

# Housing Wealth Inequality and Mortgage Market

## Stimulus

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### Abstract

Can mortgage market interventions reduce housing wealth inequality? To answer this question we study the UK Help-to-Buy (HTB) program, which significantly lowered the minimum down payment requirement. Exploiting geographic variation in *ex ante* exposure to the program and administrative mortgage data, we first show that homeownership increased by 25 percent due to the policy change. Utilizing a novel measure of financial support we show that the program primarily enabled households without access to financial support to get on the property ladder. These first-time buyers tend to have higher incomes, explaining a simultaneous right-ward shift of the income distribution. Our findings thus show that lowering the down payment requirement reduces housing wealth inequality by weakening the link between (parental) wealth and housing outcomes.

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# 1 Introduction

Driven by stagnating incomes, rising house prices and stricter lending standards, homeownership rates are in long-term decline in many advanced countries. Owning a home seems increasingly unattainable for low-income or otherwise credit constraint households. This raises concerns about growing wealth inequality, as housing is the main source of household wealth in most countries. To curb these trends, policymakers are intervening in various ways to make homeownership more accessible.<sup>1</sup> However, it is still unclear whether such policies succeed in getting more disadvantaged socioeconomic groups on the property ladder. Therefore, at present there is little guidance as to whether such policies help reduce housing wealth inequality.

In this paper we shed light on this issue by studying one large mortgage market intervention, the UK Help-to-Buy (HTB) program. This program significantly lowered the minimum down payment requirement, arguably the most relevant policy lever for tackling housing affordability issues. Due to its inbuilt leverage effect, the down payment requirement has a non-linear impact on housing affordability.<sup>2</sup> Furthermore, the down payment (and not income) is often the binding constraint for first-time buyers (Linneman and Wachter, 1989; Fuster and Zafar, 2021). When this requirement tightens, first-time buyers disproportionately drop out of the market (Van Bakkum et al., 2019; Defusco et al., 2020; Carozzi, 2020). When it is loosened, first-time buyers are the main beneficiaries (Tracey and Van Horen, 2021).<sup>3</sup>

Households build their down payment by saving out of their own income. However, wealth transfers from relatives or friends, in most cases the “Bank of Mom and Dad”, can be an important supplement.. Such financial support allows an otherwise constraint household to save less out of their income, purchase earlier or buy a larger home (Engelhardt and Mayer, 1998; Charles and Hurst, 2002; Guiso and Jappelli, 2002). While exact numbers are hard to come by, estimates of the share of first-time buyers relying on financial support range from 20-40 percent. <sup>4</sup> Relaxing the down payment requirement can potentially

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<sup>1</sup>Examples are First-Time Homebuyer Credit (US), Help-to-Buy (UK), homeownership schemes (e.g. Singapore) or targeted stamp duty holidays (e.g. Netherlands, UK).

<sup>2</sup>For example, a household with £10,000 saved for a down payment would be able to buy a house worth only £100,000 with a 10 percent requirement (90% LTV), but one worth £200,000 with a 5 percent requirement (95% LTV). By contrast the loan-to-income (LTI) and payment to income (PTI) requirements have a linear impact on housing affordability.

<sup>3</sup>In addition, McCann and Durante, 2022 find that first-time buyers do not buy larger properties, but instead lower the down payment and retain more cash when the LTV requirement loosens.

<sup>4</sup>Engelhardt and Mayer (1994) find that one in five first-time buyers receive a financial transfer.

affect housing wealth inequality along both these dimensions.

When the minimum down payment falls, households need to save less out of their income. This should make it easier for lower-income households to purchase a home. Housing wealth inequality declines by shifting the income distribution of homeowners.<sup>5</sup> However, various countervailing factors might be at play. Banks could demand higher incomes to compensate for the increased riskiness of the mortgage. Regulatory loan-to-income (LTI) or debt-to-income (DTI) limits could act as binding constraints for lower-income households, rendering the minimum down payment requirement meaningless. Furthermore, higher-income households can also decide to bring forward their purchase. Such effects could very well offset the leftward shift of the income distribution.

A reduction of the minimum down payment should also make it easier for households without access to financial support to purchase a home. This reduces housing wealth inequality by weakening the link between (parental) wealth and housing outcomes. But, if the easing of borrowing constraints attracts more first-time buyers with wealthy parents to the market housing wealth inequality could also rise (Brandsaas, 2021). Overall, the impact is *ex ante* unclear.

Ultimately it is an empirical question if and how lowering the down payment requirement affects housing wealth inequality. The UK offers a unique setting to examine this question. In 2013, the UK government implemented the HTB program in an attempt to make housing more affordable for households with limited ability to save for a down payment. It did so by facilitating home purchases with only a 5 percent down payment. The program was introduced in the aftermath of the global financial crisis when UK mortgage lenders were unwilling to offer mortgages with less than 10 percent down payment, despite there being no regulatory restrictions to do so. Due to particularities of the UK mortgage market, HTB led to a sudden and significant drop of the minimum down payment requirement from 10 to 5 percent. For many first-time buyers, this policy change was key to accessing the mortgage market.

For our analysis we exploit administrative mortgage data capturing the universe of regulated mortgages in the UK. These data contain information on the mortgage such as

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Brandsaas (2021) estimates that parental transfers account for 31 percent of homeownership rates of young adults in the US. A survey by Santander in the UK puts the number at 40 percent (Santander, 2019)

<sup>5</sup>If house prices rise due to an increased demand for housing, the impact could be muted. However, because of the in-built leverage effect of the down payment requirement, the house price increase must be very high for it to outweigh the impact of the drop in the down payment on housing affordability.

date of issuance, location of the house, property value and loan amount (and therefore the down payment). But also information on the borrower, including the borrower type (first-time buyer or home mover), employment status, income and age. This unique information enables us to simultaneously examine changes in the income distribution of first-time buyers and whether access to financial support became a stronger or weaker determinant of homeownership.

We start by creating a novel measure of financial support. Our measure identifies mortgages for which the down payment was extremely unlikely independently financed in full by the buyer.<sup>6</sup> Specifically, we compare a household's *actual* down payment with an estimate of their *potential* down payment savings. When the actual down payment is higher, we classify the household as having likely received financial support. A household's potential down payment savings equals the maximum amount a household would be able to save out of their income, based on their age and income as well as some generous assumptions about their savings rate. To the best of our knowledge, ours is the first estimate of whether the buyer received financial support derived from administrative mortgage data and that covers the universe of mortgages.

Some interesting stylized facts emerge. One, we estimate that 20 percent of FTB (likely) relied on financial support in the years prior to HTB. Two, we observe a very strong negative correlation between buying a home with financial support and household income for first-time buyers in the UK (Figure 1).<sup>7</sup> Over 50 percent of first-time buyers in the lowest quintile of the income distribution (likely) received financial support; the share drops to around 5 percent in the highest income quintile, which is consistent with the idea that receiving a wealth transfer significantly reduces borrowing constraints. Three, households without financial support rely much more on low-down payment mortgages compared to those without financial support (Figure 2).<sup>8</sup> Again a strong signal that access to financial support reduces borrowing constraints.

To examine the redistributive effects of HTB we need to create a reasonable counterfactual. Our research design builds on the work of Tracey and Van Horen (2021) and exploits geographic variation in *ex ante* HTB exposure in a similar vein as the identifica-

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<sup>6</sup>Using a different method and assumptions, Rostom (2021) developed a related measure to quantify the importance of the Bank of Mom and Dad in the UK mortgage market.

<sup>7</sup>Using survey data from the 80s and 90s, Engelhardt and Mayer (1996) document a similar negative relationship for the US and Cox (1990) shows that US households with low current income and high permanent income were significantly more likely to have received transfers.

<sup>8</sup>In line with the findings of Benetton et al. (2022) who find that children whose parents extract equity at the time they buy a house, have lower LTVs at origination.

ation strategies of Mian and Sufi (2012) and Berger et al. (2020). The idea is that even though HTB was national in scope, and the down payment requirement thus loosened across the UK, parts of the UK were affected differently due to variations in local housing market characteristics. Lowering the down payment requirement primarily benefits liquidity constrained households and these households are not randomly spread across the country. Instead, they tend to be concentrated in specific areas with a more suitable housing supply. As local housing market characteristics typically change very slowly, one can reasonably assume that the policy change has a bigger impact in districts where historically many households bought their home with a low-down payment mortgage.

We define HTB exposure as the proportion of households in a district that bought their home with a 5 percent down payment before the global financial crisis, a period when the market for such mortgages was relatively unconstrained.<sup>9</sup> <sup>10</sup> We show that this measure strongly correlates with the actual purchase of low-down payment mortgages after HTB was introduced and also accurately predicts time variation.

Our difference-in-differences design then compares home purchases by first-time buyers in low relative to high exposure areas before and after HTB came into effect. Districts with a historically small share of low-down payment buyers can serve as a control group because HTB unlikely induced many first-time buyers to buy in these districts. To mitigate endogeneity concerns we include district and region-by-time fixed effects. We also include various pre-policy control variables interacted with yearly time dummies to capture differences in macroeconomic and housing market developments. When analyzing the impact on housing inequality we exploit within-district variation which allows us to include district-by-time fixed effects. This ensures that we eliminate differences in time-trends at the district level.

We first document that lowering the minimum down payment from 10 to 5 percent led to a sharp rise in homeownership. We observe very similar trends in the number of first-time buyers in high and low exposure districts in the years prior to the start of HTB and a clear divergence of trends when the policy came into full effect. We estimate that over the period 2013 to 2016, when the two main HTB schemes were active, an additional

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<sup>9</sup>Throughout the paper we use the terms 5 percent- and low down payment mortgages intermittently. These mortgages are also known as 95 LTV mortgages. To account for the notched interest rate schedule in the UK, they include all mortgages with a down payment less than the 10 percent threshold. The vast majority of them have a down payment at or close to 5 percent. For further details see Section 3.

<sup>10</sup>The term district refers to Local Authority District (LAD). England, Scotland and Wales comprise of 379 districts. Even though we refer to the UK throughout the paper, we focus our analysis on England, Scotland and Wales only as very few of our data sources include information on Northern Ireland.

195,000 homes were purchased by first-time buyers, representing a 25 percent increase in homeownership. In line with HTB driving the housing market response, this increase was primarily due to a rise in house purchases with a 5 percent down payment.<sup>11</sup> The magnitude of the effect highlights the critical role of down payment constrained buyers in driving housing market fluctuations (Ortalo-Magne and Rady, 2006).<sup>12</sup>

Next we turn to the impact on housing wealth inequality. We first examine how the income distribution of first-time buyers changed. Controlling for district-by-time fixed effects, we document a relative increase in first-time buyers in high-exposure regions in all income quintiles. However, the impact is larger for the higher income quintiles. In the first quintile, an additional 21,900 households were able to transition into homeownership (14 percent increase). In the fifth quintile, the number equaled 68,900 (42 percent increase).<sup>13</sup> At first glance these findings might be surprising. Taken at face value they suggest that lowering the down payment requirement increases housing wealth inequality.

This interpretation changes when access to financial support is taken into account. Differentiating between first-time buyers with and without access to financial support shows that the main beneficiaries of lowering the minimum down payment are in fact first-time buyers without access to financial support. Such households experienced a sharp increase in homeownership (36 percent rise in aggregate). First-time buyers with access to financial support, barely reacted to the policy change, in line with such households in general opting for mortgages with larger down payments to begin with. When differentiating across the various income quintiles we observe an increase in homeownership of households without access to financial support in all income groups, but especially in the higher-income groups. As first-time buyers without access to financial support tend to have higher incomes, the ability of such households to now become a homeowner is an important explanation for the rightward shift of the income distribution.

We provide novel evidence showing that lowering the down payment requirement has important implications for housing wealth inequality as it reduces the reliance on financial support. As parents most often provide such support, this implies a weakening of the

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<sup>11</sup>These numbers reflect both the direct effect of HTB as well as its indirect effect of re-opening the market for low-down payment mortgages outside the program.

<sup>12</sup>Tracey and Van Horen (2021) show that the relative increase in housing market activity cannot be explained by endogenous moves as (outside of the London area) migration patterns do not change after HTB was introduced.

<sup>13</sup>These results are robust to controlling for the tightening of the LTI regulation in the UK in 2014, which Peydro et al. (2020) show has induced constrained banks to reallocate mortgage lending from lower-income to higher-income households.

link between parental wealth and housing outcomes and thus has important implications for the persistence of housing wealth and inequality across generations. The fact that many households hold most of their wealth in housing (to the extent they have wealth), suggests that the down payment requirement can act as an import policy lever to reduce wealth inequality. Our study also shows that focusing only on changes in the income distribution when studying the distributional effects of mortgage market interventions, can potentially lead to the erroneous conclusion that such interventions predominantly benefit the better-off in society.

The remainder of the paper is structured as follows. The next section provides a review of the related literature. Section 3 discusses the policy background. Section 4 describes the data and Section 5 introduces the empirical strategy and discusses our measure of financial support. Section 6 reports the results. Section 7 concludes.

## 2 Related Literature

Our main contribution to the literature is to show the distributional effects of lowering the down payment requirement, focusing both on household income and intergenerational wealth transfers. To the best of our knowledge there is currently no paper which studies this. On the one hand, this is due to scarcity of administrative data on mortgages, and in particular data that contain information on the income of the buyer. On the other hand, because policies that restrict borrower leverage are much more common than those that loosen it. The UK offers an ideal setting as it has a mortgage register and experienced a large policy shock which suddenly reduced the minimum down payment from 10 to 5 percent. We can therefore provide novel insights in how mortgage market stimulus can impact housing wealth inequality.

Some papers have studied the distributional consequences of tightenings of macroprudential policy, focusing solely on income. Acharya et al. (2022) and Peydro et al. (2020) show that a tightening of the LTV and/or LTI limits lead to a reallocation of credit from low- to high-income borrowers. Other papers have studied the redistributive effects of monetary policy (Auclert, 2019) and policies aimed at access to finance more general (Rajan, 2011; Agarwal et al., 2012). Some studies pointed to the potential negative welfare effects of macroprudential policies in terms of wealth and income inequality within a country. Frost and Van Stralen (2018) find that countries that use LTV and DTI limits display higher (gross) income inequality compared to countries that do not use these measures. In a theoretical model, Carpentier et al. (2018) show that LTV limits have a positive

effect on wealth inequality. Georgescu and Vila Martin (2021) using simulation results show that borrower-based measures have a moderate negative welfare impact in terms of wealth inequality and a negligible impact on income inequality.

Our focus on the link between the down payment requirement, access to (parental) support and homeownership links our paper to the literature that studies the transmission of economic and social outcomes across generations. Due to the importance of housing for wealth-building, several papers have focused on the importance of the housing market for intergenerational persistence ((Piketty and Zucman, 2014); Sodini et al., 2016; Bernstein and Koudijs, 2021). The importance of financial transfers to get on the property ladder has been documented by various papers. Engelhardt and Mayer (1998) show that transfers to first-time buyers in the US lead to shorter time to save for down-payments, higher down-payments and more expensive houses. Charles and Hurst (2002) find a strong positive association between parental wealth (used as a proxy for available financial assistance) and homeownership in the US. Guiso and Jappelli (2002) show that bequests, gifts and other inter vivo transfers shorten the saving period before homeownership and increase the value of the house purchase in Italy. Focusing on the UK, Blanden and Machin (2017) document a large persistence in homeownership rates which has strengthened significantly over time. Brandsaas (2021) estimates a rich overlapping generations life-cycle model with altruistic parents and children housing decision and finds that transfers account for 31% of the homeownership rate of young adults in the US. Benetton et al. (2022) use rich administrative data in the US and show that parents attract home equity to help finance their children’s home purchases. Our paper adds to this literature by showing that lowering the down payment requirement weakens the link between (parental) wealth and housing outcomes.

Finally, our use of Help-to-Buy as a quasi-natural experiment relates our paper to the literature that studies the impact of HTB, which hitherto has mostly focused on the Equity Loan (EL) scheme of the program. It finds that the EL scheme positively affected the purchase of new properties (Finlay et al., 2016; Szumilo and Vanino, 2018), with households buying more expensive properties instead of reducing mortgage debt or house price risk exposure (Benetton et al., 2021). In addition, it induced an increase in house prices (housing construction) but only in areas with unresponsive (responsive) housing supply (Carozzi et al., 2020). Benetton et al. (2018) exploit the EL scheme to show that lenders use down payment size to price unobservable borrower risk. Finally, Tracey and Van Horen (2021) study both schemes and show that HTB not only stimulated housing



market activity, but positively affected household spending as well.

### 3 The UK Help-to-Buy Program

HTB was first announced in March 2013 as part of the UK’s budget. The key feature of the program was that it made it easier for households to purchase a home with only a 5 percent down payment. At the time of its introduction, lenders were very reluctant to offer mortgages with less than 10 percent down payment. The explicit objective of the program was to facilitate mortgage market access to borrowers facing significant down payment constraints, with George Osborne explaining in his budget speech that “for anyone who can afford a mortgage but can’t afford a big down payment, our [HTB] Mortgage Guarantee will help you buy your own home” (Chancellor of the Exchequer, 2013).

There were two main HTB options. The first was the “Equity Loan” (EL) scheme, which was offered from 1 April 2013 to 31 December 2020.<sup>14</sup> The EL scheme was available for both first-time buyers and home movers (but not for buy-to-let or second home mortgages) and applied to new-build properties with a purchase price of less than £600,000 (£300,000 in Wales). While the borrower(s) required a 5 percent down payment, the UK Government lent up to 20 percent (40 percent within London from 2016) of the property value via a low-interest “equity loan”. A lender provided a mortgage for the remaining amount of up to 75 percent (55 percent in London from 2016) of the property value. The government equity loan component was interest free in the first 5 years after the property purchase. There were other requirements about the type of qualifying HTB mortgage. For example, the mortgage needed to be a capital repayment mortgage and could not be an interest-only or offset mortgage. Additionally, the LTI of the mortgage needed to be 4.5 or less.<sup>15</sup>

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<sup>14</sup>In April 2021 a new Equity Loan scheme started that is restricted to first-time buyers and includes regional property price caps to ensure the scheme reaches people who need it most.

<sup>15</sup>The EL scheme loosened the income constraint, in addition to the down payment constraint, because the government equity loan was not included in the LTI calculation. This loosening of the income constraint via the EL scheme allowed buyers to purchase a more expensive home (Benetton et al., 2021; Finlay et al., 2016). But Finlay et al. (2016) document that the down payment - and not income - was the critical constraint in determining access to a mortgage and homeownership for the vast majority of potential buyers. Tracey and Van Horen (2021) show that there is little difference in the average income for EL scheme buyers versus MG scheme buyers.

The second main HTB option was the “Mortgage Guarantee” (MG) scheme, which was offered from 1 October 2013 to 31 December 2016. As with the EL scheme, borrowers required a 5 percent down payment and the scheme was available to first-time buyers and home movers. The UK government provided a guarantee of 20 percent of the property’s value to lenders in exchange for a small fee. This meant that MG scheme mortgages effectively had a 75 percent LTV from a lender’s perspective. Unlike the EL scheme, the MG scheme applied to all properties with a purchase price of less than £600,000, rather than new-builds only. Not all lenders provided MG scheme mortgages but many did. Table A.1 in the Internet Appendix summarizes the two schemes and their requirements.

Due to peculiarities of the UK mortgage market, HTB effectively implied a significant lowering of the down payment requirement. Lenders in the UK offer notched mortgage interest schedules, whereby the mortgage interest rate features discrete jumps at critical thresholds of the down payment ( 5, 10, 15, ..., and 40 percent). This pricing strategy means that a borrower is charged the same interest rate for a mortgage with either 9.9 or 5.0 percent down payment as both are in the same pricing bucket. By contrast, a borrower is charged a significantly lower interest rate for a mortgage with a 10.0 percent down payment compared to a 9.9 percent down payment as these are in different pricing buckets. This creates very strong incentives for households to borrow just below the threshold. Mortgage down payments therefore bunch in incremental steps of 5 percentage points with only very few down payments in between these discrete steps (see, e.g., Best et al., 2020; Robles-Garcia, 2019). Figure 3 illustrates that HTB was highly effective lowering the minimum down payment requirement from 10 to 5 percent. While there was no bunching at the 5 percent threshold prior to HTB, significant bunching occurred after the program was introduced.

The number of completed home purchases under the HTB program from January 2014 to December 2016, when both the EL and MG schemes were on offer, was approximately 200,000. This figure was split almost equally between EL scheme and MG scheme home purchases. HTB mortgages represented around 18 percent of all first-time buyer mortgages.<sup>16</sup> Aggregate patterns thus suggest that HTB had an effect. However, to examine whether and how the policy change impacted housing inequality, we must form a reasonable estimate for what would have happened if the program had not been implemented (i.e. construct a counterfactual). We follow the approach introduced by Tracey and Van Horen (2021) and exploit cross-sectional geographic variation across UK districts.

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<sup>16</sup>When remortgages are included, HTB represented around 6 percent of all mortgages over this period.

We explain the empirical methodology in detail in Section 5.

## 4 Data

In this section, we describe the data sources and key variables that we use in our analysis, as well as present the corresponding summary statistics. Our data set includes 379 local authority districts (LADs) in the UK for which we have mortgage market and other housing market and macroeconomic data. We refer to LADs as “districts” throughout the text. The data set covers districts in England, Wales and Scotland. We exclude Northern Ireland as this region is not included in all of our data sources. The districts in our sample cover 97 percent of the UK population and 98 percent of total mortgages issued. We conduct our analysis at the district level because these regions most closely represent distinct housing markets. Outside the greater London area they also tend to represent naturally integrated economic units similar to the core based statistical areas (CBSAs) in the US.

The empirical analysis is based on loan-level mortgage information from the Product Sales Database (PSD). The PSD is a regulatory dataset collected by the UK Financial Conduct Authority. These data provide information on all regulated UK mortgage transactions at the point of sale, including: the date of mortgage issuance, loan value and property value (and therefore the down payment). The PSD also provides information about the borrower, including: buyer-type (e.g. first-time buyer or home mover), income and age. Finally, the PSD includes information about the lender for each loan and the postcode of the property. We map the postcode information to the LADs using the November 2018 National Statistics Postcode Lookup dataset.

Our key outcome variables are year-district-level measures of home purchases by first-time buyers. We construct several measures. Our main measure “*First-time Buyers*” equals the total number of homes purchased with a mortgage by first-time buyers.<sup>17</sup> Our next measures are: “*Down Payment 5%*”, “*Down Payment 10%*” and “*Down Payment 15%+*”, which comprise the total homes purchased by first-time buyers with a down

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<sup>17</sup>In the UK, the majority of home purchased are financed with a mortgage. For example, in 2012 around 84 percent of total home sales were purchased with a mortgage. For first-time buyers this number is even higher.

payment of 5 percent, 10 percent, and 15 percent or more, respectively.<sup>18</sup> The other dependent variables are discussed in their relevant sections. We winsorize all outcome variables at the 1st and 99th percentile to remove any outliers.<sup>19</sup>

Income is a key variable in the analysis that we collect from the PSD. It captures the income of the household at the time the house is purchased (i.e. the income on which the lender based its decision to provide a mortgage). We deflate income to 2016 values using a common U.K. inflation index called the Consumer Price Index including owner occupiers housing costs (CPIH).

Finally, we collect various macroeconomic data at the year-district-level to include as pre-policy control variables in our analysis. They include the 2008 year-end values of district-level median income, unemployment, average house price and population. The average house price information is taken from the UK Land Registry Price Paid Dataset (PPD). All other control variables are provided by the UK Office of National Statistics (ONS). We adjust all relevant nominal control variables, as well as the nominal PSD variables, to 2016 prices using the CPIH.

## 5 Empirical Strategy

To assess the impact of lowering the minimum down payment requirement on housing wealth inequality, we use the identification strategy introduced by Tracey and Van Horen (2021) and exploit geographic variation in *ex ante* HTB exposure. This identification strategy is similar in spirit to that used by Mian and Sufi (2012) who evaluate the effects of the Cash for Clunkers program, by Berger et al. (2020) who evaluate the First-Time Homebuyer Credit program, and by Agarwal et al. (2017) who evaluate the broader consequences of debt relief programs using regional variation. These differences in geographic exposure help us produce a counterfactual to estimate what would have happened in the absence of this mortgage market intervention. In addition we construct a novel measure of financial support.

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<sup>18</sup>As explained above, mortgages included in *Down Payment 5%* can have a down payment between 9.9 and 5 percent, those in *Down Payment 10%* a down payment between 14.9 and 10 percent etc.

<sup>19</sup>Our results are robust when we include the outliers.

## 5.1 Measuring Exposure to Help-to-Buy

Tracey and Van Horen (2021) exploit the idea that even though HTB was national in scope, and down payment requirements were thus relaxed across the UK, parts of the UK were more exposed due to variations in local housing market characteristics. Lowering the down payment requirement primarily benefits liquidity constrained households and these households are not randomly spread across the country. Instead, they tend to be concentrated in specific areas with a more suitable housing supply. Local housing market characteristics typically change very slowly. We can thus expect the impact of HTB to be greater in districts where *historically* many households bought their home with a low-down payment mortgage as this should strongly correlate with the number of *potential* low-down payment home buyers at the time HTB came into effect. Areas with few potential low-down payment home buyers can function as a control group as first-time buyers in these areas unlikely react to the program. The difference between high exposure (treated) and low exposure (control) districts provides an estimate of the marginal impact of reducing the minimum down payment requirement to 5 percent via HTB.

Following Tracey and Van Horen (2021) we use the loan-level mortgage data and define “*Exposure*” as the number of mortgages with a down payment of around 5 percent issued in a district between 2005 and 2007 scaled by the total of number of mortgages issued in the district over that period.<sup>2021</sup> Exposure is based on the years before the financial crisis as during this period the market for low-down payment mortgages was relatively unconstrained.

To illustrate the validity of the HTB exposure measure, we replicate in the Appendix the relevant figures from Tracey and Van Horen (2021). Figure A.1 illustrates that significant variation exists across the whole of the UK. Exposure ranges from 8.7 percent to 42.1 percent, with a mean exposure of 22.6 percent. Figure A.2 shows that a strong positive correlation exists between our *ex ante* HTB exposure measure and the *ex post* number of low-down payment mortgages taken out over the period 2013 to 2016. This indicates that the exposure measure performs well in predicting the actual take-up of low-down payment mortgages over the period that both the EL and MG schemes were offered. In districts

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<sup>20</sup>PSD starts in 2005. It is therefore not possible to measure exposure going further back in time.

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Our measure thus includes all mortgages with a down payment less than the 9.9 percent threshold. See Section 3 for further explanation.

with low HTB exposure, the share of low-down payment mortgages purchased during the HTB period is close to zero percent, while in high exposure areas it is much higher (with a maximum of around 28 percent). Finally, Figure A.3 shows that the exposure measure also accurately predicts time variation. Both the number and share of low-down payment mortgages show similar trends prior to the introduction of HTB in high and low exposure areas. But high exposure areas see a small uptick in 2013 and experience a sharp relative increase when both schemes came into full effect.

## 5.2 Covariates

Our identification strategy compares outcomes in districts with *many* potential low-down payment home buyers versus districts with *few* potential low-down payment home buyers. Thus, our identifying assumption is that home purchases by (different types of) first-time buyers would have a similar evolution across all districts in the counterfactual scenario in which no change to the down payment requirement took place.

A potential concern with this identification strategy is that high exposure districts might differ in ways that could independently impact housing market activity. Indeed Tracey and Van Horen (2021) show that HTB exposure is not random and positively correlated with the unemployment rate and population and negatively correlated with income levels, rents and house prices. It is important to note that these correlations do not necessarily imply the existence of a significant bias of our estimates either upwards or downwards.

We take careful measures to mitigate concerns regarding alternative explanations. First, we include district-level fixed effects in all specifications to control for any time-invariant differences between districts. Second, we include region-by-time fixed effects to account for variations across UK regions in the recovery after the global financial crisis.<sup>22</sup> Third, we include as controls a number of macroeconomic and housing market district-level variables: median income, unemployment, average house price and population. These variables are measured in 2008 and interacted with year dummies. We consider 2008 values to ensure these variables are entirely unaffected by the program and outside of our estimation window. Additionally, we explicitly test for parallel trends in the pre-event

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<sup>22</sup>In our main analysis we use NUTS2 regions, but our results are also robust to using the broader NUTS1 regions.

period and examine whether the observed difference in trends coincides with the timing of HTB.

Finally, in various parts of our analysis we exploit heterogeneity either within mortgage or buyer-type which allow us to include district-by-time fixed effects. This approach ensures that we eliminate any differences in time-trends at the district level. We note that our analysis allows for differences in the evolution in house sales across districts with higher and lower shares of potential low-down payment buyers that are not due to the relaxation of the down payment constraint, as long as these differences are, controlling for other observables, roughly constant over time during our sample period.

### 5.3 Estimating financial support

We use the PSD to calculate the indicator variable “*Financial support*” for each first-time buyer mortgage transaction. The underlying idea is that under some (conservative) assumptions one can identify those mortgages for which it is highly unlikely that, based on their age and income, the (first-time) buyer independently financed the entire down payment. We determine the likelihood that a first-time buyer financed their entire down payment by comparing their actual down payment with an estimate of their “*potential down payment savings*”, which is given by:

$$\text{Potential down payment savings} = \text{income} \times \text{savings rate} \times (\text{age} - 20) \quad (1)$$

We make the following three key assumptions to estimate Equation 1:

1. We assume that the first-time buyer’s “*income*”, which is taken as their gross income from the PSD information, has been constant since the age of 20. This is a very conservative assumption given that income tends to increase with age.
2. We assume that the savings rate is 23.9 percent, which is the highest savings rate recorded for the UK. UK households saved 23.9 percent of their income in the second quarter of 2020, during the first “lockdown” associated with the Covid-19 pandemic. That is, when households were forced to cut spending on non-essential items such as outside entertainment and restaurants.

3. We assume that first-time buyer’s have been working since the age of 20.

All three assumptions that underpin the “*potential down payment savings*” are very conservative and so should provide use with an upper bound estimate. We give “*Financial support*” a value one when the *potential down payment savings* are lower than the actual down payment. To the best of our knowledge, ours is the first estimate of whether the buyer received financial support applicable to administrative mortgage data and covers the universe of mortgages.

Using this (conservative) measure of financial support some interesting stylized facts emerge. One, our conservative estimates indicate that in the years prior to HTB approximately 20 percent of first-time buyers (likely) relied on financial support. Two, we observe a very strong negative correlation between buying a home with financial support and household income for first-time buyers in the UK (Figure 1).<sup>23</sup> Over 50 percent of first-time buyers in the lowest quintile of the income distribution (likely) received financial support, in the highest income quintile the share drops to close to 5 percent, consistent with the idea that receiving a wealth transfer significantly reduces borrowing constraints. Three, households without financial support rely much more on low-down payment mortgages compared to those without financial support (Figure 2). Again a strong signal that access to financial support reduces borrowing constraints.

## 6 Results

### 6.1 The Effect on Homeownership

To examine the impact of lowering the down payment requirement on first-time buyer sales, we estimate the following panel regression model:

$$Y_{d,t} = \sum_{s \neq 2012} \mathbb{I}_{t=s} \times \text{Exposure}_d \times \beta_s + \gamma \text{District}_{d,t} + \theta_{r,t} + \delta_d + u_{d,t} \quad (2)$$

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<sup>23</sup>Using survey data from the 80s and 90s, Engelhardt and Mayer (1996) document a similar negative relationship for the US and Cox (1990) shows that US households with low current income and high permanent income were significantly more likely to have received transfers.



where  $d$  indexes a district and  $t$  is the year. The dependent variable  $Y_{d,t}$  is First-time Buyers $_{d,t}$ , which equals the number of home purchases by first-time buyers in a given year and district.  $Exposure_d$  is our measure of *ex ante* exposure to the HTB program. **District** $_{d,t}$  is a vector of district-level pre-policy control variables that are interacted with yearly time dummy variables; these include (the log of) 2008 year-end values for: median income, the unemployment rate, population, and average house prices. The specification further includes region-by-time fixed effects,  $\theta_{r,t}$ , and district fixed effects,  $\delta_d$ .<sup>24</sup> We cluster the standard errors by district. We estimate the model over the period 2009 to 2016 and the year 2012 is taken to be the base year. We end the sample period in 2016 as by the end of 2016 the MG scheme was deactivated as the market for low-down payment mortgages had been reestablished.

The model described by Equation 2 provides a series of coefficient estimates  $\beta_s$  that illustrate the time dynamics of the effect of HTB on first-time buyer home sales. Panel A of Figure 4 presents estimates from Equation 2 where the pre-policy control variables are excluded from the estimation. Panel B presents estimates that include the pre-policy control variables. In both cases, we observe very similar trends in first-time buyer home purchases in the years prior to the start of HTB. A clear divergence of trends emerges in more exposed areas when the policy came into full effect and the minimum down payment was effectively lowered to 5 percent. This divergence in trends persisted throughout the entire HTB period. The pattern thus corresponds exactly with the timing of the program. These findings are in line with Tracey and Van Horen (2021) and show that lowering the down payment requirement had a positive impact on the number of first-time buyers being able to purchase a home.

If the observed differential increase in first-time buyers in high exposure districts is a direct consequence of relaxing the down payment constraint, then we should also observe that the vast majority of these homes are purchased with a 5 percent down payment. To test this, we exploit the discrete interest rate jumps that occur at the 5 and 10 percent thresholds for UK mortgages and we estimate the following difference-in-differences version of Equation 2:

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<sup>24</sup>The “region” represents the broader NUTS2 regions, and “district” represents the granula local authority district regions.

$$\begin{aligned}
Y_{d,t,p} = & \beta_1 \text{Pre}_t \times \text{Exposure}_d + \beta_2 \text{Post}_t \times \text{Exposure}_d \\
& + \beta_3 \text{Post}_t \times \text{Exposure}_d \times \text{Down Payment}_p \\
& + \beta_4 \text{Post}_t \times \text{Down Payment}_p + \beta_5 \text{Exposure}_d \times \text{Down Payment}_p \\
& + \gamma \text{District}_{d,t} + \theta_{r,t} + \delta_d + u_{d,t,p}
\end{aligned} \tag{3}$$

where  $d$  indexes a district,  $t$  is the year. The dependent variable  $Y_{d,t,p}$  equals the number of mortgaged first-time buyer home purchases within a down payment size category in a given year and district.  $\text{Pre}_t$  is a dummy variable equal to 1 for the period 2009 to 2011, and zero otherwise.  $\text{Post}_t$  is a dummy variable equal to 1 for the period 2013 to 2016, and zero otherwise.  $\text{Down Payment}_p$  is a dummy variable for three different down payment buckets (5%, 10% and 15+%). The model is estimated over the period 2009 to 2016, where 2012 is the base year. The other variables and model specifications are the same as in Equation 2.

Table 2 presents the results. In column 1, we estimate the model but keep  $\beta_2$  constant across the different categories. This captures the average effect of lowering the down payment requirement on first-time buyer home sales with different down payment sizes. As expected, the effect is positive and significant. In column 2 we allow the impact to vary over the different down payment size categories. The triple interaction term for homes purchased with a 5 percent down payment has by far the largest positive and significant coefficient estimate. These results show that the increase in first-time buyers in more HTB exposed districts is primarily driven by homes purchased with a low-down payment. The triple interaction term for homes purchased with a down payment of 10 percent is also positive and significant, but the estimate is significantly smaller in magnitude relative to the 5 percent down payment term. This likely reflects the fact that some mortgages bought under the MG or EL scheme had a somewhat larger down payment than the minimum of 5 percent (Benetton et al., 2021). Importantly, the double interaction is insignificant indicating no impact on other down payment sizes.

In addition to validating that the increase in home sales in high exposure areas is driven by home purchases with a low-down payment, this analysis also allows us to include district-by-time fixed effects and thus to control for all time-(in)variant differences across districts. In other words, we isolate the impact of relaxing the down payment constraint purely from within-district heterogeneity. Column 3 shows that the results are hardly affected by including district-by-time fixed effects, reducing concerns that the patterns we document are driven by differential district-trends. Finally we examine whether these results hold when we exclude the London area. The London housing market has some distinct features

compared to those in other parts of the country. For example, international and buy-to-let investors are much more dominant in London. We reassuringly see that the estimates for  $\beta_2$  and  $\beta_3$  remain highly significant and even become slightly larger (column 4).

To estimate the aggregate, economy-wide increase in homeownership that can be attributed to the lowering of the down payment requirement we use the estimates of Equation 2.<sup>25</sup> We use an approach similar to that of Berger et al. (2020) and Mian and Sufi (2012), where we treat the district with the minimum HTB exposure as the control group.<sup>26</sup> We calculate for each district the additional homes purchased by first-time buyers over the period 2013 to 2016, as implied by the estimate of  $\beta_s$ . This is done by multiplying the coefficient by each district’s HTB exposure minus the control district HTB exposure. We then sum the number of home sales for all districts to get the total aggregate effect in a given year.<sup>27</sup> We estimate that approximately 195,000 households could become a homeowner due to the relaxation of the down payment requirement. This implies that lowering the minimum down payment to 5 percent increased home ownership by 24.6 percent during the HTB period.<sup>28</sup>

## 6.2 The Effect on Housing Wealth Inequality

Having established that lowering the down payment requirement has a significant positive impact on homeownership, we now turn our focus on which types of first-time buyers benefited and how housing wealth inequality is affected. We first start with some non-parametric evidence. Table 1 shows some basic statistics on how lowering the down payment affected the characteristics of first-time buyers. A few facts are worth highlighting. Comparing the pre-HTB and the post-HTB period, the average annual number of home purchases by first-time buyers increased for every income quintile group. The relative increase was the largest for the lowest income quintile group while the absolute

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<sup>25</sup>This number does not represent an aggregate general-equilibrium effect as due to our empirical design we cannot capture any economy-wide indirect effects of the intervention.

<sup>26</sup>Our identifying assumption is thus that districts with very low potential low-down payment buyers were not affected by the relaxation of the down payment constraint,

<sup>27</sup>For a given year, this is equivalent to:  $\sum_d (\beta_2 \times (\text{Exposure}_d - \text{Exposure}_{min}))$ , where  $d$  indexes a district.

<sup>28</sup>As highlighted by Berger et al. (2020), this is a lower-bound estimate. If we treat zero-exposure as the control group and so assume that the minimum HTB exposure group also responds to the program, our estimate becomes 351,200 home purchases, which is equivalent to a 16.8 percent increase.

increase was the largest for the highest income quintile group. The table also shows that the average “*Financial support*” decreased from 21 percent in the pre-HTB period to 18 percent in the post-HTB period. The reduction in use of financial support happened across all income quintiles.

Next we formally investigate whether lowering the down payment requirement affected the income distribution of first-time buyers. To do so, we estimate a modified version of Equation 3 by replacing  $\text{Down Payment}_p$  in the triple (and double) interaction term with  $\text{Income Quintile}_i$ . The dependent variable  $Y_{d,t,i}$  now equals the number of first-time buyer mortgaged home purchases within an income group in a given year and district.  $\text{Income Quintile}_i$  is a series of dummy variables that correspond to the district-level income quintiles of buyers measured in 2012. We use a localized income distribution, rather than the national distribution, to account for regional differences across the UK.

Table 3 presents the results. In column 1, we estimate the model but keep  $\beta_2$  constant across the income buckets. This captures the average effect of lowering the down payment requirement on home purchases by first-time buyers in different income quintiles. As expected, the effect is positive and significant. In column 2 we allow the impact to vary over the different income quintiles. The double interaction and all the triple interaction terms are positive and significant, indicating that first-time buyers in all income groups benefit from the policy change, but those in the higher income quintiles benefit more. When comparing the different estimates of  $\beta_3$ , we see that they become increasingly larger. In other words, first-time buyers with higher incomes reacted more strongly. These results remain largely unchanged by including district-by-time fixed effects (column 3). They also remain when we exclude London districts (column 4). Interestingly in this specification the parameter for the highest income quintile becomes somewhat smaller.

We estimate the aggregate, economy-wide increase in homeownership that can be attributed to the lowering of the down payment requirement for the various income quintiles. In the first income quintile, an additional 21,900 households were able to transition into homeownership (14 percent increase), in the second quintile, 31,800 households (20 percent increase), in the third quintile 32,800 households (21 percent increase) and in the fourth quintile 40,100 households. Finally, the number equaled 68,900 for households in the fifth quintile (42 percent increase).

At first glance these findings might be surprising. Taken at face value they suggest that lowering the down payment requirement increases housing wealth inequality. However, income is not the only margin that might be changing. Households can build their down

payment by saving out of their own income. But a wealth transfer from a relative or friend can, and frequently is, an important supplement. When the minimum down payment falls, wealth transfers from family or friends become less important, making it easier for households without access to financial support to purchase a home. If this happens housing wealth inequality will be reduced by weakening the link between (parental) wealth and homeownership.

To examine whether this is the case, we next investigate whether lowering the down payment requirement affected the likelihood of first-time buyers to have access to financial support to purchase a home. To do so, we estimate another modified version of Equation 3 by replacing  $\text{Down Payment}_p$  in the triple (and double) interaction term with  $\text{Financial Support}_i$ . The dependent variable  $Y_{d,t,i}$  now equals the number of mortgaged home purchases by first-time buyers with or without (likely) financial support in a given year and district.  $\text{Financial Support}_i$  is defined in Section 5.3.

Table 4 presents the results. In column 1, we estimate the model but keep  $\beta_2$  constant across the two types. This captures the average effect of lowering the down payment requirement on home purchases by first-time buyers with and without financial support. As expected, the effect is positive and significant. In column 2 we differentiate between first-time buyers with and without access to financial support. The double interaction is positive and significant, but the triple interaction negative and significant and of similar magnitude as the double interaction. This clearly shows that the main beneficiaries of lowering the minimum down payment are first-time buyers without access to financial support. Such households experienced a sharp increase in homeownership (36 percent rise in aggregate). First-time buyers with access to financial support, barely reacted to the policy change, in line with such households in general opting for mortgages with larger down payments to begin with.

These results remain largely unchanged by including district-by-time fixed effects (column 3). In column (4) we use a less stringent definition of (likely) financial support. This leads to a small drop of the triple interaction (column 4). Results are again hardly affected when we exclude London districts (column 5).

As a final exercise we run the same regression but for the five different income quintiles. Table 5 presents the results. In all income quintiles we observe a positive and significant double interaction and negative and significant triple interaction. This shows that households without financial support benefit in all income groups. However the impact is much larger for the highest income quintile. As first-time buyers without access to financial

support tend to have higher incomes (see Figure 1), the ability of such households to now become a homeowner is an important explanation for the rightward shift of the income distribution. It turns out that it is crucial to take access to financial support into account as well as focusing exclusively on changes in the income distribution can lead to erroneous conclusions about the impact on housing inequality.

## 7 Conclusions

In this paper we examine how a mortgage market intervention aimed at lowering the down payment requirement affects housing inequality. We exploit a large-scale policy intervention in the UK called Help-to-Buy, which prompted a significant relaxation of the minimum down payment requirement from 10 to 5 percent. We create a novel measure of financial support which allows us to examine simultaneously how the policy change affected both the income distribution of first-time buyers and their need for financial support to access the mortgage market.

The intervention proved effective at increasing homeownership; we document a 25 percent increase in first-time buyers. This rise was almost entirely driven by first-time buyers without access to financial support. These first-time buyers tend to have higher incomes, explaining a simultaneous right-ward shift of the income distribution. As parents most often provide financial support, our findings show that housing wealth inequality declined by weakening the link between parental wealth and housing outcomes. They also indicate that considering both income and (parental) wealth is essential to fully capture the impact of mortgage market interventions on housing wealth inequality.

Our results are directly relevant to policymakers who are looking for ways to reduce inequality in homeownership. However, a policy which reduces the down payment requirement can have (long-term) costs as well, which we do not consider. First, due to the intervention more households have high-LTV mortgages. This can make households and the banking system more vulnerable to a sharp economic downturn. Policymakers thus might face an important trade-off: stimulating homeownership versus protecting households and the banking system against future boom-bust cycles. The rationale behind introducing macroprudential policies aimed at curbing household leverage during credit booms is exactly to prevent costly boom-bust cycles from occurring. While the policy intervention that we examine could potentially increase systemic vulnerabilities, this does

not necessarily have to be the case. For example, Berger et al. (2020) show that buyers induced to purchase a home via the First-Time Homebuyer Credit program in the US were not more likely to default than previous or subsequent cohorts of buyers.

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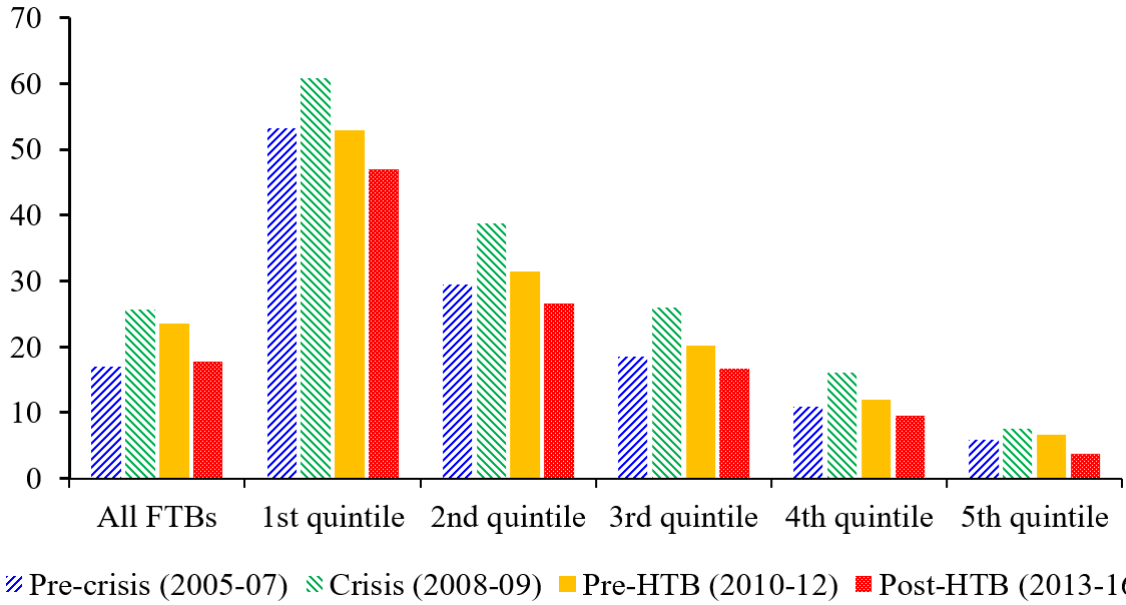
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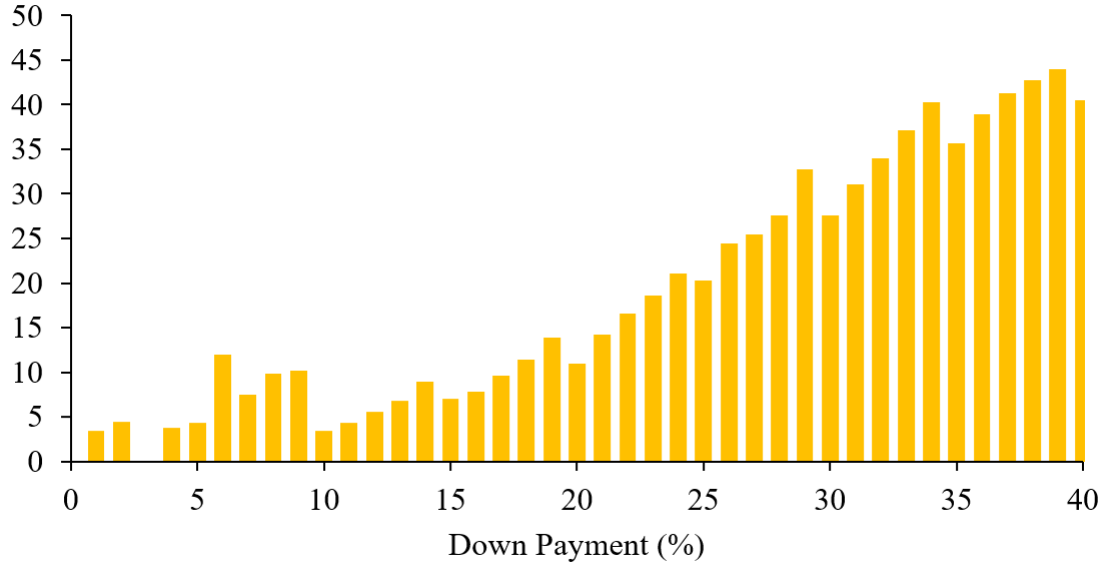
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Figure 1: Financial support by income quintile and time for first-time buyers  
 First-time buyers with likely financial support (%)



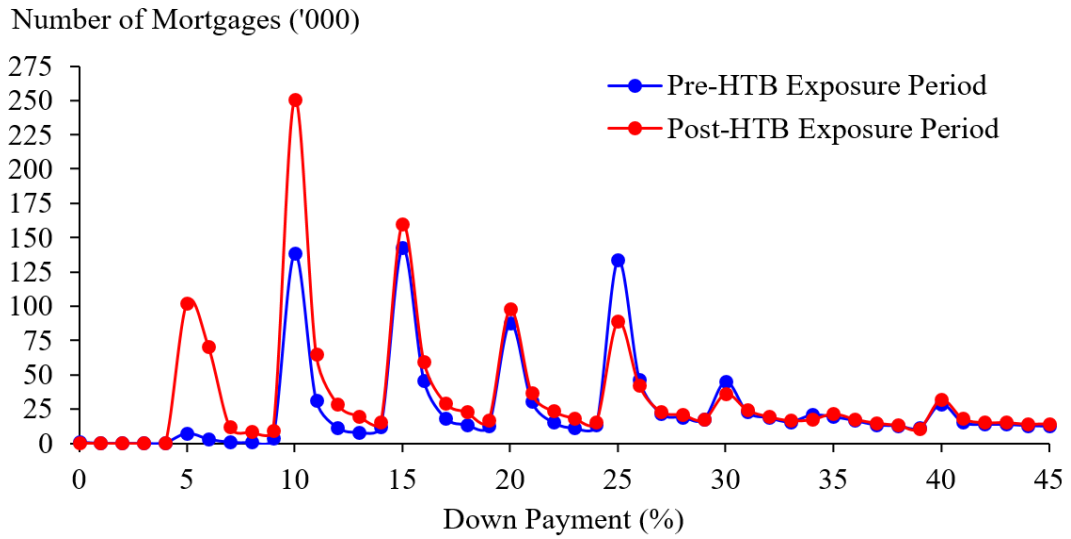
The figure shows how the proportion of first-time buyers with likely financial support varies by time period and by the income quintile of first-time buyers. Financial support” is a dummy variable equal to one when we estimate that it is extremely unlikely that the buyer could have independently financed their complete down payment based on their age and income. The thresholds for first-time buyer income quintiles are calculated at the district level using 2012 data.

Figure 2: Financial support and down payment size for first-time buyers  
First-time buyers with likely financial support (%)



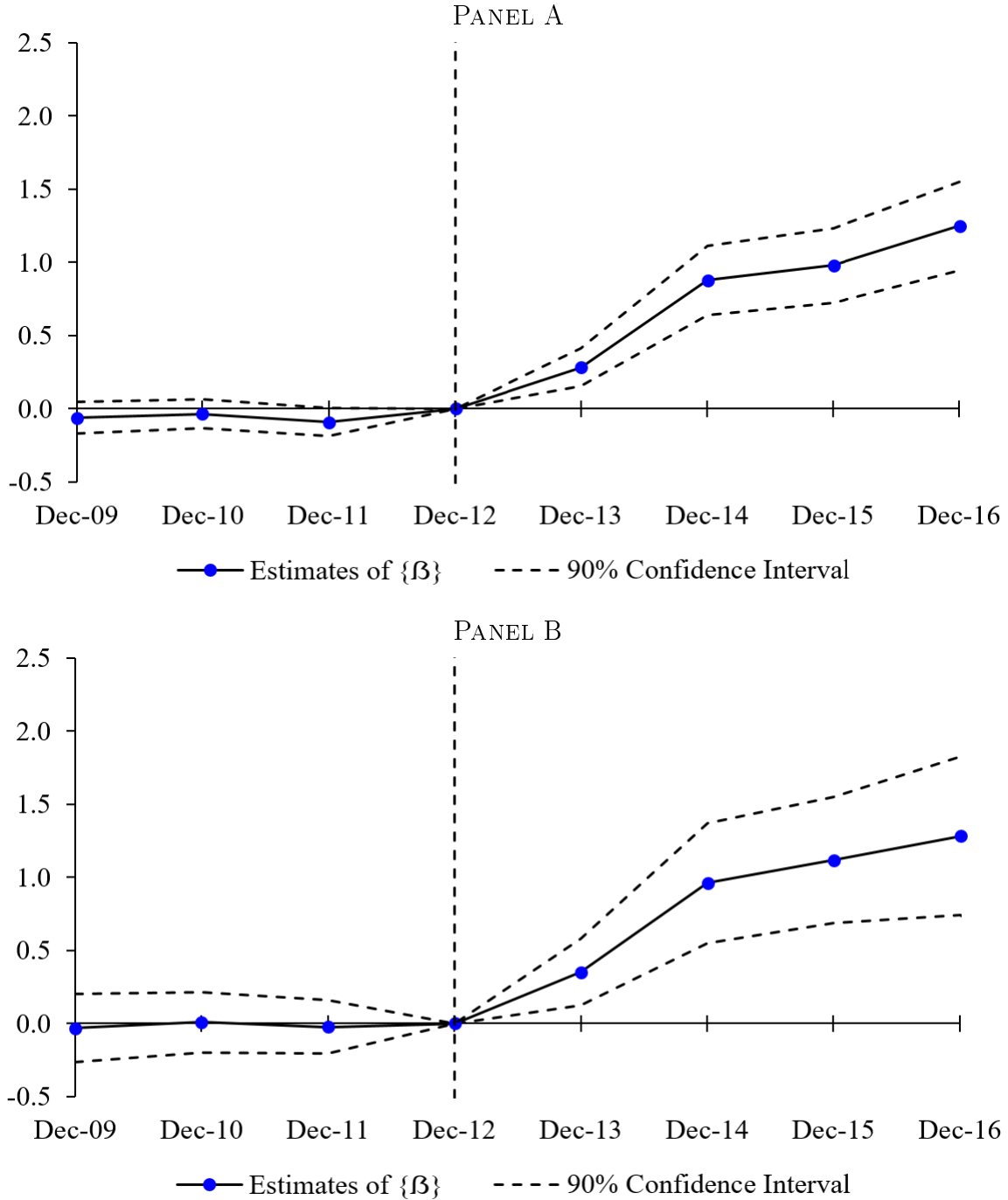
The figure shows how the proportion of first-time buyers with likely financial support varies with the size of a home down payment. “Financial support” is a dummy variable equal to one when we estimate that it is extremely unlikely that the buyer could have independently financed their complete down payment based on their age and income.

Figure 3: Down Payment Distribution Among Mortgages



The figure shows the aggregate number of mortgages by down payment size in the pre-HTB and post-HTB exposure periods. The pre-HTB and post-HTB exposure periods cover 2010 to 2012 and 2013 to 2016, respectively.

Figure 4: The Effect of Help-to-Buy on First-time Buyer Home Sales



The figure presents estimates of  $\beta$  from Equation 2 for each year, where the outcome variable  $\text{Home Sales}_{d,t}$  equals the number of mortgaged home sales for first-time buyers in a given year and district and 2012 is the base year. The dashed lines show the 90 percent confidence interval. All regressions include time-varying district-level controls as well as district and time fixed effects. Panel A presents estimates from a specification with no pre-policy control variables. Panel B presents estimates from a specification that includes pre-policy control variables. Standard errors are clustered at the district level.



Table 1: Lowering the Dow Payment and Housing Inequality

Variable Name (Unit)	Pre Help-to-Buy (2009-2012)						Post Help-to-Buy (2013-2016)					
	All	1st	2nd	3rd	4th	5th	All	1st	2nd	3rd	4th	5th
First-time Buyer Sales	121.7	77.4	98.9	117.8	145.3	169.0	154.3	103.4.4	126.6	148.6	183.0	209.9
	128.5	67.1	85.7	108.8	146.7	179.2	135.9	85.5	105.3	119.8	146.8	175.5
Financial Support (%)	20.6	54.5	32.0	20.5	12.2	6.0	17.8	47.3	27.4	17.7	10.5	4.1
	40.5	49.8	46.7	40.3	32.7	23.8	38.3	49.9	44.6	38.1	30.6	19.9

The table presents some basic summary statistics capturing the characteristics of first-time buyers before and after the down payment requirement was reduced. Summary statistics are reported for both the pre HTB period (from 2009 to 2012) and the post HTB period (from 2013 to 2016). Moreover, summary statistics are reported for all first-time buyer sales, as well as sales broken down into the five categories that correspond to the buyer's income quintiles. For each variable, we report the mean and the standard deviation, which appears directly below the mean value. Summary statistics for First-time Buyer Sales are computed at the district-year-income quintile level. Summary statistics for the other two variables are computed at the loan-level.

Table 2: The Effect of Help-to-Buy on First-time Buyer Home Sales by Down Payment

	First-time Buyer Mortgages by Down Payment Size			
	All	All	All	Excl.
	Districts	Districts	Districts	London
	(1)	(2)	(3)	(4)
$\text{Pre}_t \times \text{Exposure}_d$	-0.000 (0.034)	0.001 (0.035)		
$\text{Post}_t \times \text{Exposure}_d$	0.314*** (0.072)	-0.016 (0.084)		
$\text{Post}_t \times \text{Exposure}_d \times \text{Down Payment}_{10\%}$		0.229*** (0.047)	0.229*** (0.046)	0.331*** (0.035)
$\text{Post}_t \times \text{Exposure}_d \times \text{Down Payment}_{5\%}$		0.760*** (0.078)	0.758*** (0.077)	0.870*** (0.070)
<i>Control Variables</i>				
$\text{Post}_t \times \text{Down Payment}_i$	No	Yes	Yes	Yes
$\text{Exposure}_d \times \text{Down Payment}_i$	No	Yes	Yes	Yes
Pre-policy Controls $\times$ Time Fixed Effects	Yes	Yes	No	No
<i>Fixed Effects</i>				
District	Yes	Yes	No	No
Down Payment	Yes	Yes	Yes	Yes
Region $\times$ Time	Yes	Yes	No	No
District $\times$ Time	No	No	Yes	Yes
<i>Model Statistics</i>				
$N$	8,993	8,993	8,993	8,226
$R^2$	0.681	0.694	0.590	0.660

The table presents coefficient estimates for Equation 3 for the period 2009 to 2016, and shows the effect of HTB on first-time buyer mortgages by down payment size. Pre is a dummy variable equal to 1 for the period 2009 to 2011. Post is a dummy variable equal to 1 for the period 2013 to 2016. The base year is 2012. Exposure equals the number of low-down payment mortgages in a district in the period 2005 to 2007 divided by the total number of mortgages in 2005 to 2007. The dependent variable is the number of first-time buyer mortgages within an down payment bucket in a given district and year. All regressions include all districts, except column 4, which exclude all London districts. “District” refers to the more granular local authority districts. “Region” refers to the broader NUTS2 regions in the U.K. Standard errors are clustered at the district level and are shown in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent and 10 percent confidence level, respectively.

Table 3: The Effect of Help-to-Buy on First-time Buyer Home Sales by Income Group

	(1)	(2)	(3)	(4)
$Pre_t \times Exposure_d$	-0.003 (0.020)	-0.003 (0.020)		
$Post_t \times Exposure_d$	0.186*** (0.043)	0.104** (0.045)		
$Post_t \times Exposure_d \times$ Income Quintile 2		0.047*** (0.013)	0.047*** (0.013)	0.050*** (0.014)
$Post_t \times Exposure_d \times$ Income Quintile 3		0.052*** (0.019)	0.052*** (0.019)	0.062*** (0.019)
$Post_t \times Exposure_d \times$ Income Quintile 4		0.086*** (0.030)	0.086*** (0.030)	0.087*** (0.029)
$Post_t \times Exposure_d \times$ Income Quintile 5		0.223*** (0.048)	0.223*** (0.047)	0.182*** (0.039)
<i>Control Variables</i>				
$Post_t \times$ Income Quintile <sub><i>i</i></sub>	No	Yes	Yes	Yes
$Exposure_d \times$ Income Quintile <sub><i>i</i></sub>	No	Yes	Yes	Yes
Pre-policy Controls $\times$ Time	Yes	Yes	Yes	No
<i>Fixed Effects</i>				
District	Yes	Yes	No	No
Income Quintile	Yes	Yes	Yes	Yes
Region $\times$ Time	Yes	Yes	No	No
District $\times$ Time	No	No	Yes	Yes
<i>Model Statistics</i>				
<i>N</i>	15,000	15,000	15,000	13,720
<i>R</i> <sup>2</sup>	0.880	0.897	0.942	0.909

The table presents coefficient estimates for an adapted version of Equation 3 for the period 2009 to 2016, and shows the effect of HTB on first-time buyer mortgages by buyer income quintile. Pre is a dummy variable equal to 1 for the period 2009 to 2011. Post is a dummy variable equal to 1 for the period 2013 to 2016. The base year is 2012. Exposure equals the number of low-down payment mortgages in a district in the period 2005 to 2007 divided by the total number of mortgages in 2005 to 2007. The dependent variable is the number of first-time buyer mortgages (i.e. mortgaged home sales) in a given district, year and income quintile group. Income Quintile *i*, is a dummy variable equal to 1 for the first-time buyer mortgages that belong to income quintile *i*. The thresholds for the buyer income quintiles are calculated at the district-level and based on 2012 data, the year prior to the introduction of Help-to-Buy and the “base year” of the regressions. All regressions include all districts, except column 4, which exclude all London districts. “District” refers to the more granular local authority districts. “Region” refers to the broader NUTS2 regions in the U.K. Standard errors are clustered at the district level and are shown in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent and 10 percent confidence level, respectively.

Table 4: The Effect of Help-to-Buy on First-time Buyer Home Sales by Financial Support

	(1)	(2)	(3)	(4)	(5)
$\text{Pre}_t \times \text{Exposure}_d$	-0.007 (0.051)	-0.007 (0.051)			
$\text{Post}_t \times \text{Exposure}_d$	0.464*** (0.110)	1.073*** (0.130)			
$\text{Post}_t \times \text{Exposure}_d \times \text{Support}$		-1.217*** (0.139)	-1.217*** (0.135)	-1.174*** (0.127)	-1.213*** (0.142)
<i>Control Variables</i>					
$\text{Post}_t \times \text{Support}$	No	Yes	Yes	Yes	Yes
$\text{Exposure}_d \times \text{Support}$	No	Yes	Yes	Yes	Yes
Pre-policy Controls $\times$ Time	Yes	Yes	No	No	No
<i>Fixed Effects</i>					
District	Yes	Yes	No	No	No
Support	Yes	Yes	Yes	Yes	Yes
Region $\times$ Time	Yes	Yes	No	No	No
District $\times$ Time	No	No	Yes	Yes	Yes
<i>Model Statistics</i>					
$N$	6,000	6,000	6,000	6,000	5,488
$R^2$	0.736	0.806	0.676	0.766	0.655

The table presents coefficient estimates for an adapted version of Equation 3 for the period 2009 to 2016, and shows the effect of HTB on first-time buyer mortgages by financial support. Pre is a dummy variable equal to 1 for the period 2009 to 2011. Post is a dummy variable equal to 1 for the period 2013 to 2016. The base year is 2012. Exposure equals the number of low-down payment mortgages in a district in the period 2005 to 2007 divided by the total number of mortgages in 2005 to 2007. The dependent variable is the number of first-time buyer mortgages (i.e. mortgaged home sales) in a given district, year and financial support group. “Support” is a dummy variable equal to 1 when we estimate that it is extremely unlikely that the buyer could have independently financed their complete down payment based on their age and income. Column 4 reports estimates where we use less a less stringent definition of likely financial support. All regressions include all districts, except column 5, which exclude all London districts. “District” refers to the more granular local authority districts. “Region” refers to the broader NUTS2 regions in the U.K. Standard errors are clustered at the district level and are shown in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent and 10 percent confidence level, respectively.

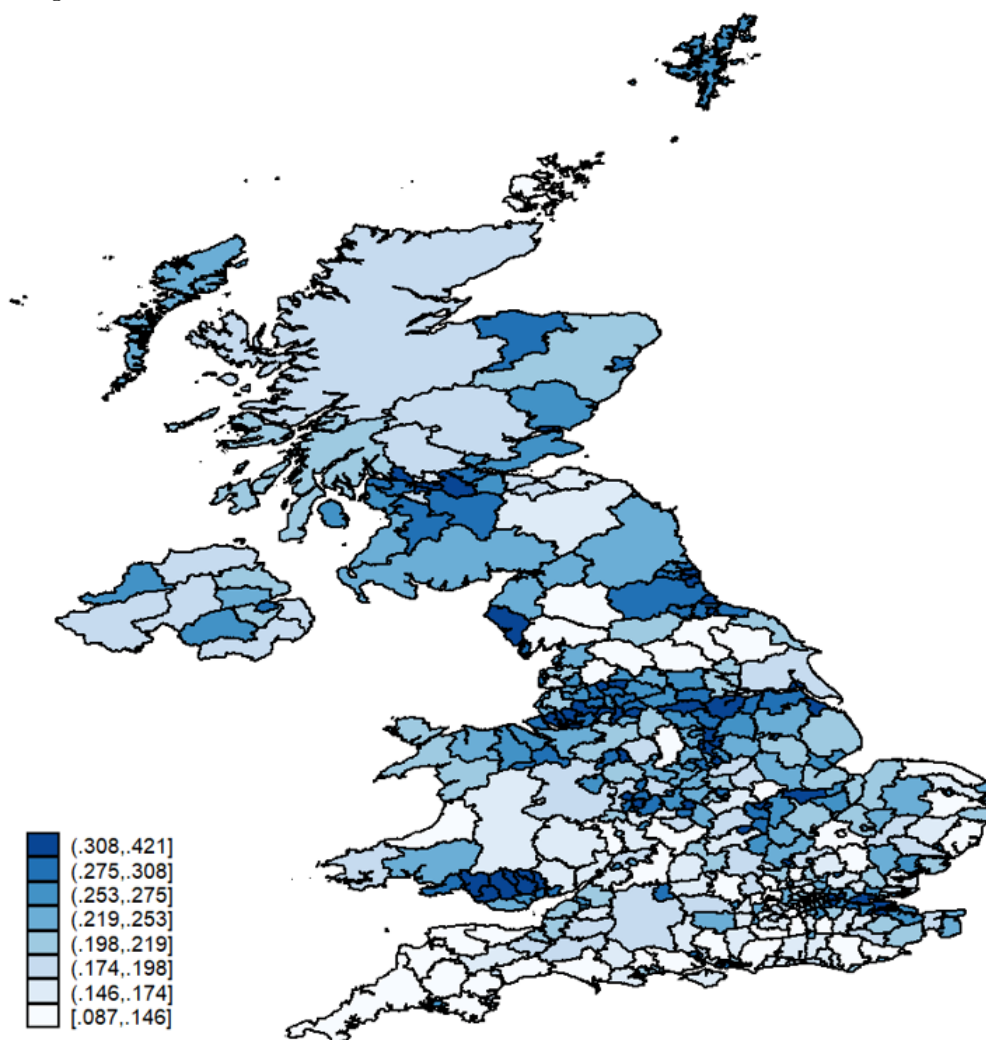
Table 5: The Effect of Help-to-Buy on First-time Buyer Home Sales by Financial Support and Income Group

	1st Income Quintile			2nd Income Quintile			3rd Income Quintile			4th Income Quintile			5th Income Quintile		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
$Pre_t \times Exposure_d$	-0.007 (0.019)	-0.007 (0.019)		0.004 (0.014)	0.004 (0.014)		-0.024* (0.014)	-0.024* (0.014)		0.007 (0.016)	0.007 (0.016)		0.014 (0.021)	0.014 (0.021)	
$Post_t \times Exposure_d$	0.024 (0.020)	0.097*** (0.022)		0.069*** (0.023)	0.181*** (0.026)		0.043* (0.023)	0.163*** (0.029)		0.120*** (0.035)	0.239*** (0.042)		0.232*** (0.049)	0.419*** (0.056)	
$Post_t \times Exposure_d \times Support$		-0.146*** (0.020)	-0.146*** (0.019)		-0.223*** (0.027)	-0.223*** (0.026)		-0.241*** (0.032)	-0.241*** (0.031)		-0.239*** (0.036)	-0.239*** (0.035)		-0.374*** (0.051)	-0.374*** (0.050)
<i>Control Variables</i>															
$Post_t \times Support$	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
$Exposure_d \times Support$	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Pre-policy Controls $\times$ Time	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
<i>Fixed Effects</i>															
District	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Support	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region $\times$ Time	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
District $\times$ Time	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
<i>Model Statistics</i>															
$N$	5,992	5,992	5,992	5,998	5,998	5,998	5,990	5,990	5,990	5,946	5,946	5,946	5,676	5,676	5,676
$R^2$	0.754	0.805	0.718	0.738	0.800	0.679	0.707	0.765	0.611	0.690	0.749	0.583	0.650	0.722	0.542

The table presents coefficient estimates for an adapted version of Equation 3 for the period 2009 to 2016, and shows the effect of HTB on first-time buyer mortgages by likely financial support for different income groups. Pre is a dummy variable equal to 1 for the period 2009 to 2011. Post is a dummy variable equal to 1 for the period 2013 to 2016. The base year is 2012. Exposure equals the number of low-down payment mortgages in a district in the period 2005 to 2007 divided by the total number of mortgages in 2005 to 2007. The dependent variable is the number of first-time buyer mortgages (i.e. mortgaged home sales) in a given district, year, financial support group and income quintile group. “Support” is a dummy variable equal to 1 when we estimate that it is extremely unlikely that the buyer could have independently financed their complete down payment based on their age and income. Income Quintile  $i$ , is a dummy variable equal to 1 for the first-time buyer mortgages that belong to income quintile  $i$ . The thresholds for the buyer income quintiles are calculated at the district-level and based on 2012 data, the year prior to the introduction of Help-to-Buy and the “base year” of the regressions. Columns 1-3, 4-6, 7-9, 10-12, 13-15 are estimated only for income quintile 1, 2, 3, 4 and 5, respectively. “District” refers to the more granular local authority districts. “Region” refers to the broader NUTS2 regions in the U.K. Standard errors are clustered at the district level and are shown in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent and 10 percent confidence level, respectively.

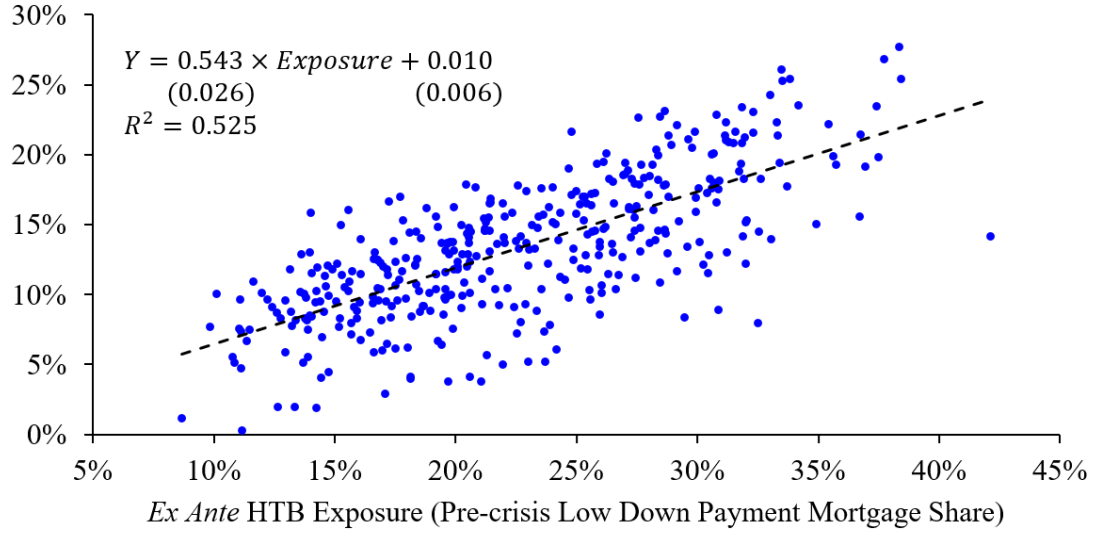
## A Additional Figures and Tables

Figure A.1: Help-to-Buy Exposure across the United Kingdom



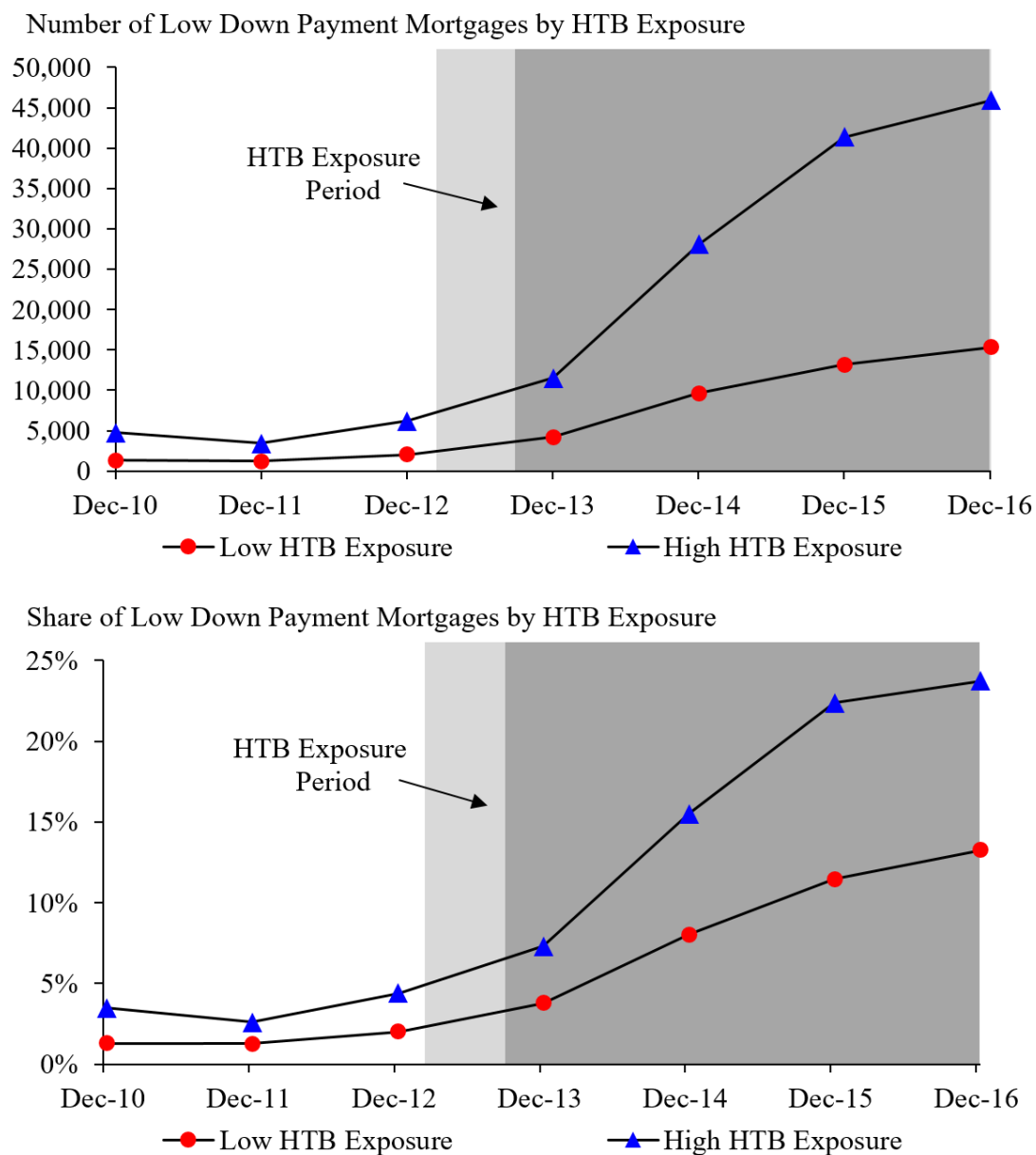
The figure shades local authority districts across the UK by their HTB Exposure. HTB Exposure equals the number of low-down payment mortgages in a district in the period 2005-2007 divided by the total number of mortgages in 2005-2007. Districts with a darker shading have higher exposure. *Source:* Tracey and Van Horen (2021).

Figure A.2: **Help-to-Buy Exposure and Ex Post Low-Down Payment Mortgages**  
*Ex Post* Low Down Payment Mortgage Share ( $Y$ ), 2013-2016



The figure is a scatter plot, which shows the relationship between our measure of HTB exposure and the actual share of low-down payment mortgages ( $Y$ ) over the program period (2013 to 2016) at the district level. The dashed line represents the regression of  $Y$  on *Exposure*, and we report the corresponding equation and  $R^2$  in the figure. The number of low-down payment mortgages is scaled by total number of mortgages purchased in the district over the program period. HTB exposure is defined as the number of low-down payment mortgages in a district in the period 2005-2007 divided by the total number of mortgages in 2005-2007. We include first-time buyer and home-mover mortgages only in all calculations. *Source:* Tracey and Van Horen (2021).

Figure A.3: Evolution Low-Down Payment Mortgages, Low vs High Exposure



The top panel of the figure shows the aggregate number of low-down payment mortgages over the period 2010 to 2016 for low and high HTB exposure districts. The bottom panel shows the weighted average share of low-down payment mortgages (as a proportion of all mortgages excluding remortgages). Low-down payment mortgages include all mortgages with a down payment of 5 percent or less. HTB exposure is defined as the number of low-down payment mortgages in a district over the period 2005 to 2007 divided by the total number of mortgages in 2005 to 2007. Low HTB exposure includes districts with HTB exposure less than the 25th percentile HTB exposure. High HTB exposure includes districts with HTB exposure greater than the 75th percentile HTB exposure. The dark-shaded area indicates the period that both the EL and MG schemes are in effect (October 2013-December 2016). The light-shaded area indicates the period that only the EL scheme is in effect (April 2013-present). We include first-time buyer and home-mover mortgages only in all calculations. *Source:* Tracey and Van Horen (2021).



Table A.1: **The Help-to-Buy Program Requirements**

Requirements	Equity Loan (EL)	Mortgage Guarantee (MG)
Period	Q2 2013 - Q4 2020	Q4 2013 - Q4 2016
Minimum down payment	5%	5%
Government Participation	Government equity loan of 20% (40% in London from 2016)	Government guarantees 20% of mortgage made by lender
Qualifying Property	New builds Value < £600k (£300k in Wales)	Any property Value < £600k
Qualifying Borrowers	First-time buyers and home movers	First-time buyers , home movers and remortgagor
Qualifying Loan	LTI ratio < 4.5 Ratio excludes EL component	LTI ratio < 4.5 Ratio includes MG component

The table describes the requirements for the two main Help-to-Buy program schemes: the Equity Loan (EL) scheme and the Mortgage Guarantee (MG) scheme. The requirements apply to the property, loan features and buyer-types.