,306	35,088|111,942	35,191|112,306	35,191|112,306	35,088|111,942
Effective observations	10,304|20,388	11,925|24,834	13,484|20,388	10,273|20,324	10,304|20,388	10,304|20,388	10,273|20,324
E [SAP 39] τ	-0.001	0.000	-0.001	-0.002	-0.001	-0.002	-0.002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bias-corrected 95% CI	-0.005|0.003	-0.004|0.005	-0.006|0.002	-0.007|0.002	-0.005|0.003	-0.006|0.002	-0.006|0.002
Bias-corrected p-value	0.614	0.824	0.421	0.263	0.541	0.337	0.232
BW estimate (h)	3.739|3.739	3.012|3.012	3.267|5.974	3.216|3.216	3.561|3.561	3.225|3.225	3.235|3.235
BW bias (b)	6.273|6.273	5.741|5.741	6.032|8.449	5.924|5.924	6.138|6.138	5.967|5.967	5.847|5.847
Observations	112,306|359,705	112,306|359,705	112,306|359,705	111,942|358,527	112,306|359,705	112,306|359,705	111,942|358,527
Effective observations	32,620|60,350	32,620|60,350	32,620|97,894	32,492|60,150	32,620|60,350	32,620|60,350	32,492|60,150
D [SAP 55] τ	-0.001**	-0.001**	-0.001*	-0.001***	-0.001**	-0.001**	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bias-corrected 95% CI	-0.002|-0.001	-0.003|-0.001	-0.002|0.000	-0.002|-0.001	-0.002|0.000	-0.002|-0.001	-0.002|0.000
Bias-corrected p-value	0.002	0.003	0.013	0.001	0.005	0.003	0.002
BW estimate (h)	3.854|3.854	3.248|3.248	3.292|3.915	3.881|3.881	4.037|4.037	3.758|3.758	3.881|3.881
BW bias (b)	6.104|6.104	5.692|5.692	5.528|5.022	6.187|6.187	6.034|6.034	6.193|6.193	6.200|6.200
Observations	359,705|589,870	359,705|589,870	359,705|589,870	358,527|587,944	359,705|589,870	359,705|589,870	358,527|587,944
Effective observations	93,033|150,542	93,033|150,542	93,033|150,542	92,711|150,079	120,724|191,689	93,033|150,542	92,711|150,079
C [SAP 69] τ	0.002*	0.002*	0.001*	0.002*	0.002*	0.002*	0.002*
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Bias-corrected 95% CI	0.001|0.005	0.000|0.004	0.000|0.004	0.000|0.005	0.001|0.005	0.000|0.005	0.000|0.005
Bias-corrected p-value	0.014	0.031	0.026	0.021	0.014	0.016	0.021
BW estimate (h)	2.952|2.952	2.808|2.808	3.092|4.662	2.837|2.837	2.911|2.911	2.934|2.934	2.813|2.813
BW bias (b)	5.036|5.036	5.085|5.085	5.192|5.216	5.019|5.019	5.020|5.020	5.031|5.031	5.011|5.011
Observations	589,870|295,206	589,870|295,206	589,870|295,206	587,944|293,646	589,870|295,206	589,870|295,206	587,944|293,646
Effective observations	87,106|116,625	87,106|116,625	132,590|177,242	86,804|116,239	87,106|116,625	87,106|116,625	86,804|116,239
B [SAP 81] τ	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Bias-corrected 95% CI	-0.004|-0.002	-0.004|-0.002	-0.004|-0.002	-0.003|-0.002	-0.004|-0.002	-0.004|-0.002	-0.004|-0.002
Bias-corrected p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BW estimate (h)	3.796|3.796	3.013|3.013	3.250|6.613	3.899|3.899	3.794|3.794	3.793|3.793	3.946|3.946
BW bias (b)	6.881|6.881	6.443|6.443	5.253|6.252	6.863|6.863	6.894|6.894	6.891|6.891	6.914|6.914
Observations	295,206|26,526	295,206|26,526	295,206|26,526	293,646|25,759	295,206|26,526	295,206|26,526	293,646|25,759
Effective observations	35,448|22,714	35,448|22,714	35,448|26,311	34,933|22,011	35,448|22,714	35,448|22,714	34,933|22,011
BW selection	MSE-Optimal	MSE-Optimal	Two MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal	MSE-Optimal
Kernel	Triangular	Uniform	Triangular	Triangular	Triangular	Triangular	Triangular
Property Characteristics				Yes			Yes
Area FE					Yes		Yes
Date FE						Yes	Yes

Standard errors in parentheses.
Significance of the bias-corrected p-value: *** at 0.1% level, ** at 1% level, * at 5% level.

Notes: N=1,418,826. The results for the threshold B-A are not included as there is only 22 properties with rating band A.

Appendix D Linear Approximation of the Degree of Inattention

As explained in Section 5.3, the functional form of the relationship between EE valuation and SAP rating is remarkably linear within each rating band. Thus, a simple linear approximation of the degree of inattention θ (in the same line as Lacetera et al. 2012) can be obtained by calculating how much the EE valuation increases when crossing a threshold relative to the total increase in valuation across the full range of the rating band SAP scores.

We use the estimated price discontinuities τ from section 5.2 as the EE valuation increase when crossing a threshold and the difference between the average prices of the highest and lowest SAP score of each rating band as the total increase in EE valuation. As before, we use the price residuals from a regression that controls for property characteristics, area fixed effects and date fixed effects to remove the portion of the price that can be attributed to these features. The inattention parameter θ is estimated as:

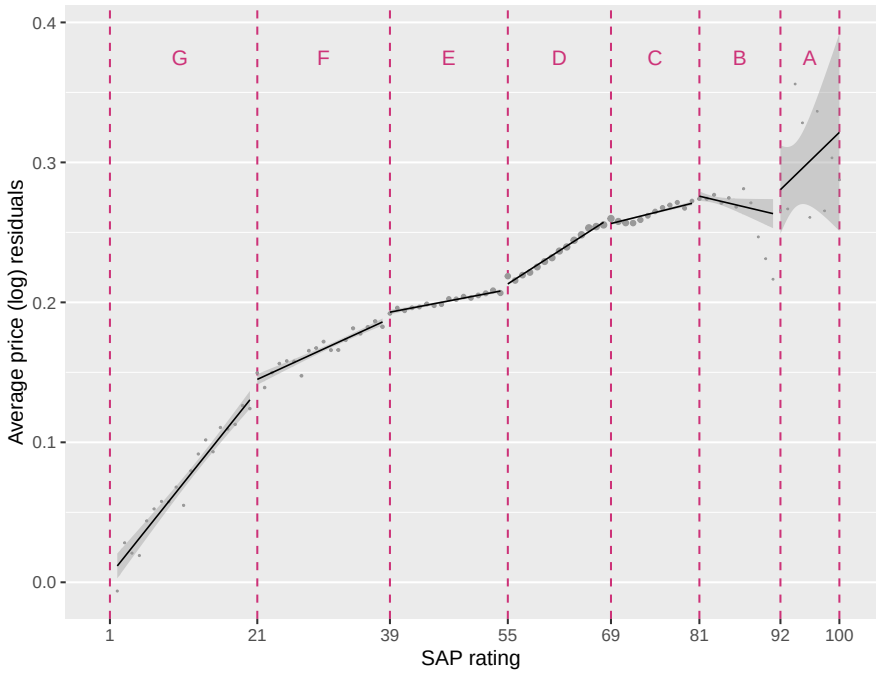
$$\theta = 1 - \left(\frac{P_H^{SAP} - P_L^{SAP}}{P_H^{SAP} - P_L^{SAP} + \tau}\right) \tag{7}$$

Where P_H^{SAP} represents the average price per meter residual for the highest SAP score of the rating band and P_L^{SAP} for the lowest SAP score. Table D1 presents the estimates for θ and Figure D1 presents linear regression lines and confidence intervals were the linearity within each rating band can be clearly observed.

Table D1: Inattention Parameter Estimates

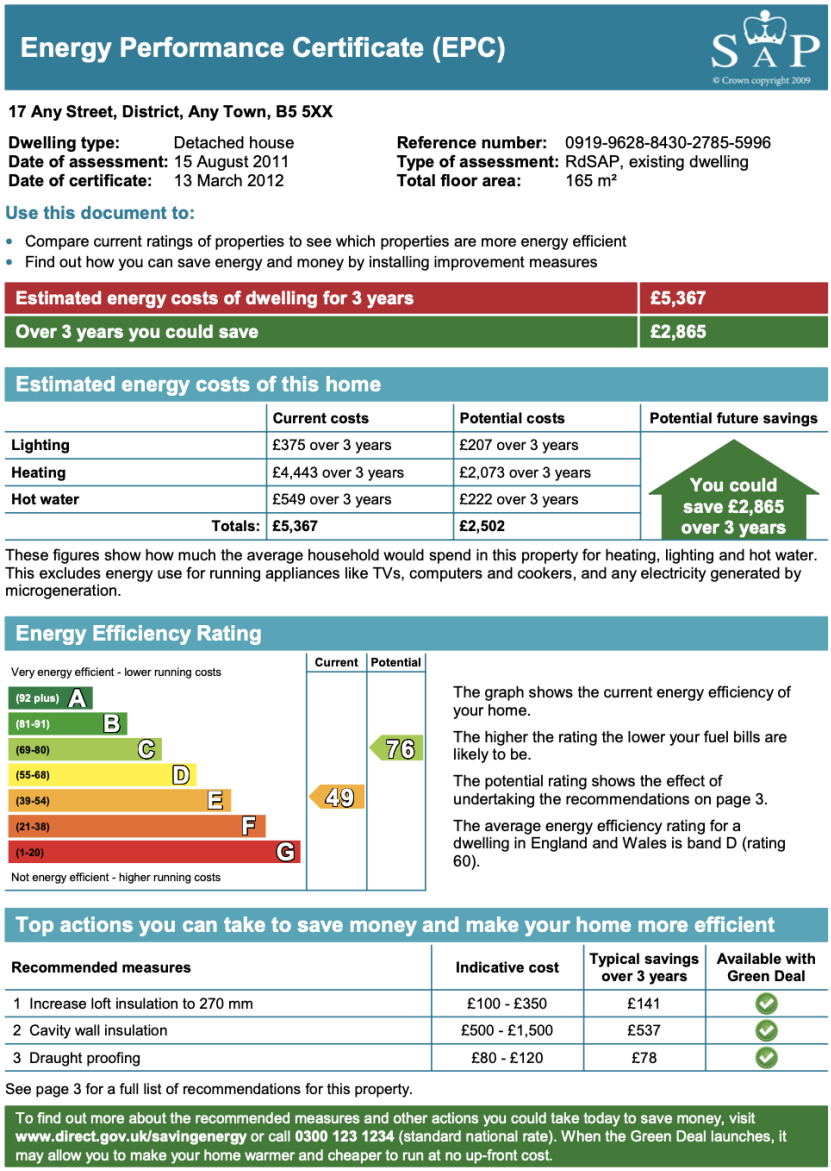
	θ	τ	P_L^{SAP}	P_H^{SAP}
F [SAP 21]	0.127	0.019	-0.006	0.124
E [SAP 39]	0.233	0.010	0.150	0.183
D [SAP 55]	0.451	0.012	0.192	0.207
C [SAP 69]	0.076	0.003	0.219	0.255
Average	0.222			

Figure D1: Price Per Square Meter (Log) Residuals - SAP Rating
Linear Fit



Appendix E Example Energy Performance Certificate (EPC)

Figure E1: Example First Page of an Energy Performance Certificate



Energy Performance Certificate (EPC)

SAP
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17 Any Street, District, Any Town, B5 5XX

Dwelling type: Detached house
Date of assessment: 15 August 2011
Date of certificate: 13 March 2012
Reference number: 0919-9628-8430-2785-5996
Type of assessment: RdSAP, existing dwelling
Total floor area: 165 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

Estimated energy costs of dwelling for 3 years	**£5,367**
Over 3 years you could save	**£2,865**

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£375 over 3 years	£207 over 3 years	You could save £2,865 over 3 years
Heating	£4,443 over 3 years	£2,073 over 3 years	
Hot water	£549 over 3 years	£222 over 3 years	
Totals:	**£5,367**	**£2,502**	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating

	Current	Potential
Very energy efficient - lower running costs		
(92 plus) A		
(81-91) B		
(69-80) C		76
(55-68) D		
(39-54) E	49	
(21-38) F		
(1-20) G		
Not energy efficient - higher running costs		

The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years	Available with Green Deal
1 Increase loft insulation to 270 mm	£100 - £350	£141	✓
2 Cavity wall insulation	£500 - £1,500	£537	✓
3 Draught proofing	£80 - £120	£78	✓

See page 3 for a full list of recommendations for this property.

To find out more about the recommended measures and other actions you could take today to save money, visit **www.direct.gov.uk/savingenergy** or call **0300 123 1234** (standard national rate). When the Green Deal launches, it may allow you to make your home warmer and cheaper to run at no up-front cost.