



BANK OF ENGLAND

# Staff Working Paper No. 767

## Does lender type matter for the pricing of loans?

Aniruddha Rajan and Matthew Willison

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Aniruddha Rajan<sup>(1)</sup> and Matthew Willison<sup>(2)</sup>

### Abstract

Loan markets often contain lenders with contrasting business models and ownership structures. But does that matter for outcomes in these markets? We examine whether it does using a loan-level data set of mortgage transactions in the United Kingdom. We find the type of lender can matter for pricing behaviour. The levels of interest rates, as well as the sensitivity of rates to funding costs and borrower risk, vary between lender types. Some of these differences are consistent with theories of how agency problems might vary between types of lenders and past empirical studies. But other differences are not consistent. The results suggest further research is needed to understand how, to what extent, and why lender types affect pricing in loan markets.

**Key words:** Banking, lending, business models, mutuals.

**JEL classification:** G21, G30, L21.

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(1) Bank of England. Email: [aniruddha.rajan@bankofengland.co.uk](mailto:aniruddha.rajan@bankofengland.co.uk)

(2) Bank of England. Email: [matthew.willison@bankofengland.co.uk](mailto:matthew.willison@bankofengland.co.uk)

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Bank of England, Threadneedle Street, London, EC2R 8AH  
Telephone +44 (0)20 3461 4030 email [publications@bankofengland.co.uk](mailto:publications@bankofengland.co.uk)

# 1 Introduction

Loan markets often contain lenders with contrasting business models and ownership structures co-existing and competing with one another. Lenders can differ in terms of whether they are public companies or mutual organisations, the types of funding they use, and whether they specialise or offer a broad range of services. For instance, in a survey of lenders in Europe, Ayadi and De Groen (2014) record how among lenders that are focused on serving retail customers 49% are commercial banks, focused on shareholders, 25% are savings banks, and 20% are cooperative banks.<sup>1</sup>

But does diversity of business models and ownership structures matter for outcomes in these markets? In this paper we examine whether lender type matters for pricing of loans in one specific market, that for owner-occupied residential mortgages in the United Kingdom using mortgage transaction-level data. There are three types of lenders present in this market. There are banks, which are typically funded with a mixture of retail and wholesale funding, provide a range of financial services to retail and commercial customers, and are companies with publicly traded shares. There are building societies, which are mutual organisations that provide a range of services primarily to retail customers, and subject to restrictions in legislation on the extent to which they can depend on wholesale funding and make loans other than loans secured on residential property. The owners of a building society are its retail depositors and retail borrowers. Third, there are specialist lenders, which specialise in mortgage lending and are not licensed to fund themselves with retail deposits. These are either standalone companies with external shareholders, or are part of banks or building societies.

We examine whether three aspects of pricing behaviour vary between these three lender types. First, we look at whether the level of interest rates on these mortgages varies between banks, building societies, and specialist lenders. Second we look at whether the degree of pass through of lenders' funding costs to mortgage interest rates varies according to the lender's type. Third, we analyse whether certain lender types price credit risk more conservatively than others by comparing the sensitivity of interest rates to characteristics of the borrower that might be associated with the risk he or she will

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<sup>1</sup>The remaining 6% consists of other types of banks such as publicly-owned lenders.

default on their mortgage. In other words, we examine whether the risk premium paid by a riskier borrower depends on the type of lender he or she borrows from.

Our prior is that pricing behaviour might differ between the lender types with different ownership structures because these structures affect the kind and extent of agency problems within lenders.

Agency problems between managers and owners might be greater in a mutual organisation, such as a building society, than in a company, such as a bank or a specialist lender, because the owners of a mutual may be less able to monitor and discipline the managers since they are more dispersed or less sophisticated (O'Hara (1981)). This could mean building societies are relatively less efficient than banks or specialist lenders, pushing up the interest rates they charge. At the same time, agency problems between owners and managers may imply that a building society does not maximise profits, which might mean they charge lower rates or pass through changes to funding costs to a lesser degree than banks and specialist lenders.

There may be agency problems between owners and debt holders in banks or specialist lenders, which could create risk-shifting incentives (Jensen and Meckling (1976)) that are absent in building societies because the depositors *are* the owners. Risk-shifting incentives might cause banks and specialists to charge riskier borrowers lower risk premiums than building societies charge.

A necessary condition for differences in ownership structures to influence pricing is that a market is imperfectly competitive: lender types could not charge borrowers different interest rates in equilibrium in a market that is perfectly competitive. There is evidence suggesting the markets for banking services in the United Kingdom are not perfectly competitive. de Ramon and Straughan (2016) measure the intensity of competition in the deposit taking sector in the United Kingdom overall between 1989 and 2013 and show the sector is not perfectly competitive and that the intensity of competition in fact weakened in the early 2000s.

We analyse differences in lender types' pricing behaviour in the UK residential mortgage market between mid-2005 and mid-2007 and assess whether the differences are consistent or inconsistent with

the theories, and existing empirical evidence, for how those lender types' pricing behaviour differs. There are two reasons for focusing on this period. First, there was little borrower distress in the mortgage market in this period; for instance, the fraction of mortgages in arrears of more than six months was less than 1% in this period, which was lower than at any point since the mid-1980s.<sup>2</sup> This means any differences between lender types in the risk premiums they charge are more likely to reflect differences in how conservatively lender types price the risk of distress in the future rather than lender types' responding to differing levels of realised distress. Second, the regulatory regime was relatively stable during this period; the sample period ends before the adoption across the whole of the financial sector of the new risk weights under Basel II and the agreement to raise capital requirements under Basel III.

We first examine how lender types may influence pricing behaviour by estimating pooled cross-sectional regressions for a loan-level data set of completed mortgage transactions in the United Kingdom. The Product Sales Database includes information about individual borrowers' interest rates as well as information about their characteristics and their mortgage products. Combined with balance-sheet information about lenders, we are able to examine differences in lender types' behaviour while controlling for heterogeneity on the borrower-side and the lender-side in ways earlier studies do not. We find some evidence of differences in pricing behaviour across lending types that are consistent with theory and existing empirical evidence. We find that building societies set interest rates that are lower than the other lender types. Some of the results also suggest lender types differ in the degree to which their interest rates reflect the riskiness of borrowers. But we would caution against making strong claims about differences in the sensitivity of loan pricing to borrower riskiness because we cannot observe how lenders might have adjusted the supply of loans to control their exposures to riskier borrowers. Other evidence of differences in pricing behaviour are, however, contrary to theory and existing empirical evidence. In particular, we find building societies pass through changes to funding costs to a greater degree than the other lender types, rather than a lesser degree as other studies suggest.

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<sup>2</sup>See Chart 2.27 in Bank of England (2011).

The loan-level data set has two gaps in it. The first gap is the upfront fees lenders may have charged borrowers. If fees are an important part of the cost of borrowing and vary across lender types we may misdiagnose differences in pricing behaviour between lender types when we ignore them. The second gap is the time that a borrower was searching and applying for a mortgage, which could be several months before a mortgage transaction is completed. Knowing when a borrower was searching/applying for a mortgage could enable us to measure more accurately the funding cost that would have affected the cost of borrowing. Using funding costs at this time might lead to different results for the degree of pass through of funding costs than when we use funding costs from the time of completion. We fill these gaps by matching mortgage transactions with mortgage products on offer listed in Moneyfacts magazines. The magazines also record fees on individual mortgage products. We run the regressions for the matched sample, adjusting the funding cost measure and incorporating the fee into the interest rate, for mortgages with two loan-to-value ratios. The results are broadly consistent with those we find for the unmatched sample.

We would draw two conclusions from our analysis. The first is that there can indeed be systematic differences in pricing behaviour in a loan market associated with lenders' types (e.g. such as ownership structures). Those differences remain even once heterogeneity on the borrower- and lender-sides are controlled for. The second conclusion is that theories of how differences in ownership structures should influence pricing behaviour and empirical evidence from other loan markets may not be accurate descriptions of all loan markets. For the specific market in the particular period we consider we find patterns of behaviour consistent with theory and past empirical studies but other patterns that are inconsistent. Further research is needed to understand how, to what extent, and why lender types price differently in loan markets.

The paper proceeds as follows. Differences in pricing behaviour across lender types we might expect to see are discussed in Section 2. Section 3 describes the data we use. The regression approach and results are presented in Section 4. Section 5 presents results for the matched sample. Robustness checks are discussed in Section 6. Section 7 concludes.

Table 1: Key differences between lender types

	<i>Bank</i>	<i>Building society</i>	<i>Specialist</i>
Objective	Profit maximisation	Capital preservation	Profit maximisation
Costs	Maybe lower	Maybe higher	Maybe lower
Risk-taking	Higher	Lower	Higher
Funding	Retail & wholesale	Mainly retail	Wholesale
Specialisation	Mixed	Mainly mortgages	Mortgages

## 2 Lender types and expected pricing behaviour

The types of lenders present in the residential mortgage market in the United Kingdom may differ from one another along several dimensions, which are summarised in Table 1. In the interests of brevity, we assume away in this section that some of the specialist lenders are part of banks and building societies rather than standalone entities.

One dimension is the objective a lender is pursuing when it prices loans such as mortgages. Banks and specialist lenders are usually companies, with external shareholders, which presumably maximise profit.<sup>3</sup> The objective of a building society is harder to pin down. The building society legislation in the United Kingdom defines the principal purpose of a building society to be to make loans secured on residential property and which are funded mainly by retail depositors (i.e. its owners).<sup>4</sup> Miles (1994) assumes a building society aims to maintain its ratio of reserves (e.g. retained earnings) to assets: he models a building society as lending one unit more if doing so does not reduce its reserves to assets ratio (a ‘capital preservation’ objective).

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<sup>3</sup>Under UK company law, a company’s board of directors are expected to ensure the company acts in the interests of shareholders while having regards to a wider set of stakeholders; see Section 172 of the Companies Act 2006 (<https://www.legislation.gov.uk/ukpga/2006/46/part/10/chapter/2>).

<sup>4</sup>See Section 6 and Section 7 of the Building Societies Act 1986 (<https://www.bsa.org.uk/information/consumer-factsheets/general/the-building-societies-act-1986-a-bsa-summary-fift>)

One way differences in objectives might manifest is the degree to which changes in costs are passed through to customers. There is some evidence that building societies pass through changes in costs more slowly than banks, which could be because they are not profit maximising. Heffernan (2005) finds building societies respond more slowly to changes in funding costs than do the societies that had converted to banks, although the overall level of pass-through is not materially different. She also finds that the lenders that converted to public companies tend to set higher prices than the lenders that remained building societies.

Contrasting objectives might mean different agency problems arise in different lender types. O'Hara (1981) argues that agency problems between owners and managers might be greater in mutual lenders because the owners – which are its retail depositors and borrowers – are more dispersed and less sophisticated than the shareholders in other types of lender. These problems might lead mutual lenders, such as building societies, to be less efficient than the other lender types.

But there is mixed evidence that building societies are relatively inefficient. Drake and Simper (2003) compare levels of efficiency at building societies, societies that converted to public companies, and publicly-listed banks. They find relative levels of efficiency fluctuate over time and that conversion to being a public company only generates a temporary boost to efficiency. Valnek (1999) looks at whether a lender is a bank or a building society affects risk-adjusted returns (i.e. return on assets divided by the standard deviation on the return on assets). He finds that building societies earn higher risk-adjusted returns.

There is also mixed evidence for mutual lenders being relatively inefficient from other countries. Comparing mutual and stock savings and loan associations ('thrifts') in the United States, Verbrugge and Jahera (1981) find evidence that mutual thrifts have higher labour expenditures than stock thrifts. But Mester (1993) finds, for a later period, mutual thrifts to be more efficient than their stock counterparts. Iannotta et al. (2007) show, for lenders in a sample of 15 European countries, commercial banks are more profitable than mutuals, but this is driven by their relatively higher income rather than lower costs. Altunbas et al. (2001) find cooperative banks, as well as publicly-owned savings banks, are more efficient than commercial banks in Germany.

The other agency problem that could differ in intensity between the lender types is the agency problem between shareholders and debt holders: shareholders may prefer an inefficiently high degree of risk because they gain all of the upside benefits but shift part of the downside costs to the debt holders (Jensen and Meckling (1976)). This problem should not arise to the same extent in a building society because a proportion of debt holders, i.e. retail depositors, are owners, but could be more pronounced in a bank or a specialist lender because shareholders and debt holders are distinct.

There is some evidence mutual lenders do behave more conservatively. Valnek (1999) finds banks have higher loan loss reserves than building societies, suggesting that they have taken on higher levels of risk. In the United States, Murphy and Salandro (1997) find stock thrifts have higher bad loans than the mutuals, while Esty (1997) shows stock thrifts have more volatile asset returns than mutual thrifts. Esty also shows how the riskiness of mutual thrifts that converted to stock thrifts increased relative to non-converts after they converted. Stock thrifts also tended to invest more in riskier assets, such as real estate investments (Esty (1997), O'Hara (1981)). Comparing Spanish commercial banks and savings banks (banks operated by a board of trustees representing a wide range of stakeholders), García-Marco and Robles-Fernández (2008) find commercial banks have relatively higher probabilities of default (based on their z-scores), while Salas and Saurina (2002) find that commercial banks' ratios of problem loans to total losses are more sensitive to GDP growth than savings banks' ratios. Hesse and Čihák (2007) report that mutuals have relatively higher z-scores (i.e. less likely to fail) than other types of lenders for a panel of lenders from 29 economies. But Iannotta et al. (2007) find no significant differences between commercial banks and mutuals in terms of riskiness.

Another dimension along which the lender types can differ is funding. Banks are funded by a mixture of retail deposits and funds borrowed in wholesale markets (e.g. deposits from other financial institutions, debt securities, repurchase agreements); the mix of funding is constrained by regulatory liquidity requirements. Building societies can also be funded by a mix of retail and wholesale funding, although they are subject to restrictions within legislation on their use of funding from non-retail sources.<sup>5</sup> In contrast, standalone specialist lenders are funded from wholesale sources (or by their

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<sup>5</sup> At least 50% of the funds of a building society (or of the society's group) must be raised in the form of shares held by

parents in the case of specialists that are part of banks or building societies), as they do not have deposit-taking licenses.

The final dimension is the degree to which lender types specialise in certain activities, e.g. mortgage lending. Specialisation could matter for pricing behaviour because it affects the extent to which a lender can cross-subsidise. For instance, a lender that undertakes several activities and where the profits derived from those activities are not perfectly correlated might be able to use profits from other activities to charge lower mortgage interest rates. They may also pass through changes in costs of making mortgages by less. Banks, in general, are the least specialised of the three lender types. They can potentially undertake a range of activities – e.g. unsecured lending to retail customers, corporate lending, investment banking – although the degree to which banks do different activities varies. Building societies, in contrast, are subject to restrictions in legislation on the activities they can do: lending apart from loans secured on residential property cannot exceed 25% of a building society's total assets (excluding liquid, fixed, and insurance-related assets).<sup>6</sup> Standalone specialist lenders by their very nature specialise in residential mortgage lending. Thus one might expect, all else equal, that banks set lower interest rates and pass through changes in funding costs less than other lender types because of their greater scope to cross subsidise.

Pulling together the theoretical arguments and empirical evidence, we set out in Table 2 hypotheses for how pricing behaviour could differ between lender types. The arrow in a cell shows the expected difference in the aspect of pricing behaviour in that column between the type of lender in the row and the specialist lender type. For example, the cell in the middle row in the left-hand column shows the expected difference between the level of mortgage interest rate set by a bank and the level set by a standalone specialist. We try to focus on the effects that differences in objectives, costs, and risk-taking have on pricing behaviour in the interests of simplicity. Therefore, the table shows expected differences in pricing behaviour *controlling* for funding mix and degree of specialisation.<sup>7</sup>

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individual members of the society (i.e. retail deposits and other forms of retail funding). See Section 7 of the Building Societies Act 1986 (<https://www.bsa.org.uk/information/consumer-factsheets/general/the-building-societies-act-1986-a-bsa-summary-fift>).

<sup>6</sup>See Section 6 of the Building Societies Act 1986 (<https://www.bsa.org.uk/information/consumer-factsheets/general/the-building-societies-act-1986-a-bsa-summary-fift>).

<sup>7</sup>We describe in Section 4 how we try to control for these dimensions in our regression analysis.

Table 2: Lender types and expected pricing behaviour <sup>(a)</sup>

	<i>Level</i>	<i>Pass through of funding costs</i>	<i>Sensitivity to borrower riskiness</i>
Bank	$\leftrightarrow$	$\leftrightarrow$	$\leftrightarrow$
Building society	$\uparrow$ or $\downarrow$	$\downarrow$	$\uparrow$

(a) The arrow in a cell shows the expected difference in the aspect of pricing behaviour in the column between the type of lender in the row and the specialist lender type.  $\uparrow$  means the lender type is expected to set a higher interest rate, pass through changes to funding costs by more, or sets interest rates that are more sensitive to borrower riskiness than the specialist lender type.  $\downarrow$  means the lender type is expected to set a lower interest rates, pass through changes in funding costs by less, or sets interest rates that are less sensitive to borrower riskiness than the specialist lender type.  $\leftrightarrow$  means the lender type is expected to price in the same way as the specialist lender type.

If we compare a bank with a specialist, one expects no statistically significant differences in pricing behaviour because both lender types are profit maximisers. In contrast, building societies might set higher or lower mortgage interest rates than specialist lenders, depending on whether greater manager-owner agency problems or non-profit maximising behaviour dominates. The differences in objectives imply that we expect building societies to pass through changes in funding costs by less. The lower intensity of owner-debt holder agency problems suggests a building society's pricing might be more sensitive to borrower riskiness.

### 3 Data

We collect data on residential mortgages in the United Kingdom from two sources: the Product Sales Database (PSD), which is compiled by the Financial Conduct Authority (FCA) and contains data on individual mortgage transactions; and Moneyfacts, a monthly magazine detailing mortgage products offered by lenders.

### 3.1 The Product Sales Database

The PSD provides us with detailed information on individual mortgage transactions. A mortgage transaction is entered into the PSD at the point it is completed (i.e. when the funds provided by a lender are drawn down by a borrower, most likely on the day when they move house). These data are collected by the FCA as part of regulatory reporting.<sup>8</sup>

We collect data from the PSD on mortgage transactions with fixed interest rates that involved first-time buyers, home-movers, and re-mortgagors between April 2005 and June 2007.<sup>9</sup> For each mortgage transaction we collect a set of variables related to the identity of the lender, the fixed interest rate and the length of time this interest rate applies (the fix length), characteristics of the borrower, features of the mortgage product, and features of the property the mortgage was for. Table A1 in the Appendix summarises the data we collect. Table A2 describes how we extract and clean the PSD data. The data on loan values, property values, and income are used to calculate the loan-to-value (LTV) and loan-to-income (LTI) ratios for each mortgage transaction.

### 3.2 Moneyfacts

We collected data from Moneyfacts to fill two gaps in the PSD. The first gap is mortgage fees; i.e. upfront fees borrowers pay to lenders. Moneyfacts shows fees for mortgage products on offer in the market. We use fees to calculate the total cost of a mortgage to a borrower. Fees can be a significant fraction of the cost of a mortgage; they are on average around 5% of the total mortgage cost over the fixed period in our sample.<sup>10</sup> The importance of fees is consistent with evidence from other loan markets (e.g. see Berg et al. (2016)).

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<sup>8</sup>The data were collected by the Financial Services Authority prior to the FCA's creation. The data have been collected since April 2005. They are shared with the Bank of England based on a Memorandum of Understanding.

<sup>9</sup>The proportion of mortgages that are fixed rate mortgages is lower for building societies. We check whether this biases our results by running a robustness check where we include floating rate mortgages. The results on differences between lender types are qualitatively unchanged.

<sup>10</sup>Fees need not always be a significant part of the costs of a mortgage to a borrower. The proportion of zero-fee mortgage products made available by lenders has increased markedly in recent years (see Chart A.12 in Bank of England (2017)).

The other gap is the time at which a borrower was searching and applying for a mortgage. Recall that a mortgage is recorded in the PSD when the transaction is completed. But this could be several months after a borrower was searching and applying for a mortgage, especially in the case of first-time buyers and home-movers given the time needed to arrange the purchase of a home. Furthermore, the length of time between searching/applying for a mortgage and completion can vary from transaction to transaction, again in particular for first-time buyers and home-movers.<sup>11</sup> Thus, we may need to estimate the time a borrower was searching for a mortgage to establish accurately the effects time-varying variables (e.g. lenders' funding costs) have on mortgage interest rates.

We estimate fees and the time a borrower was searching for a mortgage by matching mortgage transactions in the PSD with offered mortgage products in Moneyfacts. We focus on mortgages involving first-time buyers and home-movers. The data on offered products were collected by hand from Moneyfacts magazines. We collected data on products offered between June 2005 and March 2008. We did so only for the third month in each quarter-year because of the time needed to hand-collect the data. As the Moneyfacts magazines are published in the first week of each month, we assume that the products detailed would have been available to the market in the previous month.<sup>12</sup> We collected data for products offering a fixed interest rate over a period of between 21 and 27 months ('two years') and that were made available to home-movers and first-time buyers. Moneyfacts sorts products by the maximum permitted loan-to-value (LTV) ratios for borrowers. We collected data for products with a maximum LTV ratio of 75% and products with a maximum LTV ratio of 95%. We also collected data on products with these maximum LTV ratios that were specifically targeted at sub-prime borrowers.<sup>13</sup> We chose not to collect data on products with a wider range of LTV ratios because of the time that would have been needed to hand-collect those data. Table 3 summarises the items for each product featured in Moneyfacts we collect.

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<sup>11</sup> According to an online guide to getting a mortgage the typical time between making an offer on a property, following which someone would be searching for a mortgage, and completion could be anywhere between two and ten weeks (see <http://www.moneysavingexpert.com/mortgages/buying-a-home-timeline>).

<sup>12</sup> For example, data on products offered in June 2005 are collected from the July 2005 magazine.

<sup>13</sup> Moneyfacts does not precisely define sub-prime borrowers, but advertises products made available to borrowers with county court judgements, arrears, bankruptcy or individual voluntary arrangements. Due to a change in the structure of the magazines, Moneyfacts data on available sub-prime mortgage products are considerably more limited after 2006.

Table 3: Data collected from Moneyfacts

<i>Data item</i>	<i>Description</i>
Lender name	The name of the entity offering the mortgage product in Moneyfacts
Quoted rate	The interest rate offered on the product
LTV ratio	Whether the maximum LTV ratio for the product is 75% or 95%
Fee	The upfront fee charged for the product
Borrowing limit	The maximum amount that could be borrowed with this product
Month	The month that the product was made available

Mortgages at these LTV ratios and with a fix length of two years were a significant part of the UK mortgage market in our sample period. A majority of mortgage transactions were fixed rate mortgages over the sample period (66%) and the mode of the sample distribution of fix period lengths for fixed rate mortgages is around two years. Finally the shares of two-year fixed rate mortgages at LTV ratios of 75% and 95% are 11% and 23% of the sample, respectively.

The matching algorithm is described in detail in Figure A1 in the Appendix. Approximately 36% of the available mortgages are discarded during the matching process. The majority are discarded because a product was not available from the matched lender in the specified time range or with the appropriate maximum LTV ratio.<sup>14</sup>

If a mortgage transaction in the PSD is matched with a product in Moneyfacts the fee is combined with the interest rate in the mortgage transaction using the formula in (1) to calculate an overall cost of the mortgage to a borrower:

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<sup>14</sup>Since we only collect Moneyfacts data for the third month of each quarter it is likely that some of the mortgages in the PSD match products offered in the other two months of the quarter. But it is unlikely that discarding these mortgages creates a bias in our sample as we have no reason to suspect that mortgages offered in the final month of a quarter are systematically different to mortgages offered in the preceding two months of the quarter. Plus, we only collect data for products with the two maximum LTV ratios. Mortgage transactions in the PSD may correspond to other products. For instance, a mortgage transaction with an LTV ratio of 75% might correspond to a product with a maximum LTV ratio of 80% rather than 75%.

$$\text{Interest rate including fee} = \frac{(Interest\ rate\ in\ the\ PSD \times Loan\ value) + \frac{Fee\ in\ MoneyFacts}{2}}{Loan\ value} \quad (1)$$

### 3.3 Other data

We collected additional data on lenders. First, we collected data on whether a lender is a bank, building society, or a specialist lender ('lender type'). The specialist lenders are further sub-categorised into specialists that are part of banks, specialists that are part of building societies, and standalone specialists. Data on lender types were collected from Bank of England supervisory data.

Second, we collected data on whether a lender subsequently failed during the 2007-08 financial crisis. A lender is defined as having failed if during the crisis it became insolvent, received a government bailout, or underwent an emergency merger with another lender. A lender's performance in the crisis might be a proxy for a lender's underlying, unobservable, risk appetite. We also collected data for a number of balance sheet variables for each lender from regulatory returns<sup>15</sup>: equity to total assets ratio; average risk weight; retail deposits to assets ratio (i.e. a lender's funding mix); number of mortgage loans ('size'); and mortgage loan assets to total assets ratio (i.e. the degree of specialisation in mortgage lending).<sup>16</sup>

There were other lender-specific data we collected, but were unable to use in our analysis. First, we collected data on the financial groups lenders are part of. This could be important because pricing behaviour might be determined at the controlling group-level. For instance, some of the specialist lenders are part of banking or building society groups. Data on controlling groups were collected using a mix of Bank of England supervisory data, lender websites, and archived news articles on

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<sup>15</sup>Balance sheet variables for banks and building societies were collected from the Bank of England's Historical Banking Regulatory Database; see de Ramon et al. (2017) for details. The corresponding variables for specialist lenders were obtained from Mortgage Lending Administration Return which is collected by the Financial Conduct Authority; see <https://www.fca.org.uk/firms/regulatory-reporting/mortgage-lending-administration-return-mlar> for details.

<sup>16</sup>The average risk-weight must be estimated for specialist lenders rather than measured directly. We follow the Basel I principles in constructing this variable by attaching a 50% risk-weight to a specialist lenders' mortgage loans and assuming a 100% risk-weight for all other assets.

mortgage market websites.<sup>17</sup> But in our sample there are only three ‘standalone’ specialist lenders (i.e. specialist lenders for which the controlling group is not a bank or a building society) preventing us from estimating regressions based on definitions of types based on controlling groups. We also collected data on whether a lender was a recent entrant to the market to examine whether entrants priced differently. We classified a lender as a recent entrant if it entered the market less than the three years before. We could not use this variable because all of the recent entrants were specialist lenders.

Lenders’ funding costs are measured using the rates on sterling interest rate swaps obtained from Bloomberg Finance L.P. For a mortgage with a fix period of  $x$  years we use the interest rate on a swap with a maturity of  $x$  years. We calculate the average swap rate for each calendar month in our sample period. The swap rate captures both the direct funding cost faced by lenders when making a new loan as well as the opportunity cost of making a new loan (i.e. a lender could choose whether to lend out a new mortgage at a fixed rate over a given period or invest over the same period to obtain the swap rate as a return). For the unmatched sample of mortgage transactions we use the relevant average swap rate for the month prior to the month in which the mortgage transaction takes place. For the matched sample we use the two-year swap rate in the month prior to the month the offered product was available.

### 3.4 Stylised facts

Tables 4 and 5 present summary statistics for the key variables for this period for each of the lender types. Table 4 shows the summary statistics for the variables that are continuous. Table 5 shows the summary statistics for the variables that are categorical.

Banks are the lender type in the majority of transactions in our sample (see Table 4). The number of transactions in which the lender is a bank is over seven times as big as the number of

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<sup>17</sup>These were particularly helpful for identifying the controlling groups of presently defunct lenders or lenders that are not regulated by the Bank of England. Examples include “Mortgage Strategy” (<http://www.mortgagestrategy.co.uk/types/news/>) and “Mortgage Solutions” (<http://www.mortgagesolutions.co.uk/news/>).

transactions in which the lender is a building society or a specialist. The mean size of mortgage loan books of a bank is also much higher than those of a building society or a specialist. The proportion of total assets consisting of retail mortgages (Table 4) shows that banks are on average more diversified than building societies, which are in turn more diversified than specialist lenders. The deposits to assets ratios confirm that building societies are more dependent on retail deposits as a source of funding than banks and specialist lenders (Table 4).

There are differences between the lender types in terms of the extent to which mortgages were made by lenders that failed during the crisis (see Table 5). Over half of the mortgage transactions involving banks were by lenders that failed, which is higher than for building societies or specialists.

The average LTV and LTI ratios of mortgages made by different lender types are shown in Table 4. The LTV ratios in mortgages made by specialist lenders are relatively higher on average. The differences are also economically significant: the average LTV ratio for specialists is twelve percentage points higher than the average for banks and 16 percentage points higher than the average for building societies. The average LTI ratio is also relatively higher for mortgages made by specialist lenders. The average mortgage interest rate charged to borrowers by specialist lenders is also higher; around one percentage point more, on average, than what is charged by banks and building societies. This is despite specialist lenders offering mortgages with a lower average fix period length.

The proportions of mortgages made to borrowers with different characteristics, apart from LTV and LTI ratios, are displayed in Table 5. Close to 30% of mortgages made by specialist lenders are on average to borrowers with impaired credit histories and 19% of their total mortgages are made to borrowers remortgaging for the purposes of debt consolidation. The respective proportions for banks and building societies are much lower. We can see a similar pattern for the proportion of mortgages made to borrowers with a county court judgement against them. Another stark difference between specialists and the other lender types is the proportion of mortgages to borrowers that are self-employed: on average, around one-third of mortgages made by specialists are to the self-employed, whereas the proportions for banks and building societies are less than half and a quarter of this proportion, respectively. A relatively higher proportion of mortgages made by building societies are

to borrowers whose income was verified. Building societies were also less inclined to lend to first-time buyers and re-mortgagors than were banks and specialists.

Table 4: Summary Statistics – Continuous variables<sup>(a),(b)</sup>

	<i>Type of lender</i>					
	Bank		Building Society		Specialist	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
<i>Mortgage characteristics</i>						
Interest rate (%)	5.19	0.55	5.03	0.57	6.05	0.79
Length of fix period (years)	3.33	2.17	3.44	1.92	2.65	0.96
Mortgage term (years)	22.62	6.32	21.53	6.00	23.06	5.08
<i>Lender characteristics</i>						
Equity to assets ratio (%)	3.41	0.56	4.73	0.96	3.68	5.20
Average risk weight (%)	45.14	6.73	46.65	2.78	54.70	5.30
Deposits to assets ratio (%)	41.33	14.65	70.03	10.82	0.00	0.00
Mortgage loan to assets ratio (%)	55.83	22.16	68.84	8.40	90.61	10.60
Size of mortgage loan book (£mn)	51,155	27,651	8,523	4,570	2,654	3,162
<i>Borrower characteristics</i>						
LTV ratio (%)	65.08	26.39	60.89	22.15	77.13	17.20
LTI ratio (%)	2.75	1.12	2.71	0.90	2.90	0.76
<i>Observations</i>	998,623		139,077		108,290	
<i>Number of lenders</i>	11		36		13	

(a) The statistics are calculated for the period April 2005 to June 2007.

(b) The mean and standard deviation for each characteristic is calculated using all of the mortgage transactions in the PSD involving the lender type in the column.

Table 5: Summary Statistics – Categorical variables <sup>(a),(b)</sup>

	Type of lender					
	Bank		Building Society		Specialist	
	Count	%	Count	%	Count	%
<i>Lender characteristics</i>						
Failed lender	522,280	52.3%	56,326	40.5%	38,660	35.7%
<i>Borrower characteristics</i>						
Impaired borrower	22,968	2.3%	1,349	1.0%	30,863	28.5%
County court judgements	3,994	0.4%	278	0.2%	10,288	9.5%
Self-employed	141,804	14.2%	9,874	7.1%	35,844	33.1%
Verified income	567,218	56.8%	111,123	79.9%	54,686	50.5%
Debt consolidation	42,718	4.3%	7,413	5.3%	20,993	19.4%
First-time buyer	199,725	20.0%	19,193	13.8%	25,232	23.3%
Re-mortagagor	539,407	54.0%	63,975	46.0%	55,769	51.5%
<i>Observations</i>	998,623		139,077		108,290	
<i>Number of lenders</i>	11		36		13	

(a) The statistics are calculated for the period April 2005 to June 2007.

(b) The count of each characteristic is the count of mortgages with that characteristic involving the lender type in the column. The percentage is calculated as the count of mortgages with that characteristic as a percentage of the total number of mortgages involving the lender type in the column.

## 4 Regression results

In this section we present the regression equations we estimate to investigate whether pricing behaviour varies with lender type and present the results for these regressions.

### 4.1 Regression specification and hypotheses

We estimate pooled cross sectional regressions where the units of analysis are individual mortgage transactions. With the sample from the PSD, we estimate the baseline specification shown in (2) for

the period April 2005 to June 2007 inclusive (Specification 1):

$$\begin{aligned}
Interest\ Rate_{i,j,t} = & \alpha + \beta Swap\ rate_{i,t-1} + \gamma \cdot \mathbf{Lender\ type}_j + \theta \cdot \mathbf{Borrower\ type}_{i,j,t} \\
& + \delta \cdot \mathbf{Product}_{i,j,t} + \phi \cdot \mathbf{Property}_{i,j,t} + \eta \cdot \mathbf{Lender\ controls}_{j,t} \quad (2) \\
& + \mu \cdot \mathbf{Borrower\ controls}_{i,j,t} + \lambda \cdot \mathbf{Postcode\_time}_{i,j,t} + \varepsilon_{i,j,t}
\end{aligned}$$

The dependent variable is the interest rate for a new mortgage transaction agreed between borrower  $i$  and lender  $j$  in month  $t$ .

The baseline regression includes the following explanatory variables: funding costs, measured by the swap rate lagged by one month ( $SwapRate_{i,t-1}$ ) matched to the maturity in years of the period of the fixed rate (i.e. a three year fixed rate mortgage is matched with the three year swap rate); a set of dummies that capture whether the borrower obtained their mortgage from a bank, building society, or specialist lender ( $\mathbf{Lender\ type}_j$ )<sup>18</sup>; a set of dummies for different borrower characteristics (e.g. impaired credit history, self-employment, income verification), as well as continuous variables measuring the borrower's loan value and gross income ( $\mathbf{Borrower\ type}_{i,j,t}$ )<sup>19</sup>; a set of dummies that control for the specific type of mortgage product the borrower chooses (e.g. the mortgage is obtained via an intermediary) ( $\mathbf{Product}_{i,j,t}$ ); a set of control variables for the type of property being purchased, including the property value ( $\mathbf{Property}_{i,j,t}$ ); a dummy for whether a lender failed during the crisis and a set of balance sheet control variables, including the lender's equity to asset ratio, its deposits to assets ratio, and mortgage loan to assets ratio ( $\mathbf{Lender\ controls}_{j,t}$ ); a set of controls for the borrower's type, including their age, and whether their application was completed on the basis of a single or joint income ( $\mathbf{Borrower\ controls}_{i,j,t}$ ); and a vector of location-time dummies based on the first two digits of a property's postcode district<sup>20</sup> to control for unobserved geographical differences, in particular

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<sup>18</sup>There is a dummy for whether or not a lender is a bank and a dummy for whether or not a lender is a building society.

<sup>19</sup>We have not included the LTV and LTI ratios directly into our regressions, but instead their constituent components (property value, loan value, and income), because it makes the coefficients easier to interpret as the LTV and LTI ratios would typically move together.

<sup>20</sup>Each property has an alphanumeric postcode which is split into two parts, an outward code and an inward code separated by a space. The outward code refers to the postcode district and is three to four digits long. The inward code refers to a property's location within a postcode district. There are 3114 postcode districts in the United Kingdom. The

in mortgage demand (**Postcode\_time<sub>i,j,t</sub>**) (i.e. we follow the approach used in Khwaja and Mian (2008) and Aiyar et al. (2014)). We cluster standard errors at the lender-region <sup>21</sup> level to account for potential correlation in error terms where the same lender lends to multiple borrowers within the same geographical area.

To investigate how lender type affects pass through of funding costs and the sensitivity of mortgage rates to borrower characteristics we estimate the following regression specification (Specification 2):

$$\begin{aligned}
 Interest\ Rate_{i,j,t} = & \alpha + \beta SwapRate_{i,t-1} + \gamma \cdot \text{Lender type}_j + \theta \cdot \text{Borrower type}_{i,j,t} \\
 & + \tau \cdot \text{Lender type}_j \cdot SwapRate_{t-1} + \kappa \cdot \text{Lender type}_j \cdot \text{Borrower type}_{i,j,t} \\
 & + \eta \cdot \text{Lender controls}_{j,t} + \mu \cdot \text{Borrower controls}_{i,j,t} \\
 & + \delta \cdot \text{Product}_{i,j,t} + \phi \cdot \text{Property}_{i,j,t} \\
 & + \lambda \cdot \text{Postcode\_time}_{i,j,t} + \varepsilon_{i,j,t}
 \end{aligned} \tag{3}$$

In this specification we interact the lender type dummies with our measure of funding costs to determine whether the degree of funding cost pass-through varies with lender type. We also interact the lender type dummies with the borrower type characteristics to see whether lender types differ in terms of the premiums they charge for these characteristics. <sup>22</sup>

Based on the expected differences in pricing behaviour set out in Table 2, we test the hypotheses set out in Table 6.

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number of addresses per district varies considerably. According to the 2011 census of England and Wales, there are on average 10,298 households per district, but this varies between as many as 62,010 and as few as 54 addresses (see the table QS408EW available at <https://www.nomisweb.co.uk/census/2011>).

<sup>21</sup>Region refers to one of the twelve first-level regions of the UK as defined by the NUTS1 Eurostat geocode standard.

<sup>22</sup>For each piece of analysis that follows we estimate both Specification 1 and Specification 2. We report the full table of results for Specification 1 but, in the interest of space, we report only the coefficients of interest for Specification 2. Full tables for Specification 2 are available upon request.

Table 6: Null hypotheses

	<i>Level</i>	<i>Pass through of funding costs</i>	<i>Sensitivity to borrower riskiness</i>
Bank	$\gamma_{bank} = 0$	$\tau_{bank} = 0$	$\kappa_{bank} = 0$
Building society	$\gamma_{bsoc} < 0$ or $\gamma_{bsoc} > 0$	$\tau_{bsoc} < 0$	$\kappa_{bsoc,c} > 0$ for characteristic $c$ which indicates a riskier borrower

## 4.2 Results

### 4.2.1 Levels of mortgage rates

Table 7 builds up across four columns to the full Specification 1 set out in (2). All of the continuous variables included in our regressions are de-meaned. Column (1) includes all of control variables, dummies for individual lending entities, and the swap rate. In column (2) the individual lending entity dummies are replaced with the lender type dummies. The coefficients on the dummy variables for banks and building societies are both negative and statistically significant at a 1% significance level. In column (3) we add dummy variable for whether a lender failed in the crisis to check whether the lender type dummies are not capturing the influence of this lender characteristic. We find that the negative and significant coefficients on the lender type dummies remain. Lastly, to account for the possibility that differences in the levels of mortgage rates across lender types reflects differences in the borrowers they lend to, in column (4) we include the borrower characteristics. Again we find banks and building societies set lower mortgage rates than specialists and the differences are statistically significant. The differences in pricing are also economically significant. The mortgage rate faced by an average borrower is around 19 basis points lower if they borrowed from a bank and just over 51 basis points lower if they borrowed from a building society than if they borrowed from a specialist lender.

These results show that there are systematic differences between lender types in terms of *levels* of mortgage rates they charge, whilst controlling for other factors which may influence pricing, during

Table 7: Regression results for the full sample<sup>(a)</sup> <sup>(b)</sup>

	(1)	(2)	(3)	(4)
Swap Rate <sub>t-1</sub>	0.442*** (0.000)	0.442*** (0.000)	0.408*** (0.000)	0.380*** (0.000)
Bank		-0.307*** (0.000)	-0.338*** (0.000)	-0.190*** (0.003)
Building society		-0.637*** (0.000)	-0.651*** (0.000)	-0.512*** (0.000)
Failed lender			0.148*** (0.000)	0.135*** (0.000)
County court judgements				0.296*** (0.000)
Impaired borrower				0.171*** (0.000)
Self-employed				0.018* (0.060)
Verified income				0.122*** (0.000)
Debt consolidation				0.122*** (0.000)
First-time buyer				0.196*** (0.000)
Loan value (logged)				0.045*** (0.000)
Property value (logged)				-0.263*** (0.000)
Gross income (logged)				0.010 (0.226)
Constant	4.702*** (0.000)	5.670*** (0.000)	5.656*** (0.000)	7.781*** (0.000)
Balance sheet controls	Yes	Yes	Yes	Yes
Product controls	Yes	Yes	Yes	Yes
Property controls	Yes	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes	Yes
Postcode-time dummies	Yes	Yes	Yes	Yes
Individual lender dummies	Yes	No	No	No
Observations	1,260,472	1,260,472	1,260,472	1,260,472
Clusters	617	617	617	617
Adjusted R-squared	0.443	0.398	0.402	0.467

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders over the period April 2005 to June 2007.

(b) P-values are in parentheses and refer to whether coefficients are different from zero.

the sample period we look at. If we think back to the null hypotheses set out in Table 6, we find that the hypothesis that banks and specialists might price mortgage similarly because of their similar objectives can be rejected for this specification. The lower rates charged by building societies is consistent with some of the existing evidence we discussed in Section 2, although we cannot ascertain the reasons why building societies set relatively lower rates.

Regarding the other variables we show in Table 7, we find that lenders that failed during the crisis set higher mortgage rates. Borrowers with impaired credit histories and county court judgements faced higher mortgage rates as one would expect. First-time, self-employed and debt consolidation borrowers also faced higher mortgage rates. Perhaps counter-intuitively, borrowers whose income was verified faced higher rates. All of the coefficients on these borrower characteristics are statistically significant. The borrower's loan value is positively and statistically significantly related to the mortgage rate. The property value is negatively and statistically significantly related to the mortgage rate, and the effect is large in magnitude. The inclusion of the controls for loan value and income imply that a change to the property value can be interpreted as a change in the mortgage LTV ratio, and therefore has the expected sign. Interestingly, changes in income (which correspondingly can be interpreted as changes to the LTI ratio) do not have a statistically significant relation to mortgage rates during this period.

Table 8 show the results we obtain for the set of balance sheet controls included in the four specifications in Table 7. A higher deposits to assets ratio is associated with lower mortgage rates, but the effect of this is very small (mortgage rates are around 1-2 basis points higher for a ten percentage point increase in the deposits to assets ratio). A higher equity to assets ratio is also associated with lower mortgage rates: 3bps lower for a one percentage point increase in the ratio. In other words, lenders that better capitalised charged lower mortgage interest rates. Mortgage rates are significantly higher if the lender has a higher average risk weight, i.e. banks with riskier assets overall charge mortgage borrowers more. Lenders that make more mortgages have lower rates; this might perhaps reflect economies of scale in mortgage lending. And rates are significantly lower if the lender's assets are more concentrated towards mortgages; this is not consistent with a lender which undertakes a

range of activities cross-subsidising its mortgage lending.

Table 8: Sensitivity of mortgage rates to lender characteristics<sup>(a) (b) (c)</sup>

<i>Lender characteristics</i>	(1)	(2)	(3)	(4)
Deposits to assets ratio	-0.002 (0.380)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
Equity to assets ratio	-0.028*** (0.000)	-0.023*** (0.000)	-0.026*** (0.000)	-0.030*** (0.000)
Average risk-weight	0.018*** (0.000)	0.018*** (0.000)	0.011*** (0.000)	0.009*** (0.000)
Total residential loans (logged)	-0.097** (0.027)	-0.148*** (0.000)	-0.148*** (0.000)	-0.153*** (0.000)
Residential loans to assets ratio	-0.002 (0.124)	-0.006*** (0.000)	-0.006*** (0.000)	-0.005*** (0.000)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Column numbers correspond to the columns in Table 7.

(b) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders over the period April 2005 to June 2007.

(c) P-values are in parentheses and refer to whether coefficients are different from zero.

#### 4.2.2 Pass through of funding costs

Based on Specification 2, Table 9 shows how the degree of pass through of the swap rate varies across the lender types. Each of the lender types passes through swap rate changes to some degree. But the degree of pass-through for specialists is lower than the degree for banks, which in turn is lower than the degree for building societies. The differences are strongly statistically significant (see Table 10). They look very different from those in the hypotheses about expected pricing behaviour in Table 2: banks and specialists do not pass through changes to funding costs to the same degree; and building societies passed through funding cost changes to a relatively greater, not lesser, extent.<sup>23</sup>

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<sup>23</sup>Of course, not all lender types rely primarily on wholesale funding to finance mortgage lending, particularly building societies. But between 2005 and 2007 the correlation between average UK deposit rates for banks and building societies and the two year swap rate was particularly high (92% and 90% respectively).

Table 9: Degrees of pass through of the swap rate across lender types<sup>(a)</sup> <sup>(b)</sup> <sup>(c)</sup>

	<i>Total degree of pass-through</i>
Bank	0.424*** (0.000)
Building Society	0.559*** (0.000)
Specialist	0.198* (0.081)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Coefficients estimated using Specification 2. The specialist lender type is treated as the omitted lender type category in this regression and so the coefficient on the swap rate variable corresponds to the degree of pass-through for specialist lenders. The degree of pass-through for banks and building societies are calculated as the sum of the coefficients on the swap rate variable and its interaction with the lender type variables. The statistical significance of bank and building society pass-through is measured using F-tests on the sum of the relevant coefficients.

(b) Sample consists of fixed rate mortgages issued by banks, building societies, and specialist lenders between April 2005 and June 2007.

(c) P-values are in parentheses and refer to whether coefficients are different from zero.

Table 10: Differences in pass-through across lender types<sup>(a) (b) (c)</sup>

	<i>Bank vs Building society</i>	<i>Bank vs Specialist</i>	<i>Building society vs Specialist</i>
Pass-through difference	-0.135*** (0.000)	0.225*** (0.000)	0.361*** (0.000)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Differences in degree of pass-through are calculated using the estimates reported in Table 9 which are based on coefficients from Specification 2. The statistical significance of the pass-through differences is examined using T-tests on the swap rate-lender type interaction terms, for the differences relative to specialist lenders, and an F-test on the difference between the swap rate-lender type interaction terms, for the difference in pass-through between banks and building societies.

(b) Sample covers fixed rate mortgages issued by banks, building societies, and specialist lenders between April 2005 and June 2007.

(c) P-values are in parentheses and refer to whether coefficients are different between the groups referred to in the column headings.

But one might draw the wrong conclusions from the results in Tables 9 and 10 if lenders pass through swap rates changes at different speeds. For instance, the relatively lower degree of pass-through of the swap rate lagged by one month for specialists might reflect how they pass through changes in the swap rate relatively slowly. To test whether this is the case we re-estimated the regression with additional lags of the swap rate. We include five lags of the swap rate in total; that is, we include the average swap rates in the five months preceding the month in which a mortgage transaction took place. The estimated total degrees of pass-through for the three lender types are shown in Table 11. Unsurprisingly, the degree of pass-through are higher for all three lender types compared with those in Table 9. Building societies still have a relatively higher degree of pass-through compared to the other lender types.<sup>24</sup> Thus, some of the differences in pass-through above reflects differences in the speed of pass-through across lender types, but not entirely.

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<sup>24</sup>The difference in the degree of pass-through is 0.28 between building societies and banks and 0.42 between building societies and specialist lenders respectively. The p-value is 0.000 for an F-test of sum of coefficients from lagged swap rate and building society interaction terms and for an F-test of comparison between bank and building society swap-rate interaction terms.

Table 11: Degrees of pass through of the swap rate across lender types with additional lags<sup>(a)</sup> (b) (c)

	<i>Total degree of pass-through</i>
Bank	0.770*** (0.000)
Building Society	1.043*** (0.000)
Specialist	0.616*** (0.000)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Coefficients estimated using Specification 2 with the addition of four further lags of the swap rate (i.e.  $SwapRate_{i,t-2}, \dots, SwapRate_{i,t-5}$ ).

(b) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders between April 2005 and June 2007.

(c) P-values are in parentheses and refer to whether coefficients are different from zero.

#### 4.2.3 Sensitivity of mortgage rates to borrower characteristics

Finally, we consider differences to the sensitivity of mortgage rates to borrowers' characteristics across lender types. When we interact the lender type dummies with the borrower characteristics, the differences between lender types in terms of the level of mortgage interest rates change somewhat from those reported above; see Panel A in Table 12. While both banks and building societies still charge significantly lower mortgage rates than specialists, the difference between the level of mortgage rates charged by banks and specialists is only significant at the 10% level. These differences in the levels of mortgage rates are closer to the hypotheses set out in Table 6.

Panel B shows the differences in the sensitivity of mortgage rates to a borrower displaying a particular characteristic. For the categorical characteristics the value in a particular cell is the premium (or discount) paid by a borrower with the characteristic in the row who borrows from the lender type in the column *relative* to the mortgage rate paid by a borrower without that characteristic who borrows from the same type of lender. For the continuous characteristics, the loan value, property value and income, the value is the premium paid by a borrower with a one log unit higher value for the variable

relative to other borrowers from the same lender type. That is, the values do *not* compare differences in the *absolute* premiums/discounts faced by borrowers with particular characteristics across the different lender types, but to what extent lenders distinguish among their borrowers on the basis of borrowers' characteristics.

Impaired borrowers from all of the lender types faced premiums. The largest premium is charged by building societies (around 46 basis points) and the smallest by banks (around 5 basis points). For borrowers with a county court judgement, building societies and specialist lenders charge a premium (24 and 35 basis points, respectively), but borrowers from banks are charged a much smaller premium. With self employed borrowers and borrowers with verified income, there are contrasting behaviours among the lender types. For example, building societies and specialists charge self-employed borrowers a premium compared with their other borrowers while banks charge borrowers with this characteristic a slight discount (though this is economically very small). All lender types charge a premium to first-time buyers, but these premiums vary in magnitude. The premium charged by banks is the highest (21 basis points). The association between lending rates and loan values varies across the lender types, with building societies charging a slight discount for larger loan sizes while banks and specialist lenders charge premiums. All lender types charge statistically significant and economically large discounts to borrowers with higher property values. Borrower income is a less significant and economically smaller determinant of mortgage rates across the lender types.

The *relative* premiums/discounts charged to borrowers with particular characteristics by the lender types are compared in Table 13. The premiums charged by building societies to borrowers with impaired credit histories are significantly higher than the premiums charged by banks and specialist lenders. Banks' premiums for borrowers with county court judgements are also considerably lower on average than the specialists' premiums. Both banks and building societies charge lower rates to self-employed borrowers relative to specialist lenders. The opposite is the case for borrowers whose income was verified. With first-time borrowers, banks charge a significantly bigger premium than do building societies while there is no significant difference between building societies and specialist lenders for these borrowers. For debt consolidation remortgages lender types charge very similar mortgage rates.

Table 12: Sensitivity of mortgage rates to borrower characteristics across lender types<sup>(a)</sup> (b) (c)

<i>Borrower characteristics</i>	<i>Bank</i>	<i>Building society</i>	<i>Specialist</i>
		Panel A	
Level effect	-0.124* (0.098)	-0.408** (0.000)	-
		Panel B	
Impaired Borrower	0.047*** (0.000)	0.459*** (0.000)	0.298*** (0.000)
County Court Judgements	0.013* (0.088)	0.241*** (0.000)	0.345*** (0.000)
Self employed	-0.013* (0.093)	0.051*** (0.000)	0.121*** (0.000)
Verified income	0.154*** (0.000)	-0.008 (0.772)	-0.091** (0.034)
First-time borrower	0.209*** (0.000)	0.056** (0.035)	0.095*** (0.000)
Debt consolidation	0.099*** (0.000)	0.054** (0.021)	0.091*** (0.000)
Loan value (logged)	0.047*** (0.000)	-0.092*** (0.000)	0.404*** (0.000)
Property value (logged)	-0.254*** (0.000)	-0.155*** (0.000)	-0.561*** (0.000)
Gross income (logged)	0.000 (0.936)	0.013 (0.158)	0.054** (0.010)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

- (a) Coefficients are estimated using Specification 2. Panel A show the coefficients on the lender type dummies ( $\gamma_{bank}$  and  $\gamma_{bsoc}$ ), where the specialist is treated as the omitted lender type. In column *Specialist* in Panel B are the coefficients on the borrower characteristics (i.e. the  $\theta$  coefficients), since the specialist is the omitted lender type. In this column the coefficients on the borrower characteristic variables correspond to the premium (or discount) paid by a borrower from a specialist lender with the relevant characteristic (in the case of the categorical borrower characteristics) or with one more log unit of the relevant characteristic (in the case of the continuous borrower characteristics) compared with a borrower from a specialist lender without that characteristic (in the case of the categorical borrower characteristics) or one less log unit of the characteristic (in the case of the continuous borrower characteristics). In the columns *Bank* and *Building Society* in Panel B are the coefficients on the interactions between the lender types dummies for banks and building societies, respectively, and the borrower characteristics plus the coefficients on the borrower characteristics (i.e. the sum of the relevant  $\kappa$  and  $\theta$  coefficients). The values in these columns correspond to the premiums/discounts paid by a borrower from a specialist lender. The statistical significance of these effects is measured using F-tests on the sum of the relevant coefficients.
- (b) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders between April 2005 and June 2007.
- (c) P-values are in parentheses and refer to whether coefficients in the cell are different from zero.

Table 13: Differences in mortgage rate sensitivity to borrower characteristics across lender types<sup>(a) (b) (c)</sup>

<i>Borrower characteristics</i>	<i>Bank vs Building society</i>	<i>Bank vs Specialist</i>	<i>Building society vs Specialist</i>
Impaired Borrower	-0.412*** (0.000)	-0.251*** (0.000)	0.161*** (0.006)
County Court Judgements	-0.228*** (0.000)	-0.332*** (0.000)	-0.104* (0.052)
Self employed	-0.064*** (0.000)	-0.134*** (0.000)	-0.070*** (0.002)
Verified income	0.162*** (0.000)	0.245*** (0.000)	0.083* (0.095)
First-time borrower	0.153*** (0.001)	0.115** (0.013)	-0.039 (0.279)
Debt consolidation	0.045* (0.090)	0.008 (0.643)	-0.037 (0.154)
Loan value (logged)	0.139*** (0.000)	-0.357*** (0.000)	-0.496*** (0.000)
Property value (logged)	-0.099*** (0.001)	0.307*** (0.000)	0.406*** (0.000)
Gross income (logged)	-0.013 (0.305)	-0.054** (0.018)	-0.041* (0.080)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Differences in treatment of borrower characteristics across lender types are calculated using the estimates reported in Table 12, which are based on coefficients from Specification 2. The columns *Bank vs Specialist* and *Building society vs Specialist* show the coefficients on the interactions between the borrower characteristic variables and the bank and building society lender type dummies, respectively (i.e. the  $\kappa$  coefficients). The column *Bank vs Building society* shows the differences between the coefficients on the interaction terms for banks and building societies (i.e. the difference between  $\kappa_{bank,c}$  and  $\kappa_{bsoc,c}$  for each borrower characteristic  $c$ ). The statistical significance of the coefficients in the *Bank vs Specialist* and *Building society vs Specialist* columns are assessed using a T-test for whether the coefficient is different from zero. The statistical significance of the differences between coefficients in the *Bank vs Building society* is assessing using an F-test.

(b) Sample covers fixed rate mortgages issued by banks, building societies, and specialist lenders between April 2005 and June 2007.

(c) P-values are in parentheses and refer to whether coefficients in the cell are different from zero.

Borrowers requiring larger loan values are charged relatively more by specialist lenders than by banks or by building societies while the reverse is true for property values. Banks charge significantly more than building societies for borrowers seeking higher loan values but also discount more for higher property values.

These results indicate there were differences between the lender types in terms of how their mortgage rates reflected borrower characteristics. Moreover, controlling for differences in how borrower characteristics are charged at the margin affects the conclusions we draw about differences in the levels of mortgage rates charged by lender types: the difference between banks and specialist lenders in the level of mortgage rates charged becomes smaller and less significant, which is closer to the hypothesis in Table 6.

But we should be cautious about drawing strong conclusions about how lender types differ with respect to their appetite to lend to riskier borrowers from these results (and hence on whether or not the hypotheses set out in Table 6 can be rejected). One reason for this is that there may be other factors that influence a lender's assessment of the riskiness of a borrower which are not captured by the borrower characteristics (or any of the other controls included) in the regression specification. This might be the reason why for some of the characteristics some lender types charge a premium while other types charge a discount, or why lenders' sensitivities to these characteristics are different. For instance, a borrower whose income is verified may be less risky than a borrower whose income was not verified because a lender is surer of the former borrower's ability to repay their mortgage. Or they could be more risky because they have some other, unobserved characteristic, which is what prompted the lender to require the borrower's income to be verified in the first place.

Another reason is that pricing is only one of the ways a lender's degree of risk appetite might manifest. The decision whether or not to supply mortgages to a riskier borrower (i.e. adjust the quantity of lending instead of the price) is an alternative way a lender can manage its exposures to riskier borrowers. A lender with a low appetite to lend to 'high-risk' borrowers might supply fewer mortgages to that kind of borrower and only lend to those among these borrowers when it has other information to suggest the borrower is unlikely to default on their mortgage; so when one compares

the mortgage rates charged to ‘high-risk’ borrowers that the lender does lend to with rates they charge to ‘low-risk’ borrowers there may be no significant difference. There is some evidence consistent with this having happened in our sample if we look at the proportion of mortgages made by lender types to borrowers with certain characteristics shown in Table 5. Only 2.3% of borrowers from banks had an impaired credit history, which is a much lower than for specialist lenders, which might help to explain why the mortgage rates they charged to borrowers with impaired credit histories was only a small amount higher than the rates they charged borrowers with healthier credit histories. But an even smaller proportion of borrowers from building societies had an impaired credit history (less than 1%), yet they charged those borrowers a significant premium. But since we do not observe mortgage applications lenders’ receive we may not be able to assess accurately the extent to which lenders manage exposures to riskier borrowers via their decisions whether or not to lend. Our dataset does, however, goes beyond the set of variables that determine mortgage approvals specified in the Moneyfacts product magazines, so we can be reasonably confident that we have captured the important factors that influenced lenders decisions over whether to lend to a borrower.

A lender may lend less conservatively if they securitised mortgages they originate (Petersen and Rajan (2002), Keys et al. (2010)). We know lenders in our dataset did securitise some of their mortgages. Unfortunately we do not observe whether a mortgage was securitised, so we cannot control for the effect securitisation might have had.

### 4.3 Summary of results

Table 14 compares the results discussed above with the hypotheses we outlined in Table 6. The results give relatively stronger support for the hypotheses for building societies than for the hypotheses for banks. We find consistent evidence that building societies charged lower mortgage rates than specialist lenders, consistent with our hypothesis. But we find there is a significant difference between the mortgage rates charged by banks and specialist lenders, inconsistent with our hypothesis.

The results support the hypotheses for relative degrees of pass-through of funding costs for

neither banks nor building societies. The degree of pass-through for banks is higher than for specialist lenders, rather than the same as we hypothesised. The degree of pass-through is also higher for building societies than for specialists, rather than lower as in the hypothesis. Why might that be? Perhaps it is related to how a building society balances the interests of its two owner types, retail depositors and borrowers. For instance, if building societies balance the interests of their retail depositors and borrowers, they may pass through interest rate changes on both sides of the balance sheet. We leave testing of this or other potential explanations to future research.

We cautioned earlier against drawing strong conclusions about the differences between lender types in sensitivity of mortgage rates to borrower characteristics, in part because it is not clear how some of the characteristics are associated with default risk (e.g. verified income). If we focus on two borrower characteristics that seem more likely to suggest a borrower is riskier – impaired credit history and county court judgement – we find mixed support for the hypotheses. We find evidence that banks set lower mortgages rates for borrowers with these characteristics than do specialist lenders, whereas we hypothesised no difference. We find building societies set higher rates for borrowers with impaired credit histories, consistent with our hypothesis, but set lower rates for borrowers with county court judgements against them, inconsistent with our hypothesis.

In summary, there are significant differences between the pricing behaviour of the lender types we observe in our data and the differences we hypothesised based on theory and past studies. In particular, there are significant differences in pricing behaviour between banks, building societies, and specialist lenders, even having controlled for the characteristics of the borrowers they lend to and the structures of their balance sheets.

Table 14: Comparing the results with the hypotheses <sup>(a)</sup>

	<i>Level</i>	<i>Pass through of funding costs</i>	<i>Sensitivity to borrower riskiness</i>
Bank	$\gamma_{bank} = 0$	✗	$\kappa_{bank}^{impaired} = 0$ ✗ $\kappa_{ccj}^{ccj} = 0$ ✗
Building society	$\gamma_{bsoc} < 0$ or $\gamma_{bsoc} > 0$	✓	$\kappa_{bsoc}^{impaired} > 0$ ✓ $\kappa_{ccj}^{ccj} > 0$ ✗

(a) ✓ means the coefficient has the same sign as in the hypothesis in Table 6 and is statistically significantly different from zero at the 10 per cent or less level. ✗ means the coefficient has a different sign from the hypothesis or is not statistically significantly different from zero at the 10 per cent or less level.

## 5 Results with the matched sample

In this section we estimate regressions using the sample of mortgage transactions in the PSD matched to mortgage products in Moneyfacts to analyse how sensitive the results presented above are to controlling for the time that a borrower would have been searching for a mortgage and for any fees borrowers were charged. There are two key differences between the matched sample and the full sample used above. To construct the matched sample we concentrate on mortgages with a fix length of two years which were taken out by first-time buyers and home movers. The dependent variable used is the interest rate in the PSD adjusted to incorporate the fee reported in Moneyfacts. We obtain regression estimates for each of two LTV ratios, 75% and 95%, using as close to the regression specification used for the full sample as is possible.<sup>25</sup> The results for the 75% and 95% LTV ratio mortgages are shown in Tables 15 and 16, respectively.

Matching to Moneyfacts mortgage products addresses two potential shortcomings in the analysis in section 4. The first is that the relationship between the swap rate and mortgage rates may be misspecified because we do not designate the time of a mortgage according to when a borrowers was applying for mortgages on offer in the market. Hence, the swap rate in the month prior to the month in which the mortgage transaction took place may not measure correctly the funding cost used to price

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<sup>25</sup>We replace the monthly time dummies with half-yearly time dummies because we were only able to collect data for the end-of-quarter month from Moneyfacts, and because we are now only looking at two-year fixed rate mortgages in the matched sample.

the mortgage. The second shortcoming is that differences in interest rates charged by different lender types might potentially disappear once mortgage fees are taking into account. For instance, though one lender type might charge lower interest rates than another type, perhaps they levy higher fees such that the overall cost of borrowing from the first type is the same or even higher than the cost of borrowing from the second type.

Consider the 75% LTV ratio mortgages first. We build up to the regression using the matched sample in steps. Column (1) in Table 15 shows the regression estimated using two-year fixed rate mortgages with this LTV ratio in the PSD sample unmatched to the Moneyfacts sample. The coefficients on the lender type dummies are qualitatively similar to those we found for the whole sample. In column (2) the same regression is estimated using just the mortgages matched to products in Moneyfacts with the timing of the mortgage adjusted to the month in which the matched product was on offer. As a final step, in column (3) the mortgage rate is replaced with the mortgage rate adjusted to incorporate the mortgage fee. The result we found for the whole sample that banks set lower mortgage rates than specialists and building societies set lower rates than banks carries across to the matched sample of 75% LTV mortgages and are large in magnitude for this product. The differences in the level of pricing are less stark at the 95% LTV ratio, shown in Table 16. Building societies continue to price at a significant discount relative to banks and specialist lenders, but banks and specialist lenders no longer have a significant difference in their levels of mortgage rates.

In summary, the result that there are significant differences, both in a statistical and an economic sense, between lender types are broadly robust (in particular for building societies) to controlling for the time we estimate that a borrower was searching for a mortgage and for incorporating fees. See Table 17.

The borrower characteristic-lender type interactions are generally less statistically significant in the matched sample regressions, due to the smaller number of mortgages in the sample with these characteristics. But we find for the 95% LTV ratio mortgages that income verification appears to matter. Specialist lenders charge a significant discount for borrowers with verified income while building societies charge a premium instead. Banks charge a much smaller (though still statistically significant)

discount for borrowers with verified income compared to specialist lenders. At the 75% LTV ratio, we find that building societies continue to charge a much larger premium for impaired borrowers (85 bps) compared to specialist lenders (25 bps). These results are presented in Tables 18 and 19.

Table 15: Regression results using the matched sample with a 75% loan-to-value ratio<sup>(a) (b) (c)</sup>

	(1)	(2)	(3)
Swap Rate <sub>t-1</sub>	0.137*** (0.000)	0.335*** (0.000)	0.369*** (0.000)
Bank	-0.297*** (0.002)	-0.630*** (0.006)	-0.761*** (0.003)
Building Society	-0.682*** (0.000)	-1.152*** (0.000)	-1.386*** (0.000)
Failed lender	0.010 (0.744)	0.121*** (0.001)	0.174*** (0.000)
County Court Judgements	0.046 (0.299)	0.095 (0.687)	0.107 (0.653)
Impaired borrower	0.203*** (0.000)	0.359** (0.024)	0.3528** (0.036)
Self-employed	0.023* (0.069)	0.031* (0.069)	0.033* (0.061)
Verified income	0.045*** (0.000)	0.021 (0.165)	0.025 (0.116)
First-time borrower	0.020 (0.154)	-0.008 (0.686)	0.004 (0.854)
Loan value (logged)	0.055 (0.552)	0.054 (0.842)	-0.153 (0.586)
Property value (logged)	-0.207** (0.030)	-0.209 (0.450)	-0.220 (0.449)
Gross income (logged)	0.013 (0.141)	0.039 (0.140)	0.049* (0.061)
Constant	5.450*** (0.000)	5.891*** (0.000)	6.261*** (0.000)
Balance sheet controls	Yes	Yes	Yes
Product controls	Yes	Yes	Yes
Property controls	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes
Postcode-time dummies	Yes	Yes	Yes
Individual lender dummies	No	No	No
Observations	30,613	10,104	10,104
Clusters	370	200	200
Adjusted R-squared	0.464	0.678	0.719

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Coefficients estimated using Specification 1 with the modification detailed in footnote 25.

(b) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders over the period April 2005 to June 2007.

(c) P-values are in parentheses and refer to whether coefficients are different from zero.

Table 16: Regression results using the matched sample with a 95% loan-to-value ratio<sup>(a) (b) (c)</sup>

	(1)	(2)	(3)
Swap Rate <sub>t-1</sub>	0.249*** (0.000)	0.718*** (0.000)	0.831*** (0.000)
Bank	-0.519*** (0.000)	0.267* (0.084)	-0.022 (0.888)
Building Society	-1.048*** (0.000)	-0.024 (0.885)	-0.310* (0.072)
Failed lender	-0.091 (0.101)	-0.029 (0.493)	0.026 (0.572)
County court judgements	0.129*** (0.000)	0.455*** (0.000)	0.421*** (0.000)
Impaired borrower	0.188*** (0.000)	0.308*** (0.000)	0.318*** (0.000)
Self-employed	0.079*** (0.000)	0.027* (0.067)	0.028** (0.036)
Verified income	-0.010 (0.649)	-0.063*** (0.000)	-0.078*** (0.000)
First-time borrower	0.105*** (0.000)	0.091*** (0.000)	0.089*** (0.000)
Loan value (logged)	1.062* (0.082)	2.910*** (0.000)	2.771*** (0.000)
Property value (logged)	-1.260** (0.035)	-3.118*** (0.000)	-3.230*** (0.000)
Gross income (logged)	0.069*** (0.000)	0.077*** (0.000)	0.098*** (0.000)
Constant	5.274*** (0.000)	5.083*** (0.000)	5.563*** (0.000)
Balance sheet controls	Yes	Yes	Yes
Product controls	Yes	Yes	Yes
Property controls	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes
Postcode-time dummies	Yes	Yes	Yes
Individual lender dummies	No	No	No
Observations	63,589	51,070	51,070
Clusters	320	282	282
Adjusted R-squared	0.513	0.574	0.661

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Coefficients estimated using Specification 1 with the modification detailed in footnote 25.

(b) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders over the period April 2005 to June 2007.

(c) P-values are in parentheses and refer to whether coefficients are different from zero.

Table 17: Differences between lender types in our baseline and matched sample regressions <sup>(a)</sup> <sup>(b)</sup>

	<i>Level effect (Specification 1)</i>			<i>Level effect (Specification 2)</i>		
	<i>Baseline</i>	<i>75% LTV</i>	<i>95% LTV</i>	<i>Baseline</i>	<i>75% LTV</i>	<i>95% LTV</i>
Bank	-0.190*** (0.003)	-0.761*** (0.003)	-0.022 (0.888)	-0.124* (0.098)	-0.840** (0.048)	-0.320* (0.094)
	Building society	-0.512*** (0.000)	-1.386*** (0.000)	-0.310* (0.072)	-0.408*** (0.000)	-1.346*** (0.008)
						-0.818*** (0.000)

(a) Coefficients estimated using Specifications 1 and 2 with the modification detailed in footnote 25.

(b) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders.

Table 18: Sensitivity of mortgage rates to borrower characteristics across lender types for the 75% LTV ratio matched sample regression (a) (b) (c)

<i>Borrower characteristics</i>	<i>Bank</i>	<i>Building society</i>	<i>Specialist</i>
Impaired Borrower	-	0.851*** (0.000)	0.245 (0.166)
County Court Judgements	-	-	0.174 (0.553)
Self employed	-0.001 (0.903)	0.209*** (0.000)	0.195 (0.150)
Verified income	0.031* (0.060)	0.014 (0.810)	0.024 (0.772)
First-time borrower	0.007 (0.800)	-0.016 (0.612)	-0.048 (0.496)
Loan value (logged)	-0.327 (0.263)	0.553 (0.465)	0.312 (0.849)
Property value (logged)	-0.037 (0.904)	-0.876 (0.237)	-1.003 (0.543)
Gross income (logged)	0.043 (0.174)	0.040 (0.547)	0.132 (0.247)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

- (a) Coefficients are estimated using Specification 2 with the modification detailed in footnote 25. Panel A show the coefficients on the lender type dummies ( $\gamma_{bank}$  and  $\gamma_{bsoc}$ ), where the specialist is treated as the omitted lender type. In column *Specialist* in Panel B are the coefficients on the borrower characteristics (i.e. the  $\theta$  coefficients), since the specialist is the omitted lender type. In this column the coefficients on the borrower characteristic variables correspond to the premium (or discount) paid by a borrower from a specialist lender with the relevant characteristic (in the case of the categorical borrower characteristics) or with one more log unit of the relevant characteristic (in the case of the continuous borrower characteristics) compared with a borrower from a specialist lender without that characteristic (in the case of the categorical borrower characteristics) or one less log unit of the characteristic (in the case of the continuous borrower characteristics). In the columns *Bank* and *Building Society* in Panel B are the coefficients on the interactions between the lender types dummies for banks and building societies, respectively, and the borrower characteristics plus the coefficients on the borrower characteristics (i.e. the sum of the relevant  $\kappa$  and  $\theta$  coefficients).
- The values in these column correspond to the premiums/discounts paid by a borrower from a bank or building society defined analogously to the premiums/discounts paid by a borrower from a specialist lender. The statistical significance of these effects is measured using F-tests on the sum of the relevant coefficients.
- (b) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders between April 2005 and June 2007.
- (c) P-values are in parentheses and refer to whether coefficients in the cell are different from zero.

Table 19: Sensitivity of mortgage rates to borrower characteristics across lender types for the 95% LTV ratio matched sample regression (a) (b) (c)

<i>Borrower characteristics</i>	<i>Bank</i>	<i>Building society</i>	<i>Specialist</i>
Impaired Borrower	-	-	0.392*** (0.000)
County Court Judgements	-	-	0.590*** (0.000)
Self employed	0.020 (0.177)	0.042 (0.468)	0.061* (0.074)
Verified income	-0.076*** (0.000)	0.306*** (0.000)	-0.354*** (0.000)
First-time borrower	0.099*** (0.000)	-0.081*** (0.003)	0.053* (0.060)
Loan value (logged)	3.221*** (0.000)	-1.256 (0.157)	2.487** (0.026)
Property value (logged)	-3.698*** (0.000)	0.885 (0.311)	-2.821** (0.012)
Gross income (logged)	0.102*** (0.000)	0.085* (0.063)	0.001 (0.974)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

- (a) Coefficients are estimated using Specification 2 with the modification detailed in footnote 25. In column *Specialist* are the coefficients on the borrower characteristics (i.e. the  $\theta$  coefficients), since the specialist is the omitted lender type. In this column the coefficients on the borrower characteristic variables correspond to the premium (or discount) paid by a borrower from a specialist lender with the relevant characteristic (in the case of the categorical borrower characteristics) or with one more log unit of the relevant characteristic (in the case of the continuous borrower characteristics) compared with a borrower from a specialist lender without that characteristic (in the case of the categorical borrower characteristics) or one less log unit of the characteristic (in the case of the continuous borrower characteristics). In the columns *Bank* and *Building Society* are the coefficients on the interactions between the lender types dummies for banks and building societies, respectively, and the borrower characteristics plus the coefficients on the borrower characteristics (i.e. the sum of the relevant  $\kappa$  and  $\theta$  coefficients). The values in these column correspond to the premiums/discounts paid by a borrower from a bank or building society defined analogously to the premiums/discounts paid by a borrower from a specialist lender. The statistical significance of these effects is measured using F-tests on the sum of the relevant coefficients.
- (b) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders between April 2005 and June 2007.
- (c) P-values are in parentheses and refer to whether coefficients in the cell are different from zero.

## 5.1 Pass through of funding costs

The coefficients on the swap rate variable, shown in Tables 15 and 16, are higher for the matched sample than for the full sample. Incorporating fees into the mortgage rate increases the coefficients further. We also check to see whether the pass through of funding costs differs across the lender types in the matched sample. The results are shown in Table 20. The results are quite different for the two LTV ratios. At the 75% LTV ratio we find no significant funding cost pass-through for specialist lenders, which is consistent with our result from the unmatched sample. But we find a higher degree of pass-through for banks (43 basis points for a one percentage point increase in funding costs) and building societies (29 basis points). At the 95% LTV ratio, however, pass-through is much higher for all lender types. The rate of pass-through for specialist lenders is not significantly different from one.

Table 20: Differences in pass through of funding costs across lender types (matched sample)

	<i>Total degree of pass-through (75% LTV)</i>	<i>Total degree of pass-through (95% LTV)</i>
Bank	0.427*** (0.000)	0.761*** (0.000)
Building Society	0.285*** (0.000)	0.806*** (0.000)
Specialist	0.011 (0.928)	1.064*** (0.000)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Coefficients estimated using Specification 2 with the modification detailed in footnote 25.

(b) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders between April 2005 - June 2007.

## 6 Robustness checks

In this section we describe a number of checks we have carried out to with regard to the validity of our results. The full regression tables for these checks are available upon request.

### 6.1 Stripping out individual lenders

To check whether the lender type effects are sensitive to the exclusion of specific lenders, we run Specification 1 and Specification 2 multiple times, each time stripping out a single lender and comparing the resulting lender type coefficients. The results are summarised in Table 21.

Our results are not especially sensitive to the exclusion of individual lenders from the sample. The pattern of results for both the bank and building society coefficients is consistent and tightly distributed around our original results for Specification 1. The pattern is also robust for the building society coefficient in Specification 2. The discount for banks relative to specialist lenders is reasonably robust as well for Specification 2, although there are more cases where the coefficient on the bank dummy is statistically insignificant. Dropping a lender can (approximately five instances) affect coefficients on particular borrower characteristics, but the coefficients on most characteristics do not vary.

Table 21: Stripping out individual lenders<sup>(a)</sup> <sup>(b)</sup>

	Lender type effects			
	(Specification 1)		(Specification 2)	
	Bank	Building Society	Bank	Building Society
Original coefficient	-0.190*** (0.003)	-0.512*** (0.000)	-0.124* (0.098)	-0.408*** (0.000)
Coefficients from robustness check				
Negative and significant	59	60	46	60
Negative and insignificant	1	0	12	0
Positive and insignificant	0	0	2	0
Positive and significant	0	0	0	0

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders between April 2005 and June 2007.

(b) P-values are in parentheses and refer to whether coefficients are different from zero.

## 6.2 Different forms of standard error clustering

In our analysis we cluster standard errors to account for correlation between observations with borrowers within a region of the United Kingdom that obtained mortgages from the same lender. But alternative choices of clustering variable are equally defensible. For example model errors could be correlated if individual lenders have a standard approach for assigning mortgage rates to borrowers, either over time or in a given time period. Alternatively, model errors could be correlated if borrowers from the same location in the United Kingdom have similar characteristics. We check whether our results are sensitive to the choice of clustering variable by estimating Specification 1 and Specification 2 while clustering standard errors at the: (1) lender-quarter; (2) lender; and (3) postcode levels. The results are shown in Tables 22 and 23.

The significance of the lender type effects remains robust under both specifications to clustering standard errors at the lender-quarter and postcode levels. But the significance of some of our results

reduces when we cluster standard errors at the lender level. This is the most stringent approach to clustering that we take. The results would indicate that there is a considerable degree of correlation between borrowers that obtain mortgages from the same lender across the sample period. While the building society effect remains significant, the bank effect is no longer significant under lender-level clustering under both specifications. Other variables that become insignificant include the swap rate, the self-employed and verified income effects when we cluster standard errors at the lender level. The majority of the interaction terms in Specification 2 also lose or remain less statistically significant.

Table 22: P-values for lender type dummies with different forms of clustering (Specification 1)<sup>(a)</sup> (b)

	<i>Form of clustering</i>			
	<i>Lender-region</i>	<i>Lender-quarter</i>	<i>Lender</i>	<i>Postcode</i>
Bank	-0.190*** (0.003)	-0.190** (0.023)	-0.190 (0.327)	-0.190*** (0.000)
Building Society	-0.512*** (0.000)	-0.512*** (0.000)	-0.512*** (0.004)	-0.512*** (0.000)
<b>Number of clusters</b>	617	479	60	153

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders between April 2005 and June 2007.

(b) The figures in the table are the p-values for whether the coefficient on the variable is different from zero.

Table 23: P-values for lender type dummies with different forms of clustering (Specification 2)<sup>(a)</sup> <sup>(b)</sup>

	<i>Form of clustering</i>			
	<i>Lender-region</i>	<i>Lender-quarter</i>	<i>Lender</i>	<i>Postcode</i>
Bank	-0.124* (0.098)	-0.124*** (0.000)	-0.124 (0.579)	-0.124*** (0.000)
Building Society	-0.408*** (0.000)	-0.408*** (0.000)	-0.408* (0.077)	-0.408*** (0.000)
<b>Number of clusters</b>	617	479	60	153

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders between April 2005 and June 2007.

(b) The figures in the table are the p-values for whether the coefficient on the variable is different from zero.

### 6.3 Including floating rate mortgages

We check to see if our results for differences in lender pricing hold when floating rate mortgages are included in our sample. We do this by proxying the marginal cost of funding for these mortgages to be the three month Libor rate. The coefficients on the bank and building society dummies are still negative and significant when floating rate mortgages are included in the sample, but the value of the coefficient on the bank dummy increases while the building society dummy decreases; see Table 24.

Table 24: Including floating rate mortgages

	Lender type effects			
	(Specification 1)		(Specification 2)	
	Bank	Building Society	Bank	Building Society
Original coefficient	-0.190*** (0.003)	-0.512*** (0.000)	-0.124* (0.098)	-0.408*** (0.000)
Robustness check coefficient	-0.386*** (0.000)	-0.477*** (0.000)	-0.269*** (0.000)	-0.292*** (0.000)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

- (a) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders between April 2005 and June 2007.
- (b) P-values are in parentheses and refer to whether coefficients are different from zero.

## 6.4 Including very high LTI mortgages

The sample on which regression results reported elsewhere in the paper are based includes mortgages up to an LTI ratio of 6, which is the 99th percentile of our sample distribution of LTI ratios. The dataset includes some extreme outliers for the LTI ratio, due possibly to miscoding of either income or the loan value for the mortgage. We check to see if the inclusion of mortgages with higher LTI ratios than our threshold materially affects our results by including mortgages up to the 99.9th percentile of the LTI distribution (LTI ratio of 40). The coefficients on the bank and building society dummies do not change materially when those mortgages are included; see Table 25.

Table 25: Including very high LTI mortgages

	Lender type effects			
	(Specification 1)		(Specification 2)	
	Bank	Building Society	Bank	Building Society
Original coefficient	-0.190*** (0.003)	-0.512*** (0.000)	-0.124* (0.098)	-0.408*** (0.000)
Robustness check coefficient	-0.181*** (0.005)	-0.510*** (0.000)	-0.120 (0.116)	-0.409*** (0.000)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Sample covers fixed rate mortgages issued by banks, building societies and specialist between April 2005 and June 2007.

(b) P-values are in parentheses and refer to whether coefficients are different from zero.

## 6.5 Controlling for product market size

The mortgage market might include different segments in which lenders active in those segments might have different degrees of market power. For example, the market for two-year fixed rate mortgages is large, so might be more competitive than other segments. If there is a correlation between lender type and presence in certain segments of the mortgage market, the lender type effects we report might in fact pick up the effect of segment size on mortgage rates. To test whether this is the case, we split the market into segments defined by the fix length and LTV ratio, and calculate the number of transactions in each segment.<sup>26</sup> We include the number of transactions in the segment to which a mortgage belongs as a control in the regressions. Table 26 shows that controlling for segment size does not change the statistical significance of the bank and building society dummy variables nor the direction of these lender type effects.

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<sup>26</sup>We segment the market by separating LTV ratios according to 10pp wide buckets and separating fix lengths by number of years.

Table 26: Controlling for mortgage segment size

	Lender type effects			
	(Specification 1)		(Specification 2)	
	Bank	Building Society	Bank	Building Society
Original coefficient	-0.190*** (0.003)	-0.512*** (0.000)	-0.124* (0.098)	-0.408*** (0.000)
Robustness check coefficient	-0.199*** (0.002)	-0.531*** (0.000)	-0.136* (0.079)	-0.431*** (0.000)

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

(a) Sample covers fixed rate mortgages issued by banks, building societies and specialist lenders between April 2005 and June 2007.

(b) P-values are in parentheses and refer to whether coefficients are different from zero.

## 7 Conclusions

We have examined for a specific loan market, the market for residential mortgages in the United Kingdom between 2005 and 2007, whether there are differences in pricing behaviour between different types of lender. Differences in objectives, costs, and risk appetite arising from variations in ownership structure and associated agency problems suggest price behaviour will differ. This result is supported by past empirical studies based on data from other countries and time periods. Our analysis builds on these past studies by using a loan-level data set, which enables us to control for heterogeneity among borrowers. We also control for differences in the balance sheets of lenders. We find evidence lender type is associated with differences in three aspects of pricing behaviour: the level of interest rates; the pass through of funding costs to interest rates; and the sensitivity of interest rates to borrower riskiness. Some of the results are consistent with priors based on theory and existing empirical studies. But other results are not (e.g. that building societies, mutual lenders, pass through funding cost changes by more than lenders oriented towards profit maximisation). The results are robust to incorporating fees into the price of a loan and the time a borrower would have been searching for a loan.

Taken together our results suggest further research is needed to understand how lender type

affects pricing behaviour in loan markets. The theory that agency problems, between managers and shareholders/owners or between shareholders/owners and debt holders, will vary across lender types, in particular across mutual and non-mutual lenders, does not explain adequately the pricing behaviour in the specific market in the particular period we focus on. Presumably it may not explain behaviour in other loan markets. Research appears to be needed to understand better the objectives of different types of lender and how those objectives translate into lenders' behaviour. This would enable one to understand how, to what extent, and why lender types matters. It would be useful information for foreseeing how shocks, such as to funding costs, might depend on the composition of a loan market in terms of lenders of different types and the consequences of shifts in the composition of these markets.

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## Appendix

Table A1: Variables collected from the Product Sales Database

<i>Data item</i>	<i>Description</i>
Lender name	The name of the lender in the Product Sales Database
Fix length	The length of time over which the fixed interest rate applies
Interest rate	The interest rate on the mortgage
Loan value	The loan size
Property value	The value of the purchased property
Income	The borrower's annual income
Impaired	Whether or not the borrower has been bankrupt, subject to an individual voluntary arrangement, or has previously been in arrears with a loan within the last three years
County court judgement	Whether or not the borrower had a county court judgement against them
Self-employed	Whether or not the borrower was self-employed
Verified income	Whether or not the borrower's income was evidenced for the mortgage application
First-time buyer	Whether the borrower was a first-time buyer or a home-mover
Debt consolidation	Whether the borrower took out a remortgage for the purpose of debt consolidation
Age bucket	The age group of the borrower
Joint income	Whether or not the borrower applied for the mortgage on the basis of a single income or along with a partner's income
Intermediary	Whether the mortgage was obtained via an intermediary or from a lender directly
Interest only	Whether the mortgage was an interest only or a repayment mortgage
Council	Whether or not the property was purchased from a council or a housing association
New dwelling	Whether the property was a new build
Postcode	The two digit post-code district in the United Kingdom in which the mortgage was provided
Region	The region of the United Kingdom (out of 12 regions) in which the mortgage was provided
Month	The month in which the mortgage transaction was recorded in the Product Sales Database

Table A2: Data cleaning process

<i>Criterion</i>	<i>Dropped observations</i>	<i>Remaining observations</i>
<b>Initial data</b>		<b>8,595,424</b>
Initial charged interest rate missing	3,057,810	5,537,614
Loan value missing	380	5,537,234
Property value missing	3,795	5,533,439
Region missing	51,569	5,481,870
Gross borrower income missing	94,155	5,387,715
Mortgage type unknown	135,525	5,252,190
Employment status unknown	113,887	5,138,303
Repayment type unknown	9,006	5,129,297
Mortgage rate type unknown	16,570	5,112,727
Remortgage reason provided on non-remortgages	27,793	5,084,934
Remove if initial charged interest rate less than 0.1%	3,140	5,081,794
Remove if loan value is less than £1000	2,104	5,079,690
Remove if annual income is less than £1000	29	5,079,661
Remove if LTI ratio is less than 0.1	15,553	5,064,108
Remove if LTI ratio is greater than 6	37,081	5,027,027
Remove if LTV ratio is less than 1	275	5,026,752
Remove if borrower age < 18 or > 70	19,654	5,007,098
Remove lifetime mortgages	375	5,006,723
Remove offset mortgages	280,041	4,726,682
Keep only fixed rate mortgages	1,397,124	3,329,558
Borrower is retired	26,584	3,302,974
Keep interest only or capital + interest mortgages	285,723	3,017,251
Keep if fixed rate period is close to integer year	826,647	2,190,604
<b>Clean data</b>		<b>2,190,604</b>
Match with lender types	0	2,190,604
Match with funding costs	0	2,190,604
Match with regulatory balance sheet data	58,079	2,132,525
<b>Merged data</b>		<b>2,132,525</b>
Keep observations without missing data	119,095	2,013,430
Remove if total residential loans > total assets	21,880	1,991,550
Remove if fixed rate period < 1 year or > 15 years	10,719	1,980,831
Keep pre-crisis data (2005m4 - 2007m6)	720,318	1,260,513
Remove if lender transactions < 20	41	1,260,472
<b>Data for regressions</b>		<b>1,260,472</b>

Figure A1: The matching algorithm

