

Technical annex: evidence on the FPC's mortgage market Recommendations¹

Section 3 of the December 2021 Financial Stability Report sets out analysis of the impact of the FPC's mortgage market measures on mortgage market access and the risks arising from highly-indebted households, drawing heavily on work by Bank staff. This technical annex provides further details on the analysis and estimates that were used to support the FPC discussions that informed the judgements described in the chapter. It covers three topics:

- [Part 1](#): Trends in the UK housing market and the role of the FPC's measures.
- [Part 2](#): Analysis of the impact that the FPC's measures have had to date.
- [Part 3](#): Simulating the impact of the FPC's measures in a scenario of rapid house price growth.

1: Trends in the UK housing market and the role of the FPC's mortgage market measures

1.1: The UK housing market prior to the introduction of the FPC's measures in 2014

The UK housing market has been characterised by periods of rapid growth in house prices relative to average incomes.

Over the past 50 years the UK housing market has been characterised by periods of rapid house price growth (**Chart 1**). This includes the “Barber boom” that accompanied rapid monetary expansion in the early 1970s, the boom that followed financial liberalisation in the 1980s and the period of prolonged house price growth from the mid-1990s until the global financial crisis (GFC).

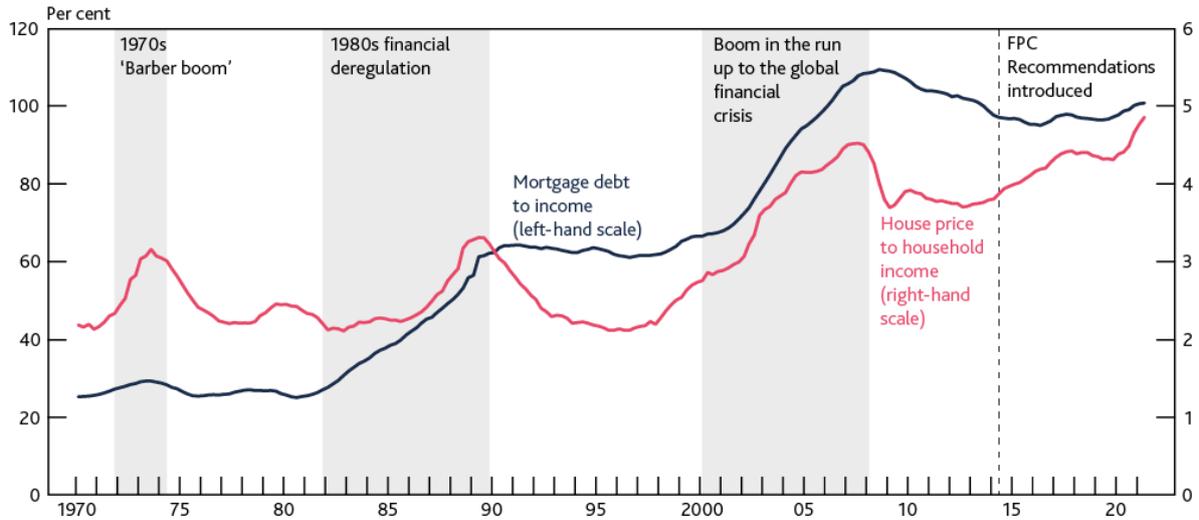
And since the late-1990s this rise in house prices relative to earnings has contributed to falling home ownership and a decline in the number of first-time buyers (FTBs).

The cumulative impact of these periodic housing booms is that house prices have more than doubled relative to earnings over the past 30 years, most of which occurred in the decade preceding the GFC (**Chart 1**). And since the late 1990s the share of households who own their home with a mortgage has fallen, as have overall rates of home ownership (**Chart 2**).

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Chart 1: There have been three periods of rapid house price growth over the past 50 years, accompanied by increases in household indebtedness

Aggregate mortgage debt to income and average house price to earnings ratios

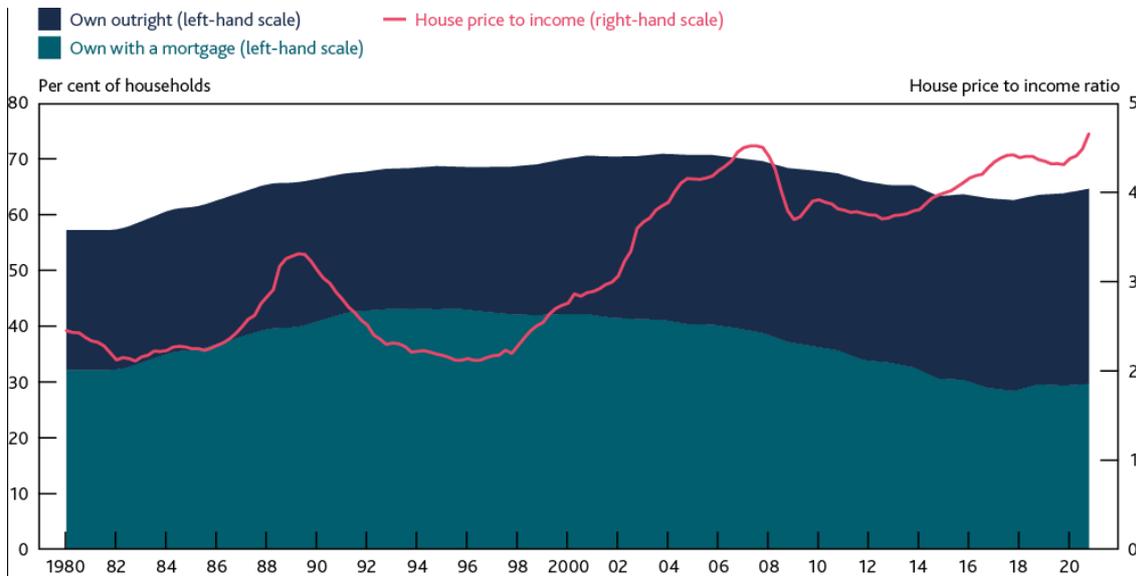


Sources: HM Land Registry, ONS and Bank calculations.

This trend has been driven by a fall in the proportion of younger households who own their own home. Whereas in 1991 about two-thirds of 25-34 year olds were home owners that figure now stands at around two fifths.² The trend reflects, in large part, the fact that rising house prices relative to incomes have increased the deposit needed to get on the housing ladder.

Chart 2: Home ownership fell during the 2000s as house prices rose relative to incomes

Housing tenure as percentage of households and average house price to earnings ratio



Sources: MHCLG, HM Land Registry, ONS and Bank calculations.

² Ministry for Housing, Communities and Local Government. Data on trends from 1984-2008 [here](#); data from 2008-09 to present [here](#).

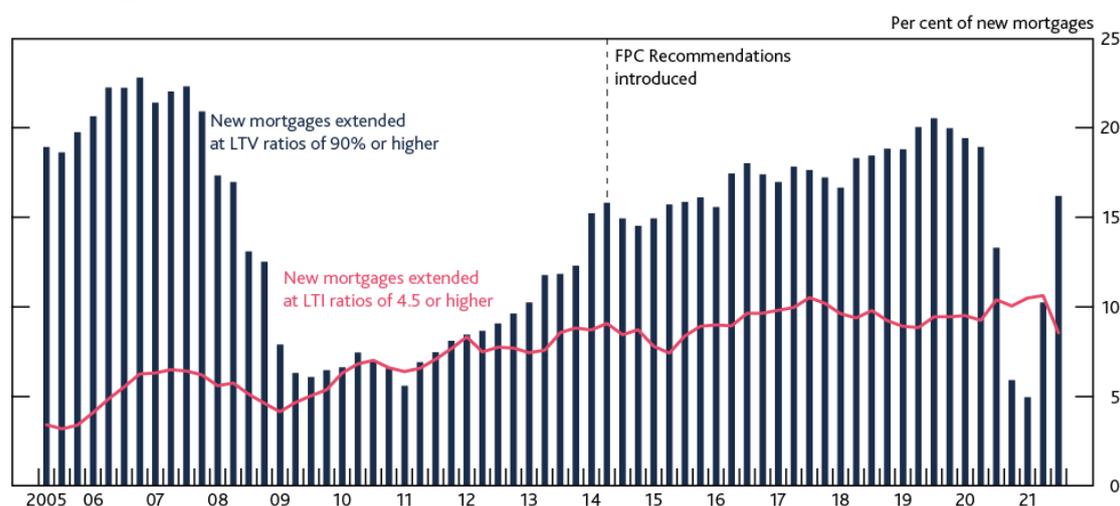
Following financial liberalisation in the 1980s, rising house prices have also been accompanied by an increase in household debt.

The two periods of prolonged increases in house prices since financial liberalisation in the 1980s have been accompanied by a material increase in household debt (**Chart 1**).

Mortgage debt rose sharply relative to disposable income during the 1980s as financial liberalisation increased the availability of mortgages.³ Aggregate household debt increased again during the run-up to the GFC. This period also saw a loosening in underwriting standards, with an increase in the share of mortgages with high loan to value (LTV) ratios and an increase in lending at high loan to income (LTI) ratios (**Chart 3**). As discussed in Section 1.2, evidence suggests that this increase in debt materially worsened the recession that followed.

Chart 3: The share of mortgages with high LTI ratios has not increased significantly since 2014, and the share of lending at high LTV ratios is below its pre-global financial crisis level

Share of mortgages with an loan to income ratio of 4.5 or higher and an loan to value ratio of 90% or higher



Source: FCA Product Sales Database (PSD) and Bank calculations.

Mortgage availability fell sharply during the GFC, leading to a further decline in home ownership.

The housing booms of both the late 1980s and the period between the 1990s and the GFC were followed by busts, when house prices fell. While losses and repossession rates on UK mortgages remained relatively contained during the GFC, in aggregate UK lenders made large losses on other parts of their portfolios and there were capital shortfalls. This led to a sharp contraction in credit availability, especially at higher LTVs as lenders withdrew these products. As a result there was a material and persistent drop off in UK mortgage activity (**Chart 4**).

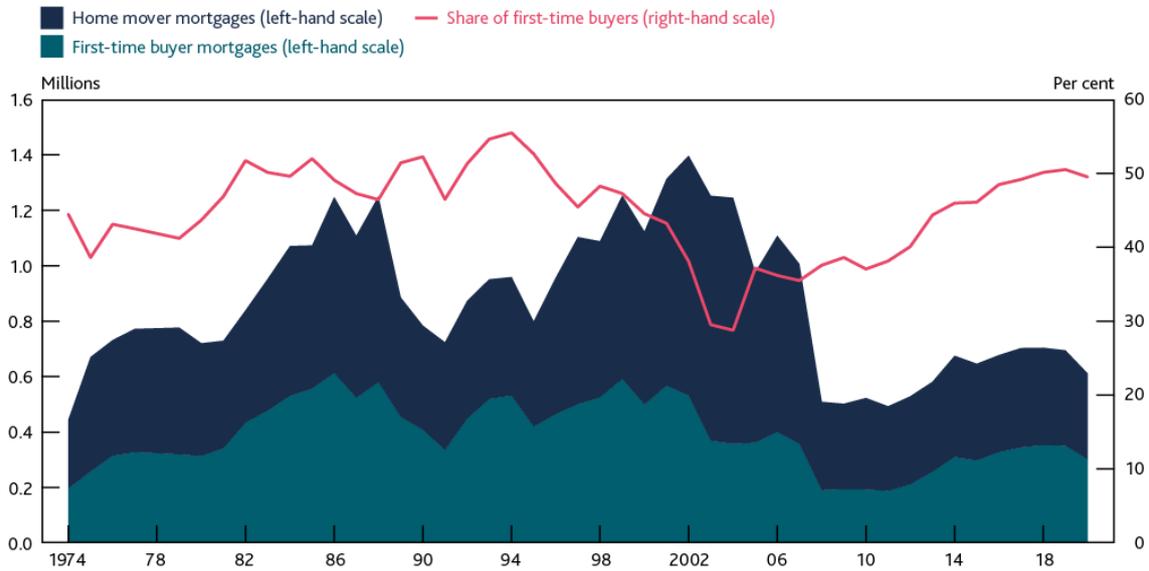
This accelerated the decline in home ownership, as first-time buyers (FTBs) were more likely to be affected by the withdrawal of high LTV products. Whereas the median FTB purchased at a 90% LTV

³In 1980 the removal of the supplementary special deposits scheme – which had restricted banks' ability to lend, enabled banks to expand their activity in the mortgage market, competing with the building societies that had previously dominated the market. See, for example, Bank of England Quarterly Bulletin "[The development of the building societies sector in the 1980s](#)" (1990).

in the early 2000s, that fell to 75% LTV by 2009. The number of mortgage approvals partially recovered between 2009 and 2014, although it remained well below pre-GFC levels.

Chart 4: Mortgage activity fell sharply during the global financial crisis but has partially recovered since

Annual number of mortgages for home movers and first-time buyers



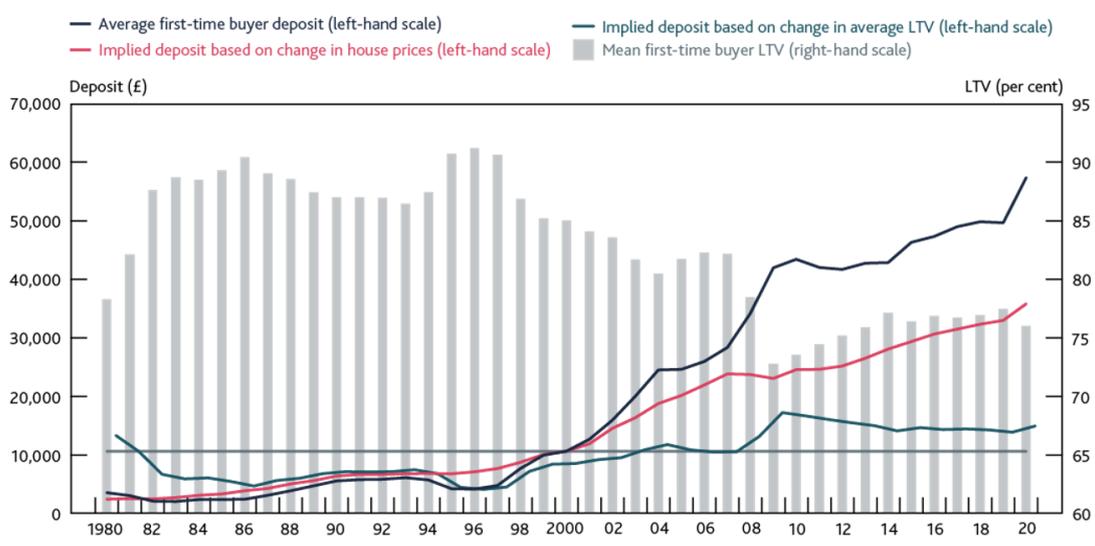
Sources: MHCLG, ONS and Bank calculations.

The average FTB deposit rose sharply before and during the GFC, mainly due to rapid house price growth.

The decline in FTB approvals during the GFC reflected tighter mortgage credit conditions, which increased the deposit required to get a mortgage. But deposit requirements had already been rising rapidly during the early 2000s (Chart 5).

Chart 5: Most of the increase in first-time buyer deposits since 2000 is due to price growth

Average first-time buyer deposit size and LTV ratio over time



Sources: Council of Mortgage Lenders, UK Finance and Bank calculations.

We can decompose the increase in average deposits since 2000 into the impact of house price growth and the impact of changes in the average FTB LTV ratio. The red line in **Chart 5** shows the implied average deposit had the average LTV remained at 85%, as in 2000, but accounting for the increase in house prices over this period. The teal line shows the implied average deposit based on actual average LTVs over this period, assuming that house prices had remained flat. This suggests that about 14% of the increase in average FTB deposits since 2000 can be explained by the fall in average LTVs of FTBs, whereas over 50% is due to house price growth. The remainder is explained by the interaction between the two.

1.2: The role of household debt in exacerbating downturns, including during the GFC

There is a strong body of evidence showing that higher levels of mortgage debt are associated with more severe and prolonged economic downturns.

There is a large body of evidence linking the build-up of household debt to more severe economic downturns. For example, there is cross-country empirical evidence that demonstrates a strong and robust correlation between rapid private sector credit growth and the severity of downturns (e.g. [Bridges et al. 2017](#)). There are also several studies that link household debt accumulation to downturns. Using data for 17 countries from 1870, [Jorda et al. \(2016\)](#) find that mortgage lending is a significant factor in explaining the duration and severity of post-war recessions. In a study of 30 countries since 1960, [Mian et al. \(2017\)](#) find that increases in household debt over a 3 to 4 year period are associated with a subsequent decline in economic growth.

Housing booms preceded more than two thirds of the 46 systemic banking crises across countries for which house price data are available ([Crowe et al. 2011](#)). And research suggests that household credit growth has a statistically significant impact on the left-hand tail of the GDP and consumption growth distributions ([Aikman et al. 2019](#), [Adrian et al. \(forthcoming\)](#)).

This can be due to high levels of household debt leading to defaults and a contraction in the supply of credit...

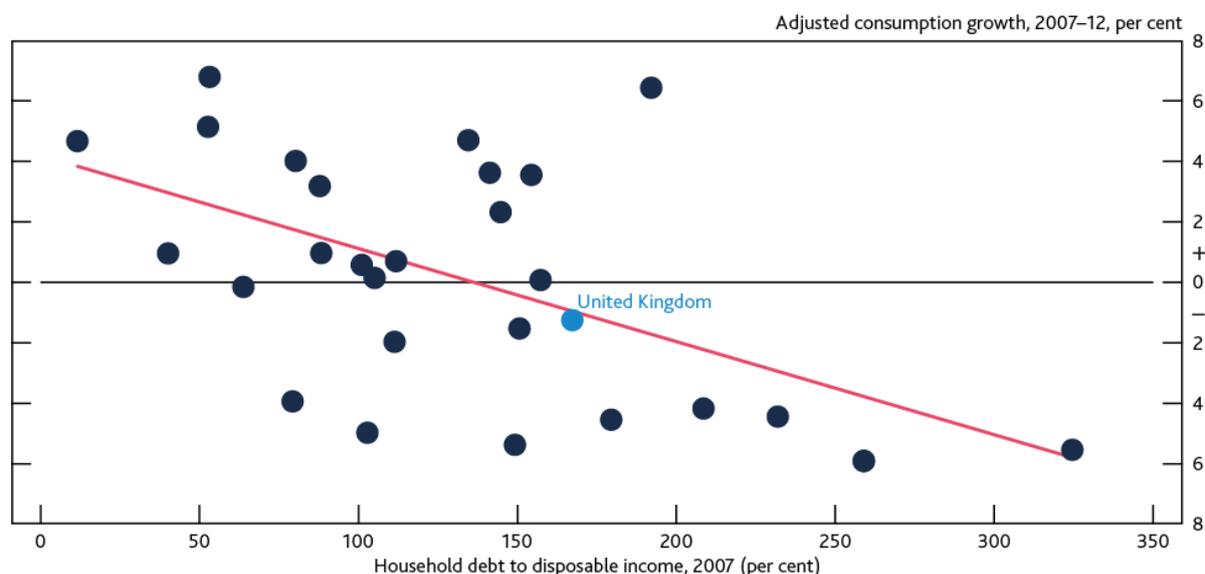
One reason why a rapid accumulation and/or a high level of debt can lead to bigger downturns is that it precipitates a higher level of default when a downturn hits. In particular, there is evidence that rapid credit growth in the run-up to the GFC was associated with higher levels of default in the US. For example, [Mian and Sufi \(2009\)](#) find that US counties with the highest rate of leverage growth experienced a larger increase in the default rate and a sharper decline in house prices. This was followed by a tightening of credit card limits, even as households continued to increase their utilisation of credit cards in order to maintain spending and mortgage payments, particularly in counties that had seen faster leverage growth.

...and also the fact that households with higher levels of mortgage debt are likely to cut consumption by more than other households, exacerbating a shock.

The other channel through which household debt may exacerbate a recession is through its impact on consumption. This is evident in the GFC, both in cross-country data (**Chart 6**) and in household level studies from the UK, US, Norway and Denmark.

Chart 6: Countries with higher household debt saw larger falls in consumption in the global financial crisis

Adjusted consumption growth 2007-12 relative to household debt to income ratio in 2007, for individual countries ^(a) ^(b)



Sources: [Flodén, M \(2014\)](#) and OECD National Accounts.

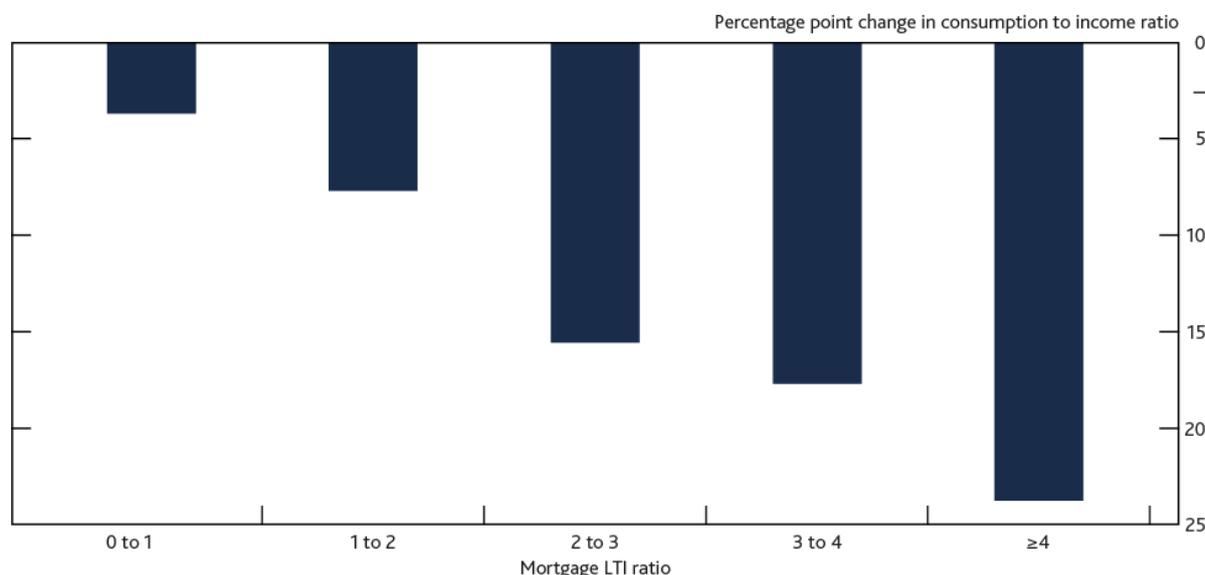
(a) As in [Flodén \(2014\)](#), change in consumption is adjusted for the pre-crisis change in household total debt, the pre-crisis change in consumption and the current account balance as a share of GDP.

(b) Original estimates by Flodén have been updated with revised macroeconomic data from the OECD available as of December 2021.

These studies have found that more highly-indebted households cut their spending more sharply during the GFC ([Chart 7](#)). There are two potential explanations for this effect. Some studies (e.g. [Andersen et al. 2016](#) which covers households in Denmark) have found that rapid growth in household credit was more strongly associated with consumption cuts during the GFC than the level of debt. This is consistent with a “spending normalisation” channel, whereby households who used credit to fund excessive spending ahead of the downturn – perhaps because they had excessively optimistic expectations about their future incomes – then normalised their spending when the downturn hit (and their expectations readjusted). This channel is discussed in more detail in [Svensson \(2021\)](#).

Others have argued that this dynamic reflected the impact of debt on households’ balance sheets and their ability to access credit ([Kovacs et al. 2018](#) and a recent [blog post, Dynan 2013](#) and [Baker 2018](#)). That might be because more highly-indebted households are unable to access additional liquidity and so are forced to cut spending. But it is also possible that households with more debt choose to cut consumption by more as a result of uncertainty about their future incomes (e.g. fear of unemployment) interacting with their debt burdens.

Chart 7: UK households with more debt cut spending by more in the global financial crisis
Change in consumption by LTI bucket from 2007 to 2009 (a) (b) (c)



Sources: Living Costs and Food Survey, ONS and Bank calculations.

(a) Change in average non-housing consumption as a share of average post-tax income (net of mortgage interest payments) among households in each mortgage LTI category between 2007 and 2009. LTI ratio is calculated using secured debt only as a proportion of gross income.

(b) Consumption and income data from the Living Costs and Food Survey data is scaled to match aggregate data in the National Accounts.

(c) Repeat cross-section methodology used and households may have moved between LTI categories between 2007 and 2009.

The evidence does not definitively identify any single metric of household indebtedness as being most clearly associated with consumption cuts by more highly-indebted households.

Collectively, the available evidence does not identify any single metric of indebtedness as being most clearly associated with the likelihood of consumption cuts. These studies suggest that debt servicing ratios (DSRs), LTIs and LTVs are associated with cuts to consumption. There are reasons to believe that all three metrics could be relevant determinants of the extent to which more highly-indebted households cut their spending back by more. For example, DSRs determine the proportion of income left available for spending before a household draws on any savings or borrows more. And households with high DSRs for a sustained period of time are likely to find it more difficult to build up savings that could be used to fund spending if their incomes temporarily fall. Historically, measures of leverage, such as LTIs and LTVs, have been important determinants of the amount of additional credit available to a household. A household with higher leverage going into a shock is likely to find it more difficult to access additional credit to finance spending.

In part, this difficulty in identifying which metric of indebtedness tends to be most closely associated with consumption cuts is likely to reflect the fact that the metrics tend to be correlated across

households – for example, households with high DSRs tend to have high LTIs.⁴ This means that it is difficult to disentangle their impact in the data, particularly when averaging across groups of households, which is the approach taken in some studies.

The precise mechanism by which higher debt transmits to lower consumption cuts following an economic shock is also likely to vary over time and across countries. For example, during the GFC in the UK, the impact of high DSRs mechanically reducing the proportion of income left for spending is likely to have been relatively less important. That is because there is evidence that highly-indebted households cut spending by more, despite the fact that many such households would have seen their DSR fall substantially when Bank Rate was cut by over 500 basis points, and more so than less highly-indebted households on average. Instead, the credit or liquidity constraints faced by households with higher leverage in the run up to the GFC are likely to have played a stronger role.

1.3: The FPC's mortgage market measures

Consistent with the evidence described above, the FPC has identified two channels through which household debt may worsen a downturn:

- **Borrower resilience:** More highly-indebted households are more likely to cut back more sharply on spending, which can in turn deepen the recession;
- **Lender resilience:** Highly-indebted households are more likely to face difficulties making repayments on mortgage and other consumer debt during a downturn. If these translate into defaults and losses on loans, lenders may reduce the general availability of credit, further weakening activity in the wider economy.

These channels do not operate in isolation, but interact to amplify the shock. For example, lower aggregate demand as more highly-indebted households cut back on spending is likely to lead to more defaults on household debt and lender losses via higher unemployment and lower incomes. This in turn is likely to lead to tighter credit conditions, which would exacerbate the consumption cuts. Both channels interact with house prices: lower demand or tighter credit conditions would tend to reduce house prices, reducing the collateral available to support lending to households and firms and worsening the downturn. And if borrowers do default on their mortgages during a downturn, banks are likely to recover a smaller proportion of the outstanding loan from selling the property used to collateralise the mortgage.

The financial stability risks associated with excessive household debt are ultimately due to various externalities.

At the root of these channels lies a mismatch between the privately optimal and the socially optimal level of debt. This is because individual borrowers may take on too much debt and lenders may extend too much credit, without taking into account the risks this poses to other households, other lenders and the wider economy. Households and lenders are likely to have a greater incentive to increase their debt beyond what is socially optimal when house prices rise faster than incomes during housing booms. This is consistent with trends observed during the 1980s – a period of

⁴ A given borrower's LTI and gross DSR are linked by this formula (where r is the mortgage interest rate and t is the mortgage term): $LTI = DSR / \left(r + \frac{r}{(1+r)^t - 1} \right)$.

increased competition in the mortgage market – and in the run-up to the GFC, when house prices rose quickly, credit supply loosened and household debt increased.

There is a strong case for macroprudential policy to intervene to limit household debt.

There is a strong case for macroprudential policy to mitigate the extent to which household debt exacerbates a downturn by constraining the aggregate amount of debt that can be taken on by households before a downturn occurs. And by targeting the underlying externalities more directly, macroprudential mortgage market measures can do so at a lower cost to the wider economy than less targeted measures like monetary policy or capital requirements.

The FPC introduced two measures to limit build-ups of household debt and guard against a deterioration in underwriting standards.

To address the externalities from household debt, the FPC introduced two mortgage market Recommendations (collectively ‘the measures’) in 2014:

- **Affordability test:** This builds on the FCA’s Mortgage Conduct of Business (MCOB) framework, which includes an assessment of affordability under its responsible lending rules. In general terms, the FPC’s Recommendation specifies that lenders should test whether a mortgage is affordable if, at any point over the first five years of the loan, mortgage rates were to be 3 percentage points higher than the contractual reversion rate (usually the lender’s Standard Variable Rate).
- **LTI flow limit:** In general terms, this restricts the share of new lending at or above an LTI of 4.5 to 15% of the flow of a lender’s new lending, implemented on the basis of a rolling four-quarter average.

The MCOB affordability assessment includes a requirement that for mortgages where the interest rate may vary within five years, lenders must test whether the borrower could still afford payments due if interest rates were to rise. In applying this interest rate stress test, lenders must have regard to market expectations and any FPC Recommendation, but must assume interest rates rise by a minimum of 100 basis points. Lenders verify whether prospective borrowers would be able to afford their repayments at this stress rate, taking into account committed expenditure including tax, repayments on other forms of credit and basic household spending.

The policies were intended to reinforce prevailing underwriting standards at the time of their introduction. In 2014, most lenders were applying an affordability stress rate of around 7%, compared with SVRs in the region of 4-4½%. The LTI flow limit was calibrated on the basis of the increased risk of consumption cuts associated with LTIs greater than around 4. The 15% flow limit was intended to accommodate some increase in high-LTI lending, consistent with the MPC’s central scenario, but to serve as a guardrail in case of greater momentum in the housing market.

These policies primarily target the borrower resilience channel. As such, they are a complement to a range of other measures that aim to ensure the resilience of lenders such as the capital framework for banks and the Bank’s stress testing framework.

2: Impact of the FPC's measures since their introduction

2.1: Estimating the impact of the FPC's measures since their introduction

Since the measures were introduced aggregate mortgage approvals and the level of mortgage debt relative to incomes have stabilised...

The FPC's mortgage market measures are designed to guard against a deterioration in underwriting standards that could lead to a significant increase in aggregate household indebtedness and the number of highly-indebted households. Aggregate household debt (excluding student loans) debt relative to income has remained broadly stable since the FPC's measures were introduced in 2014. While house price growth has accelerated during the pandemic, this has not so far been associated with a corresponding increase in household debt (**Chart 1**).

...and the number of mortgage approvals has remained fairly flat, including for FTBs.

In guarding against excessive increases in mortgage debt, the measures might reduce access to the mortgage market for some households. But since the measures were introduced the total number of mortgage approvals – including the number of FTB approvals – has remained fairly flat, at least until the Covid pandemic (**Chart 3** above).

The rate of home ownership has stabilised since 2014, although deposits still present a barrier.

Some of the other trends discussed in **Section 1** have also stabilised since 2014. For example, overall home ownership rates have stopped falling (**Chart 2**). And there has been a small increase in home ownership rates among 25-34 year-olds, from a low point of around 36% to over 40%.

This stability in the home ownership rate and the share of FTBs likely reflects a combination of more muted house price growth between 2014 and early 2020 and a normalisation of credit conditions after the GFC, which has supported affordability. While the average FTB deposit has continued to increase, this growth has been much slower than in the pre-GFC period. This period also saw a decline in interest rates on most mortgage products and increased availability of high LTV mortgage products, supported by government schemes such as Help to Buy. Despite the increased availability of higher LTV products, average LTVs for FTBs were stable between 2014 and early 2020 and remained below levels seen in the late 1990s and early 2000s.

But we need to analyse micro data to examine the role of the FPC's measures underneath these macro trends.

While the aggregate trends suggest that the FPC's measures are unlikely to have had a very large effect on the market, they do not, by themselves, reveal the effect that the measures have had. That is because we do not have information about what would have happened in the absence of the measures. Borrowers and lenders would have taken different actions in that counterfactual, so we cannot infer the impact the measures have had without making assumptions for these actions.

In general, it is not possible to observe directly whether some households would have opted for a larger mortgage in the absence of the measures⁵ or whether some households had mortgage applications rejected or chose not to apply. There has also been a range of other factors influencing the mortgage market over that time period, including changes to the broader macroeconomic environment and other changes in policy like the introduction of Help to Buy, changes to stamp duty thresholds and tax rates and buy-to-let mortgage policy.

Research in [Tripathy et al. \(2020\)](#) is the closest to identifying an appropriate counterfactual. They compare the lending outcomes immediately after the introduction of the LTI flow limit for lenders that started above the 15% limit with those lenders already operating within the limit. The lenders that started above the limit issued fewer ‘high LTI’ mortgages after the policy was introduced, as would be expected.⁶ This led to a reduction in mortgage credit for lower income borrowers in local areas more exposed to these lenders and lowered house price growth to some extent. But as the authors note, this identification strategy is only valid for identification of the effects immediately after the introduction of the FPC’s measures. It loses power over time as borrowers are able to switch lenders, and lender practices and the housing market change. It is also unable to distinguish impacts that result from the LTI flow limit and from the affordability test.

Therefore, in order to attempt to gauge the effect that the FPC’s mortgage market measures might have had since 2014 we have conducted a number of analytical exercises, drawing on household surveys and regulatory mortgage market data. In particular, we use data from the FCA Product Sales Database (PSD). The PSD contains detailed loan-level information on all regulated mortgages originated in the UK and on the stock of outstanding mortgages.

2.2: The impact of the LTI flow limit on recent mortgagors

There remains a significant degree of headroom below the 15% LTI flow limit in aggregate.

When the FPC introduced the measures in 2014, their central expectation was that – in the absence of policy – the share of mortgage lending at LTI ratios of 4.5 or higher would have risen to around 15% within three years given the MPC’s central projection for the economy at that time. Between 2014 and 2017, house prices and secured lending grew more or less in line with the MPC’s projection, but the share of ‘high LTI’ lending remained below 10%. House price to income ratios have continued to grow slowly since then and, in 2021, annual house price inflation reached its highest rate since the GFC. However, the share of lending above an LTI of 4.5 has remained at around 10% since 2017 and has never exceeded 11% (**Chart 8**). This suggests that, in aggregate, there is headroom that would allow lenders to increase their ‘high LTI’ lending closer to the 15% flow limit.

Some lenders are close to the 15% limit, which implies the LTI flow limit is unlikely to present a direct barrier to increasing the share of ‘high LTI’ lending in aggregate.

There is significant heterogeneity across lenders in terms of their shares of ‘high LTI’ lending and the degree of headroom against the 15% limit. Some major lenders have operated with shares that are well below the 15% limit. For those lenders, there is no reason why the FPC’s LTI flow limit alone

⁵ Some households might have also opted for a different type of mortgage, for example with a shorter term length.

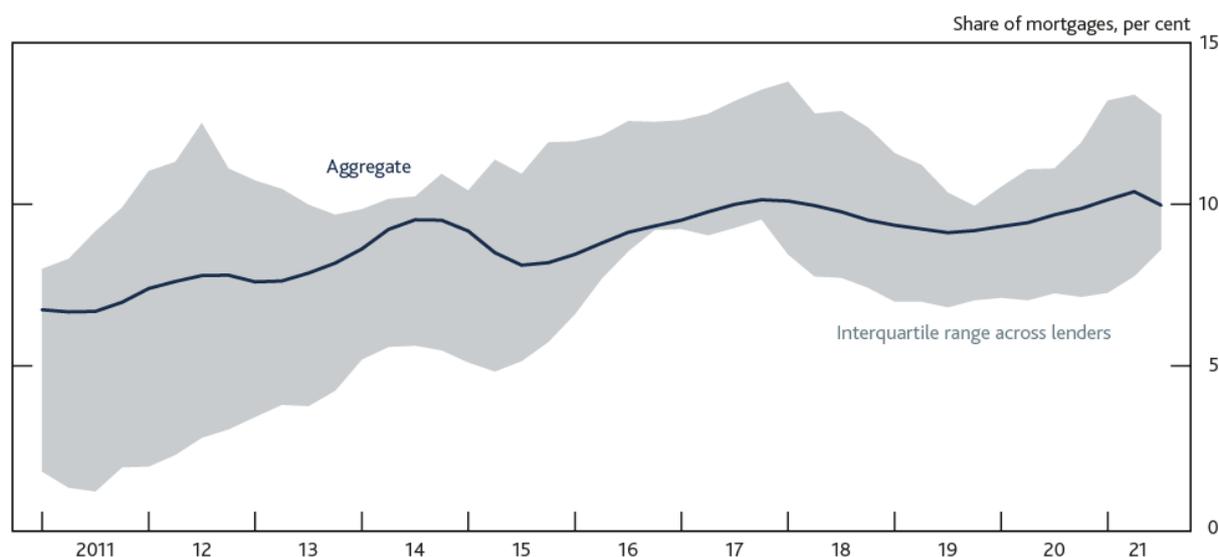
⁶ In this document, we use ‘high LTI’ to refer to LTI ratios of 4.5 and above.

would prevent an increase in ‘high LTI’ lending. For the major lenders that have operated with shares of ‘high LTI’ lending that are close to 15%, the flow limit may be acting as more of a constraint.

One reason why some lenders differ in how much lending they are prepared to extend at ‘high LTI’ ratios is differing risk appetites. Intelligence from the 13 largest mortgage lenders in the UK – together accounting for around 90% of all mortgage lending in the UK – shows that some are willing to extend nearly the full 15% limit of ‘high LTI’ lending, while others target a proportion below the 15% limit.

Chart 8: There is headroom against the 15% LTI flow limit on aggregate, and some lenders operate with shares well below 15%

Share of new mortgage lending at or above 4.5 LTI, aggregate and weighted inter-quartile range across all lenders ^(a) ^(b)



Sources: FCA Product Sales Database (PSD) and Bank calculations.

(a) The share is calculated on a rolling four-quarter basis.

(b) The interquartile range is weighted according to lending volumes.

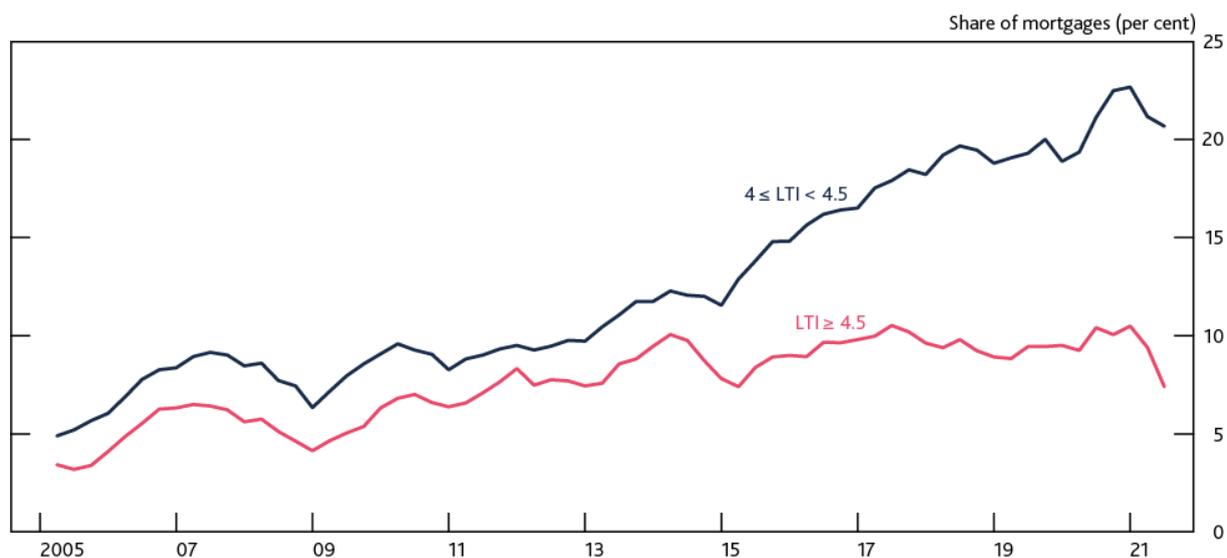
There has also been a notable increase in the concentration of lending just below the flow limit threshold, suggesting that some households may have been prevented from getting a larger loan.

Despite the degree of headroom against the 15% flow limit, there has been a substantial increase in lending just below the 4.5 LTI threshold specified in the limit. The aggregate share of lending with an LTI between 4 and 4.5 has increased from 12% in 2014 to 21% in 2021 Q3 (**Chart 9**).

The pattern of demand for lending at different high LTI ratios is very unlikely to be able to explain this concentration of lending, which was much smaller before the measures were introduced. This concentration might therefore suggest that the way in which lenders have incorporated the LTI flow limit into their risk management practices has played a role in reducing the size of mortgages that households have been able to take out.

Chart 9: Since 2014 there has been an increase in mortgage lending at LTI ratios between 4 and 4.5

Share of new mortgages by LTI bucket



Sources: FCA Product Sales Database (PSD) and Bank calculations.

These effects are likely to reflect lenders' risk management practices within the LTI flow limit.

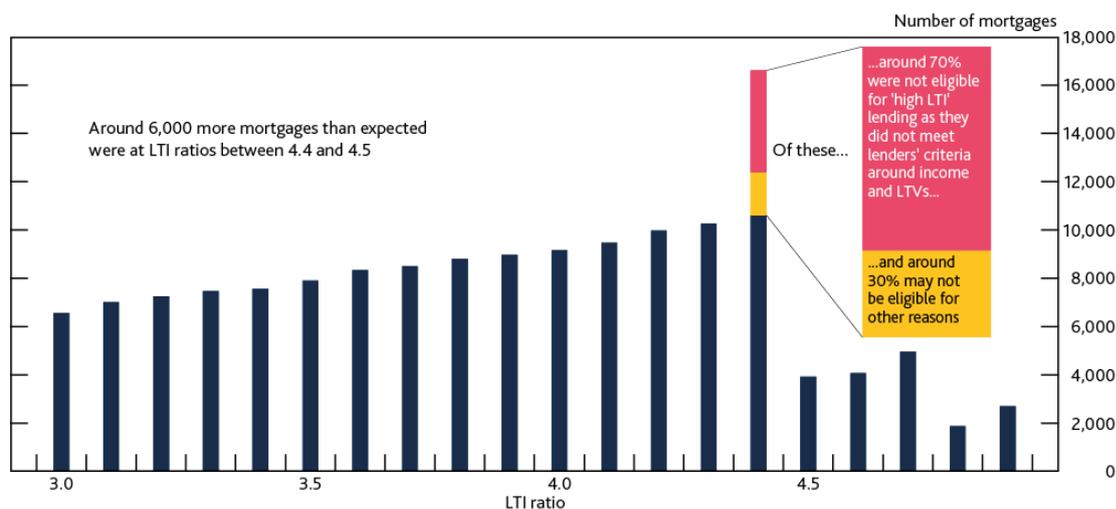
Many lenders have additional lending criteria to manage the volume and credit quality of 'high LTI' lending, which tend to apply above the 4.5 LTI threshold. These additional criteria vary by lender, but generally include minimum income and maximum LTV ratio. Some lenders also apply restrictions on minimum credit scores, restrictions on interest-only loans and early warning systems in order to prevent breaching specific shares of risky lending.

These lender risk management practices are likely to be the main driver of the degree of headroom against the 15% LTI flow limit and are likely to explain the concentration of lending just below the 4.5 threshold, given the headroom to the 15% limit. We analyse the impact of these lender restrictions by comparing the number of loans with an LTI between 4.4 and 4.5 over and above to a simple linear extrapolation from the rest of the distribution. This analysis suggests there was an additional 6,000 (3%) mortgages being extended at LTI ratios between 4.4 and 4.5 in 2021 Q3 than would have been implied by extrapolating from LTI ratios below that level. Around 70% of these mortgages did not meet lenders' minimum income and LTV criteria for 'high LTI' lending (**Chart 10**).

It is likely that some of these practices reflect lenders managing their own exposures to 'high LTI' lending in line with their own risk appetites within the LTI flow limit. Indeed, some lenders were already restricting LTVs on their 'high LTI' lending before the LTI flow limit was introduced in 2014. The income restrictions have generally been introduced since 2014 but, as discussed above, there is nothing in the FPC's flow limit that should prevent some lenders from adjusting their risk management practices if they chose to increase their share of 'high LTI' lending closer to 15%.

Chart 10: Most of the concentration in mortgage lending at LTI ratios of 4.4 to 4.5 would not meet lenders' requirements for 'high LTI' lending

Number of new mortgages issued by the 13 largest lenders in 2021 Q3, by LTI ratio (a)



Sources: FCA Product Sales Database (PSD) and Bank calculations.

(a) The number of mortgages concentrated between LTI ratios of 4.4 and 4.5 is the number greater than would be implied by a linear extrapolation from LTI ratios between 3.0 and 4.4.

It is also possible that the affordability test has contributed to the headroom under the flow limit.

As described in the next section, the affordability test is also likely to contribute to some extent to the degree of headroom under the flow limit. However, the affordability test is much less likely to explain the concentration of lending just below the 4.5 LTI threshold.

2.3: The impact of the affordability test on recent mortgagors

Assessing the impact of the affordability test is more challenging, as we cannot directly observe all of the characteristics used in affordability calculations.

For each potential borrower, the FPC's affordability test implies a maximum LTI based on the stress rate used, their mortgage term, net income⁷, other credit commitments and basic household expenditure.⁸ Given that the implied LTI varies for each individual depending on their other credit commitments, basic expenditure and mortgage term, the affordability test is very unlikely to generate a concentration of lending at any particular LTI value. Both the variation in implied maximum LTI across households and the limited data on basic expenditure mean that it is harder to monitor the impact of the affordability test than the LTI flow limit.

We have analysed the flow of new mortgages to estimate the impact of the FPC's affordability test on recent mortgagors.

Since its introduction, the affordability test is likely to have limited how much some mortgagors have been able to borrow. We have analysed PSD data on the recent flow of new mortgagors – pooling

⁷ Note that LTIs are simply calculated as the mortgage loan divided by gross annual income.

⁸ MCOB contains rules around calculating expenditure, which include that if a lender uses statistical or modelled data they must apply realistic assumptions to determine the level of expenditure of the household.

data over the last three years – to attempt to quantify how many mortgagors may have taken out a smaller mortgage than they otherwise would have as a result of the affordability test.

We proxy for lenders’ implementation of the FPC’s affordability test by using their online calculators to estimate the maximum amount that recent borrowers could have taken out.

To conduct this analysis we have built an algorithm that approximates how lenders apply the affordability test, based on the results of 6 large lenders’ online mortgage affordability calculators.⁹ The algorithm estimates basic expenditure – a key input into affordability testing – given data on incomes, number of dependents and whether the mortgage application is sole or joint.¹⁰ It also takes into account data on other credit commitments. This allows us to estimate the maximum mortgage amount that recent mortgagors might have been able to borrow under the FPC’s affordability test and if subject only to the minimum increase of 100 basis points under the FCA’s MCOB rules. In this analysis, the LTI flow limit is assumed not to apply.

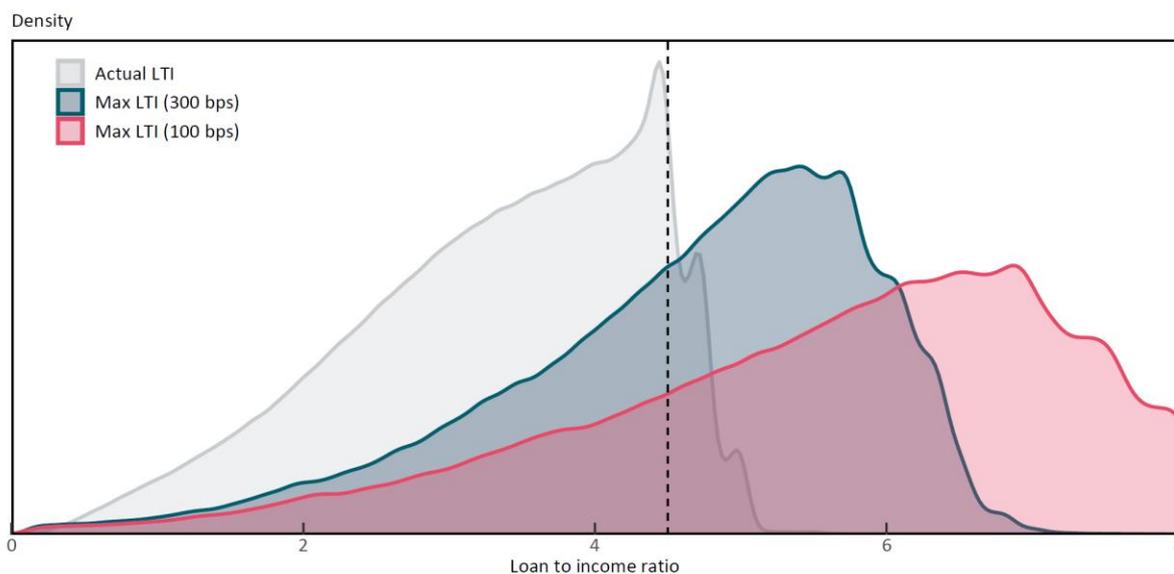
The difference between the blue and red areas in **Chart 11** illustrates that the maximum LTI distribution would shift to the right with affordability testing subject only to the minimum rise of 100 basis points under the FCA’s MCOB rules. As discussed in Section 3, this does not imply that the realised LTI distribution would shift to the right to the same extent. In particular, the LTI flow limit would act to restrain the proportion of lending above LTIs of 4.5. In addition, although many borrowers would be able to obtain a mortgage with a higher LTI ratio in theory, many might not opt to do so in practice. As can be seen from the difference between the grey and blue areas, many borrowers opt not to obtain the largest mortgage they could afford at the moment.

⁹ This is a proxy. There could be differences between online calculators and actual affordability assessments.

¹⁰ The algorithm estimates net income based on a proxy for the personal income tax and National Insurance regime. It then estimates the relationship between the logarithm of net income and the logarithm of basic expenditure implied by lender mortgage affordability calculators, using a simple bivariate regression in logarithms. This relationship is allowed to vary by joint versus sole applicants and number of dependents.

Chart 11: Comparison of the maximum LTI that borrowers could obtain under FPC affordability testing and actual LTIs suggests most borrowers are not maxing out

Distribution of LTI ratios in the flow of mortgages from 2018-2020, with estimates of the maximum LTI under different affordability test interest rate buffers ^{(a) (b)}



Sources: FCA Product Sales Database (PSD) and Bank calculations.

(a) Using the algorithm described in Section 2.3 we calculate, for each mortgagor in the recent flow of new mortgages, the maximum LTI ratio implied by affordability testing, based on household composition and data on existing credit commitments.

(b) We recalculate the maximum LTI ratio for different levels of stressed interest rate buffer. Note that many borrowers have taken out mortgages well below their maximum LTI ratio implied by affordability testing. Many would also face other constraints in reality, such as those driven by ‘high LTI’ lending criteria.

Around 6% of recent mortgagors might have taken out smaller mortgages than they would have been able to in the absence of the FPC’s affordability test.

We can estimate the proportion of mortgagors that might have been constrained by the FPC’s affordability test by comparing borrowers’ maximum permitted LTI ratios calculated using the algorithm described above to their realised LTI ratios. We assume that a recent mortgagor was constrained by the affordability test if their estimated maximum LTI was less than or equal to their realised LTI.¹¹ The results suggest that around 6% of recent mortgagors (roughly 30,000 per year) would have been able to take out a larger mortgage under the FCA’s minimum MCOB test than under the FPC’s affordability test (**Chart 12**).

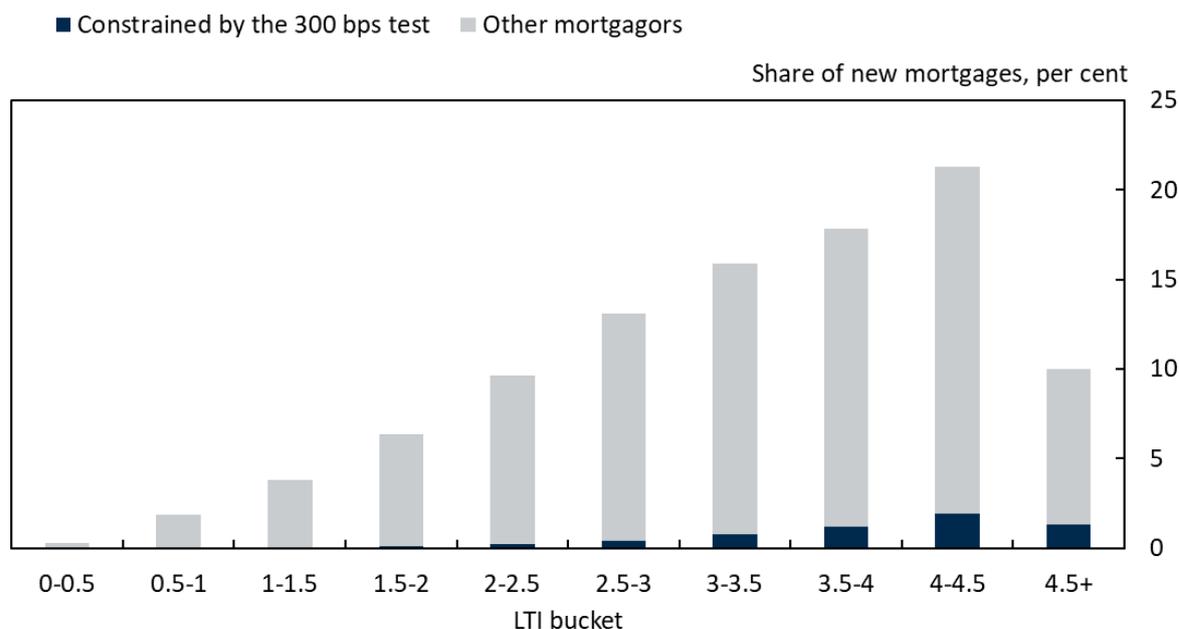
Most of the mortgagors that we estimate to have been constrained by the FPC’s affordability test took out mortgages with LTI ratios of under 4.5. If all of those mortgagors immediately chose to take

¹¹ The algorithm we use to estimate maximum LTIs is an approximation of real-world affordability testing, which takes into account each borrower’s reported basic expenditure (rather than estimating it). As a result, in some cases our estimates of the maximum permitted LTIs are lower than borrowers’ realised LTIs.

out the maximum mortgage they could afford under MCOB rules, the share of the flow with an LTI of 4.5 or higher could rise slightly from around 10% to around 11%.¹²

Chart 12: Around 6% of recent mortgagors are estimated to have been directly constrained by the FPC’s affordability test and would not be under the minimum test in the FCA’s MCOB rules

Estimates of the share of the flow of new mortgages from 2018 to 2020 that were constrained by the FPC’s affordability test, by LTI bucket



Sources: FCA Product Sales Database (PSD) and Bank calculations.

(a) Using the algorithm described in Section 2.3 we calculate, for each mortgagor in the recent flow of new mortgages, the maximum LTI ratio implied by affordability testing, based on household composition and data on existing credit commitments.

(b) We assume that mortgagors were constrained by the FPC’s affordability test who took out the same – or higher – LTI than the maximum we estimate given the test. The blue bars show those mortgagors that are constrained and would be unconstrained by a stressed interest rate buffer of 100 basis points.

2.4: The impact of the measures on renters and prospective buyers

To assess the impact of the measures on renters and prospective buyers, we have updated analysis of renters that was first published in the December 2020 Financial Stability Report (FSR).¹³

To model the possible impact on renters and prospective buyers, we use household level data on renters in the latest wave of the Wealth and Assets Survey, conducted in 2016-18. As the PSD only has loan-level data on completed mortgages, we cannot observe those who wanted a mortgage but were rejected or didn’t apply because they would have been rejected. The survey data allows us to

¹² Note that in this step of the analysis we implement a proxy for lenders’ ‘high LTI’ criteria, which we assume would still be in place in the absence of the FPC’s affordability test and prevent some borrowers from obtaining LTI ratios of 4.5 or higher.

¹³ This analysis was subsequently detailed in two Bank Overground posts [here](#) and [here](#).

gauge the potential effect of the measures on prospective buyers rather than those that have already bought.

There is necessarily uncertainty around the results of this exercise. In particular, we cannot observe the demand for home ownership among the population of renting households, so we do not know if households that we estimate as being unable to afford to purchase actually want to enter the market but are excluded in practice.¹⁴

This analysis considers the distribution of households and uses data on their income and savings, to try to gauge the impact of different borrowing constraints.

In general, a borrower who wants a mortgage to buy a home will be constrained by the size of the deposit they can raise and their income. Lenders' LTV limits will determine how much they can borrow given their deposit. FPC policy and lenders' internal limits determine how much they can borrow relative to their incomes. We estimate the share of renter households who can afford to purchase the median-priced FTB property in their region, calculated using house price data from the PSD between 2020 Q3 to 2021 Q2, under different combinations of borrowing constraints. For those unable to afford the median-priced FTB property we calculate which of the different constraints acts as the barrier to obtaining a mortgage.

We approximate affordability testing using the algorithm outlined in **Section 2.3**. We model MCOB affordability assessment by assuming that mortgages are stressed at a rate of 5%, i.e. 100 basis points above a 4% reversion rate, consistent with the minimum stress rate required within the FCA's MCOB rules.¹⁵ We approximate the FPC affordability test in the same way as the minimum affordability test, except for using a 7% stress rate, i.e. 300 basis points above a 4% reversion rate. We also assume an LTI of 5.5 is the maximum for a typical FTB, regardless of the LTI flow limit.¹⁶

We focus the analysis on current renters who might be prospective FTBs.

Since our analysis uses household level data on incomes and savings, we focus on prospective FTBs who are either renting alone or who live in family units and would likely combine their incomes and savings when getting a mortgage. Data from the English Housing Survey suggests that around two thirds of FTBs come from existing households in the private rented sector ([BuiltPlace 2020](#)). We also focus on households where the head of household is less than 45 years old, which is true for nearly 95% of recent FTBs. Our approach should be representative of the majority of prospective FTBs.

Raising a deposit is by far the largest constraint affecting prospective buyers, with 83% of renters in our sample lacking the savings to afford a 5% deposit on the median-priced FTB property in their region.

Chart 13 summarises the impact of different borrowing constraints on renters in our sample.¹⁷ Starting from the top, we sequentially layer on borrowing constraints and look at the share of

¹⁴ There is also uncertainty about the data. Unlike the PSD mortgage data, the Wealth and Assets Survey is a sample of the total population and so will be subject to measurement error as a result of small samples when we filter it down. It is also more likely to be subject to reporting error and biases.

¹⁵ Note that this represents the minimum since MCOB also requires lenders to have regard to market expectations for a rate rise over a five-year period.

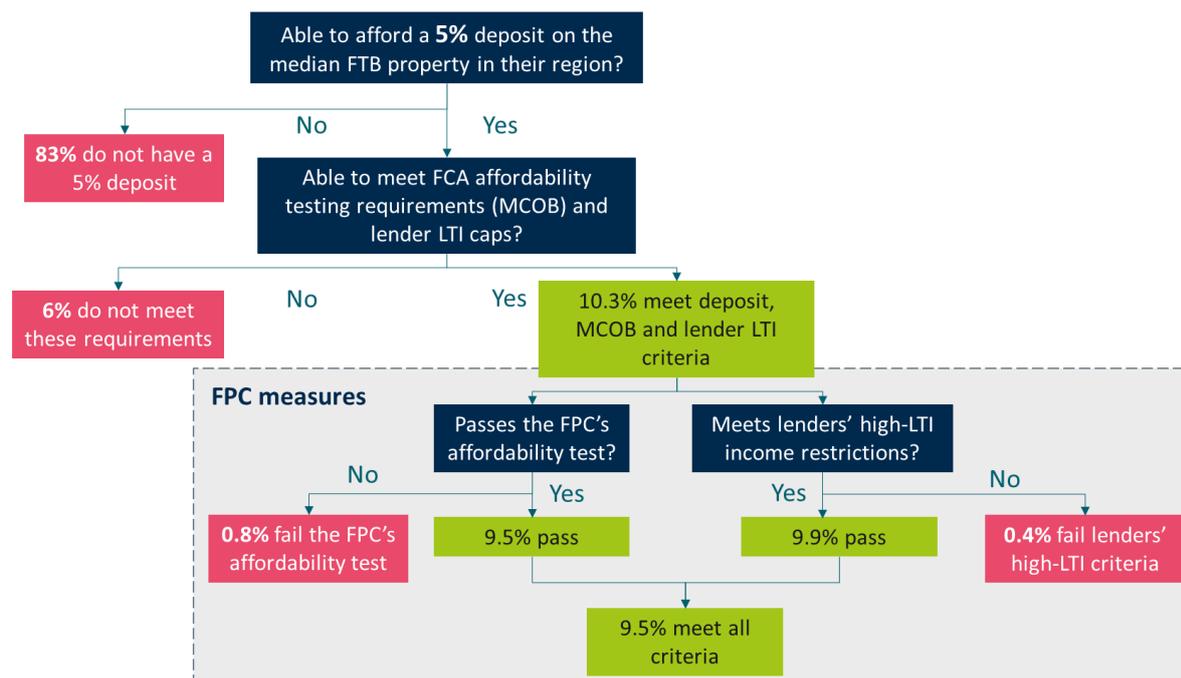
¹⁶ See, for example, [Nationwide's Helping Hand mortgage](#).

¹⁷ This analysis is also summarised in Chart A in Box D of the December 2021 Financial Stability Report (FSR), where the impact of the FPC's two measures is combined.

households affected by each constraint. In the first step, we apply a 5% minimum deposit requirement, based on a maximum LTV ratio of 95%.¹⁸ Given their current savings, around 83% of renters would currently be unable to raise a 5% deposit on the median FTB property in their region.

Chart 13: Deposit size is the most significant barrier for current renters, but FPC measures could stop around 1% of renters from affording the median first-time buyer property in their region

Estimates for the share of renters in the Wealth and Assets Survey who can afford the median-priced first-time buyer property in their region, and the impact of borrowing constraints, based on household income and savings



Sources: Wealth and Assets Survey, ONS, FCA Product Sales Database (PSD) and Bank calculations.

Around 6% of renters have sufficient savings for a deposit on the median FTB property but do not meet a minimum affordability test and lenders' own maximum LTI cap.

Around 17% of renters do have sufficient savings to afford a 5% deposit on the median FTB property in their region. Of these, we estimate that 6 percentage points (i.e. around one third of 17%) would be unable to purchase, either due to failing the proxy for the minimum affordability testing set out in the FCA's MCOB rules that we apply, or by requiring an LTI above 5.5, which we impose to proxy for lender risk management practices that might be in place in the absence of FPC measures.¹⁹

¹⁸ LTV ratios have been lower than 95% in recent years, which would increase the impact of LTV constraints. However, the government's Help to Buy scheme makes 95% LTV mortgages available to some people.

¹⁹ In this step, 5.7 percent fail due to the LTI cap and 4.4 percent due to minimum affordability standards; 3.8 percent fail both criteria.

Around 0.4% would then fail to meet lender's minimum income criteria for 'high LTI' mortgages.

We then apply a criterion, based on the restrictions discussed in **Section 2.2**, that any household with an income of less than £30,000 is restricted to an LTI of 4.49. As a result, an extra 0.4% of renters are unable to afford the median FTB property in their region.

An alternative version of this step would also include a restriction on the maximum LTV for mortgages at LTI ratios of 4.5 or above. We do not include this in our baseline analysis because deposit-constrained renters could use the Help to Buy: Equity Loan scheme to borrow above 4.5 LTI with a 5% deposit.²⁰

And a little less than 1% would fail to meet the FPC's affordability test.

We estimate that the FPC's affordability test could prevent 0.8% of renters from being able to afford the median FTB property in their region. This equates to around 44,000 households. This compares to an average of around 340,000 new FTB mortgages per year in the UK over the past few years.

There is some overlap in renters we estimate as being potentially constrained by the affordability test and those that do not meet lenders' minimum income criteria. Around half of the 44,000 constrained by the affordability test are also unable to afford the median FTB property in their region as a result of minimum income criteria.

If renters were unable to access high LTV mortgages, deposits would become even more constraining and the impact of the FPC measures would fall significantly.

As discussed in **Section 1**, the availability of high LTV mortgages has varied over time. In some periods, a typical FTB would find it hard to take out a 95% LTV mortgage. If we assume that prospective first-time buyers can only take out a maximum LTV of 80%, only around 5% of renters could afford a deposit on the median-priced FTB home in their region according to this analysis. The relative tightening of deposit constraints reduces the impact of the FPC's measures. Under this assumption, the share of renters affected by the FPC's measures would be around 0.1%.

Gifted deposits from family members, for example, might increase the number able to afford a deposit and therefore the impact of the FPC's measures, but the impact is unlikely to be large.

A key assumption in this analysis is that renters fund deposits entirely from their accumulated savings. In practice, many FTBs partially or fully fund their deposits from other sources such as inheritance, and gifts or loans from family members or friends.

In the absence of data on renters' individual circumstances, it is difficult to precisely model the impact of these additional sources. But, as a very simple cross-check on the sensitivity of the results to this assumption, we approximate their impact by assuming that some renters have access to these additional sources to help fund their deposits. Survey data suggests that around one third of prospective FTBs expect to receive financial help from family or friends.²¹ We therefore boost savings for randomly-selected households such that the number of renters who can afford a 5%

²⁰ But if FTBs with incomes of at least £30,000 were restricted to an LTV of 90% above 4.5 LTI, lenders' 'high LTI' criteria (both LTV and income restrictions taken together) would stop 0.9% of renters from affording the median FTB property in their region.

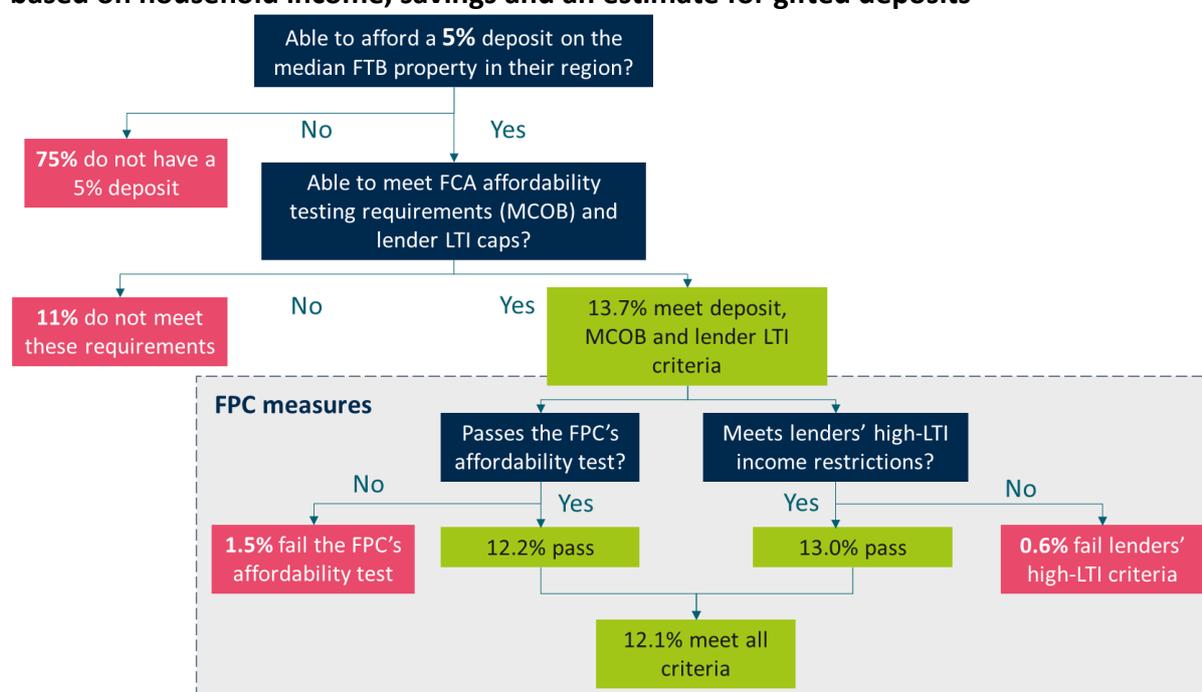
²¹ See the [Bank of Mum and Dad Report](#).

deposit on the median FTB property in their region increases by 50%, from 17% to 25%.²² This means, of the population of renters who can now afford a deposit, one third can do so as a result of gifts (8 percentage points).

Chart 14 summarises the results of this cross-check. After adding gifted deposits allowing for some renters to be able to benefit from these additional sources, around 75% of renters would still currently be unable to raise a 5% deposit on the median FTB property in their region. The impact of the affordability test also increases, but only to around 1.5% or 84,000 households.

Chart 14: Even if we assume one third of first-time buyers use gifted deposits, only 1.5% of renters would be constrained by the FPC's affordability test

Estimates for the share of renters in the Wealth and Assets Survey who can afford the median-priced first-time buyer property in their region, given borrowing constraints, based on household income, savings and an estimate for gifted deposits



Sources: Wealth and Assets Survey, ONS, FCA Product Sales Database (PSD) and Bank calculations.

Overall, these exercises suggest that the FPC's current measures may be acting as a barrier to around 1 to 2% of prospective FTBs from buying the median-priced FTB property in their region.

This analysis suggests that around 1-2% of current renters may be unable to afford the median-priced FTB property in their region as a result of the FPC's measures. This does not necessarily mean these renters are locked out of the housing market altogether. They could take out a smaller mortgage on a less expensive property. The effect of the measures on individuals will ultimately depend on their demand for housing, the distribution of properties available to them, and how they respond to any constraints on the amount they can borrow.

²² We assume that the candidates for receiving a gifted deposits are households where the head is at least 25 years old, with a household income of at least £25,000, and with insufficient savings to afford a 5% deposit without a gift.

Box A: the impact of the measures across the countries and regions of the UK

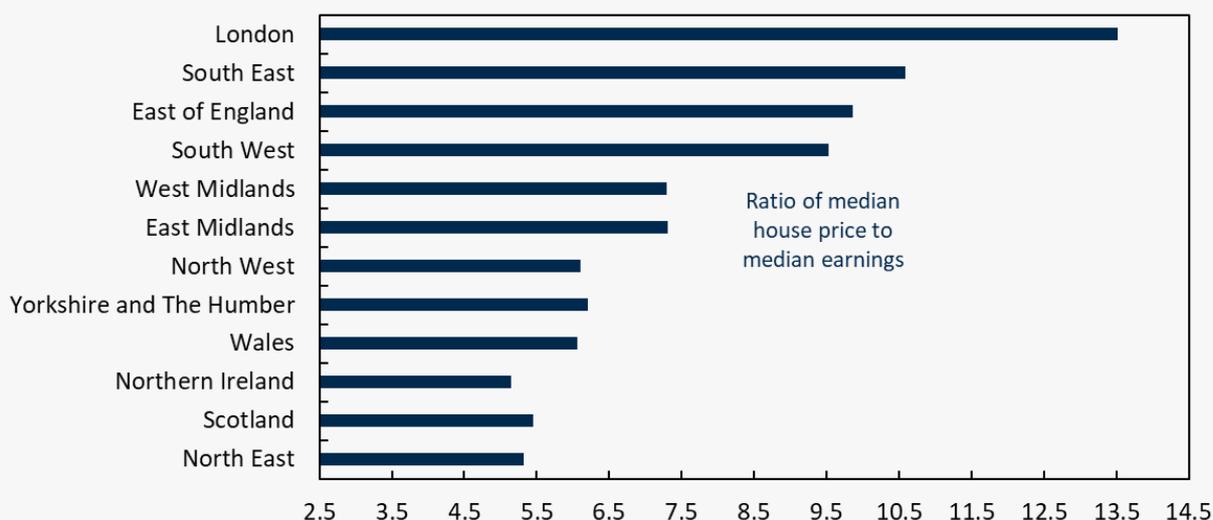
All prospective buyers are more likely to face barriers to purchasing a property where prices are higher relative to earnings, particularly in London and the South East.

Access to the housing market – for both home movers and FTBs – will depend on households’ ability to raise a deposit and the amount that can be borrowed. The latter will depend on both lenders’ risk appetite – via ‘high LTI’ criteria linked to income and LTV – and the FPC’s measures.

The LTI flow limit and affordability test both act to limit how much some prospective buyers can borrow relative to their incomes. In principle, this means that the FPC’s measures are more likely to be constraining buyers in those areas where average house prices tend to be high relative to incomes, like in London, the South and the East of England (**Chart A**).

Chart A: House price to income ratios are higher in London, the South and the East of England

Ratio of median house price to median full-time earnings by region ^(a)



Sources: ONS, NISRA, Registers of Scotland, and Bank calculations.

(a) The chart uses data on median house prices in each region and expresses them as a ratio to median earnings for all households.

But there remains considerable headroom under the 15% limit and there is large variation in the share of ‘high LTI’ lending across regions.

In practice, many home buyers will be home movers, with large deposits from the sale of their existing property, which limits the LTI and LTV needed to purchase their next property. And there remains considerable headroom under the FPC’s 15% LTI flow limit on aggregate. But within the aggregate there is large variation in the share of ‘high LTI’ lending by region (black markers in **Chart B**). Regions with higher house prices relative to earnings, like London, the South and the East of England, typically have a higher share of ‘high LTI’ mortgages than regions like Scotland, the North East and Northern Ireland.

There is a greater concentration of lending just below 4.5 LTI in regions with higher house prices relative to earnings, which is likely to be driven by additional lender criteria for ‘high LTI’ lending.

Despite the headroom under the LTI flow limit, there has been an increase in the concentration of lending just below the 4.5 LTI threshold. As described in **Section 2.2**, this reflects that most lenders attach additional restrictions to ‘high LTI’ lending, including minimum income requirements. We have repeated the analysis detailed in **Section 2.2** to analyse the additional concentration by region. Consistent with the distribution of house price to earnings across regions, there tends to be more of a concentration just below an LTI of 4.5 in the South, East and the Midlands than in Wales, the North, Scotland and Northern Ireland (red bars in **Chart B**).

Chart B: There is large variation in ‘high LTI’ lending across regions and there is evidence of an additional concentration just below the 4.5 LTI threshold in all regions

Share of total mortgage lending by LTI bucket, by region



Sources: FCA Product Sales Database (PSD) and Bank calculations.

(a) The number of mortgages concentrated between LTI ratios of 4.4 and 4.5 is the number greater than would be implied by a linear trend in increase from LTI ratios between 3.0 and 4.4 within each region.

The exception to this pattern is London, where the estimated concentration of lending just below 4.5 LTI is in line with the UK average, despite having the highest house prices relative to earnings.

This could reflect the fact that borrowers in London are more likely to seek high-LTI loans and more likely to meet lenders’ ‘high LTI’ lending restrictions. Those able to purchase in the capital tend to have incomes much higher than the UK average. LTV ratios in London are also lower than in other areas of the UK, so fewer borrowers will be affected by the lenders’ LTV limits. This is consistent with both a higher share of lending above 4.5 LTI – about a quarter of the UK total – and less concentration below the threshold.

But the lack of concentration below the 4.5 threshold could also indicate that buyers who do not meet lenders’ ‘high LTI’ criteria cannot find a suitable property at a lower LTI and are therefore more likely to be excluded from the market altogether. Given the level of prices in London it might be

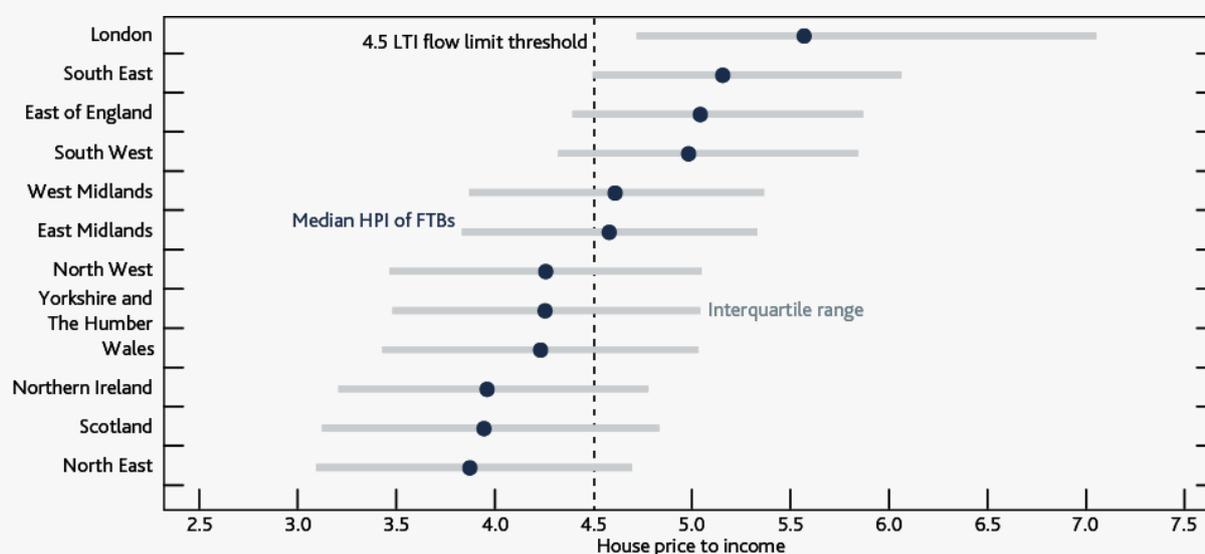
more difficult to find a cheaper property (see below). This is consistent with much lower home ownership rates for younger cohorts in London.²³

Focussing on FTBs, in principle the measures would also be expected to have a greater impact in regions with higher house prices relative to incomes.

Looking at the overall house price to income ratio will of course not be representative of those who are looking to purchase their first property. In London, the South and the East of England, the median house price to income ratio among recent FTBs is well above 4.5 (**Chart C**). This implies that the median FTB will have required a larger deposit or a loan of over 4.5 times their income to get on the housing ladder.

Chart C: Median house price to income ratios for first-time buyers are highest in London, the South and the East of England

Interquartile range and median of house price to income ratios for first-time buyers



Sources: FCA Product Sales Database (PSD), ONS and Bank calculations

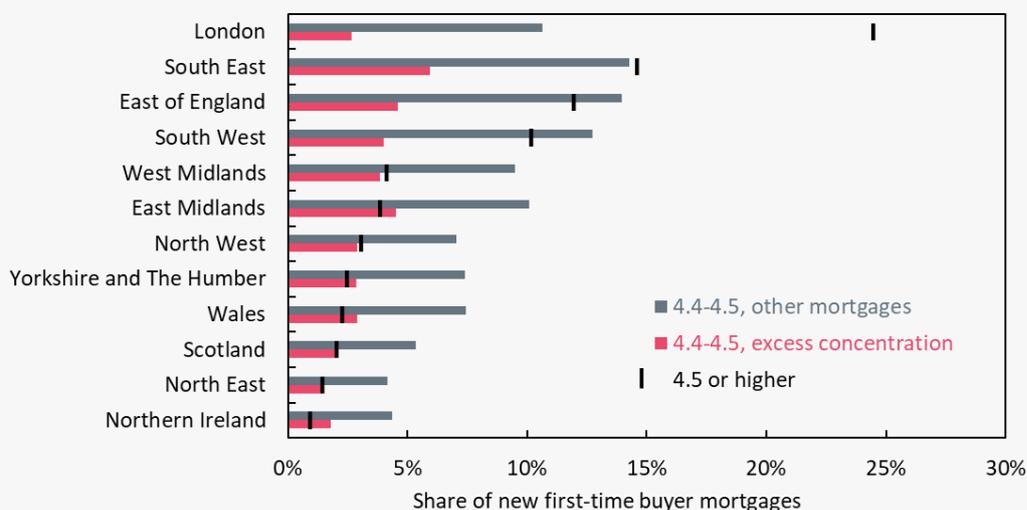
There is a higher concentration of FTB lending just below the 4.5 LTI threshold in regions with higher house prices relative to incomes.

There is more of a concentration of lending just below the 4.5 LTI flow limit threshold for FTBs than other mortgagors, which holds across most regions of the UK (red and grey bars in **Chart D** vs red and grey bars in **Chart B**). This reflects the fact that lenders' 'high LTI' criteria are more likely to constrain FTBs, who tend to have lower incomes and higher LTVs than other mortgagors. There is also a similar picture to other mortgagors when we compare the degree of additional FTB concentration across regions, with a bigger additional concentration just below 4.5 in the South, the East of England and the Midlands than in Northern Ireland, Scotland and the North East (red bars in **Chart D**).

²³ Institute for Fiscal Studies, "[The decline of homeownership among young adults](#)", Figure 4

Chart D: There is evidence of an additional concentration just below the 4.5 LTI threshold in lending to first-time buyers in all regions

Share of first-time buyer mortgage lending by LTI bucket, by region



Sources: FCA Product Sales Database (PSD) and Bank calculations.

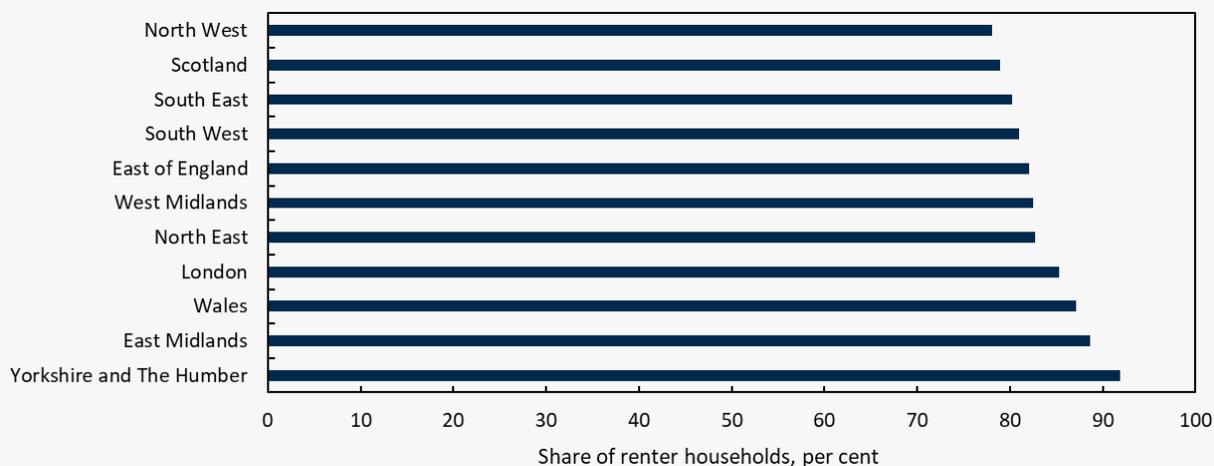
(a) The number of mortgages concentrated between LTI ratios of 4.4 and 4.5 is the number greater than would be implied by a linear trend in increase from LTI ratios between 3.0 and 4.4 within each region.

Raising a deposit is the biggest constraint across all regions of the UK for prospective FTBs.

We have repeated the analysis of the constraints facing current renters detailed in **Section 2.4** separately for renters in different regions of the UK. We find that across all regions less than 25% of renters have sufficient savings to raise a 5% deposit on the median FTB property in their region (**Chart E**). This falls to less than 15% if we assume a maximum LTV of 80%. There is no obvious pattern across regions, with no correlation between deposit constraints and average house price to income ratios. The FPC's affordability test is a much smaller constraint than raising a deposit in all regions for renters looking to buy the median property.

Chart E: Raising a deposit is a significant barrier for renters in all regions

Estimates for the share of renters in the Wealth and Assets Survey who would be unable to afford a 5% deposit for the median-priced first-time buyer property in their region



Sources: Wealth and Assets Survey, FCA Product Sales Data, and Bank calculations

The sample sizes in the household survey data become too small to repeat the analysis of the impact of the FPC's measures on renters by individual region. Instead we group regions where house prices are generally higher relative to incomes and those where prices are generally lower relative to incomes. Roughly the same proportion of renters in each of these region groupings are estimated to be constrained by the FPC's measures.

However, as also noted in **Section 2**, renters unable to afford the median property may still be able to afford a cheaper property in their region. When looking at the impact based on the properties in the cheapest quartile within a region, we find that the measures may be having a slightly larger impact in regions where house prices are generally higher relative to incomes, where even less expensive properties can be around 4.5 times average FTB income.

3: Simulating the impact of the FPC's measures in a scenario of rapid house price growth

3.1: Background for the exercise

Bank staff have built a modelling framework to simulate how changes to the FPC's measures could impact the stock of mortgage debt under different scenarios for the housing market.

This section sets out the framework that we have used to model how the FPC's mortgage market measures might affect the future stock of mortgage debt and the extent to which it could exacerbate a downturn in a scenario of rapid house price growth. It combines a range of different modelling approaches and the results are therefore subject to considerable uncertainty. The analysis builds on the modelling framework laid out in [Levina et al. \(2019\)](#), with results summarised in [Cunliffe \(2019\)](#).

The model enables us to understand what might happen to the stock of debt if lenders' underwriting standards deteriorate and house prices rise rapidly relative to incomes.

As set out in **Section 1**, housing booms and the associated rapid build-ups of mortgage debt have historically been an important source of risk to the financial system and to the economy more generally. For this reason, we simulate how the FPC's measures mitigate financial stability risks in a hypothetical scenario of rapid house price growth, which is designed to be severe but plausible. We apply assumptions for how house prices, incomes, Bank Rate and mortgage interest rate spreads might change in such a scenario, and map those assumptions to the flow and then the stock of mortgage debt under alternative assumptions about the measures.

The ultimate risk to financial stability is likely to depend in part on the number of highly-indebted households when an economic downturn occurs. This means we need to model how changes in the flow of new mortgages translate into changes in the stock of mortgages over time, which is likely to be a slow process given that the flow in a given year typically amounts to less than 10% of the stock.

3.2: Methodology and data

The methodology for modelling the impact of the measures builds on analysis used to calibrate the measures when they were introduced in 2014 and in subsequent reviews.

The FPC has previously used loan-level projections of the UK mortgage market to inform the calibration of its mortgage market measures. These projections helped to inform the original calibration of the LTI flow limit in 2014 and supported the FPC's conclusions when it reviewed the measures in 2017 and 2019.²⁴

Using loan-level data allows us to model the full distribution of debt, rather than just aggregate indebtedness. This is critical in assessing the financial stability risks of a given stock of debt, given the evidence that more highly-indebted households cut their spending by more and are more likely to default than less highly-indebted households (as set out in **Section 1**).²⁵ The model uses loan-level mortgage data from the PSD (described in **Section 2**). In order to project forward lenders' stress rates, we augment the PSD data with reversion rate data from Moneyfacts.²⁶

We compare the results of projections under different combinations of the FPC's measures. To set a baseline, we first project the stock of mortgages in the absence of the FPC's measures. Against this, we compare scenarios in which both measures are in place and where each measure is in place without the other. These results are summarised in Chart 3 in Section 3 of the December 2021 Financial Stability Report and discussed in more detail below.

We combine loan-level mortgage data with projections for key macroeconomic variables to arrive at an estimate for the outstanding stock of mortgages in future.

Chart 15 summarises the key steps in our modelling approach.

As a first step, the model projects demand for mortgage lending in a given scenario, using assumptions about lender risk appetite and borrower behaviour. The model takes a sample of recent mortgagors and updates their key characteristics in a way that is consistent with the scenario. For example, property values are assumed to move in line with the house price path, incomes in line with aggregate income, and interest rates in line with Bank Rate and mortgage interest rate spreads. In a scenario in which house prices rise relative to incomes, this has the effect of increasing demand for 'high LTI' loans. From this pool of potential borrowers in each quarter, we identify which borrowers meet lenders' risk appetites in the absence of FPC policy,²⁷ from which we randomly sample to match the aggregate approvals path in the scenario.

In the second step, both of the FPC's mortgage market measures are applied. Prospective buyers who fail one or both of these measures may be able to "try again" with a 10% cheaper property and a longer mortgage term. If a prospective borrower still fails to obtain a loan of the required size after extending their term and reducing the value of the property they are seeking to buy, then they are unable to purchase.

²⁴ See the Financial Stability reports published in [June 2014](#), [June 2017](#) and [December 2019](#).

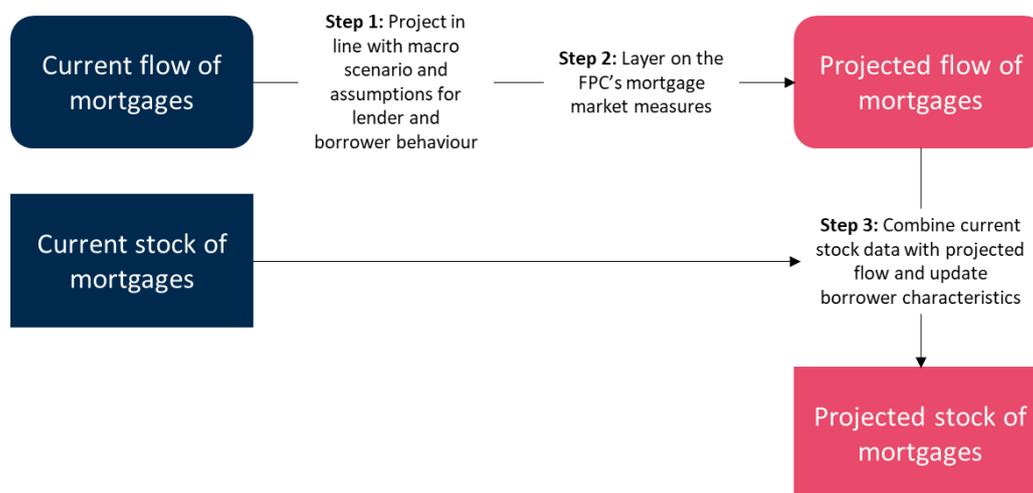
²⁵ This implies that two distributions of debt with identical means would pose differing levels of financial stability risk depending on their variance, skew and kurtosis.

²⁶ See Section 2.1 of Levina et al. for details of the data used.

²⁷ We assume that lenders apply a 100 basis points buffer over reversion rates and limit lending above 6.7 LTI to 2.5% of the flow, which is based on the right tail of LTIs observed before the GFC.

In the third step, after projecting the flow of new mortgage lending, both with and without the FPC's measures, the model projects forward the stock of outstanding mortgages in each case. To do this we make assumptions about the dynamics of mortgage repayments, the distribution of changes in borrowers' income²⁸, and the characteristics of the new mortgagors that enter the flow over time, some of whom will be FTBs and so will never have had a mortgage before. This stock is the basis for calculating the potential risks associated with household debt.

Chart 15: A summary of the key steps of our modelling, adapted from Levina et al. (2019)



Sources: [Levina et al. \(2019\)](#).

There are two important improvements we have made to the model detailed in [Levina et al. \(2019\)](#):

- **We directly model churn in the mortgage stock, rather than using a weighting approach.**²⁹ When projecting the stock of mortgages, we cannot simply estimate this year's stock by adding this year's flow to last year's stock. Home movers and remortgagors in this year's flow will have been in last year's stock, so simply adding flow and stock together would double count them. We therefore drop enough mortgagors in the stock to match the number of new home movers and remortgagors in the flow. Candidates to be dropped are randomly selected from mortgagors whose initial rate has expired.
- **The maximum stressed DSR a borrower can obtain varies across borrowers.**³⁰ This is due to variation in other spending commitments, include taxes and credit repayments. [Levina et al. \(2019\)](#) account for this variation by assuming only a certain share of lending can be extended at stressed DSR ratios above 40%. We extend this approach by estimating a distribution for the maximum stressed DSR across borrowers, calibrated using survey data on household credit commitments and the algorithm outlined in **Section 2.3 (Chart 16)**.³¹ In the model,

²⁸ Changes in borrower income in each period are drawn from a distribution of potential income shocks that accounts for age, employment status and how their income changed in the previous period. See [Levina et al. \(2019\)](#) for details.

²⁹ See Section 3.3 of Levina et al.

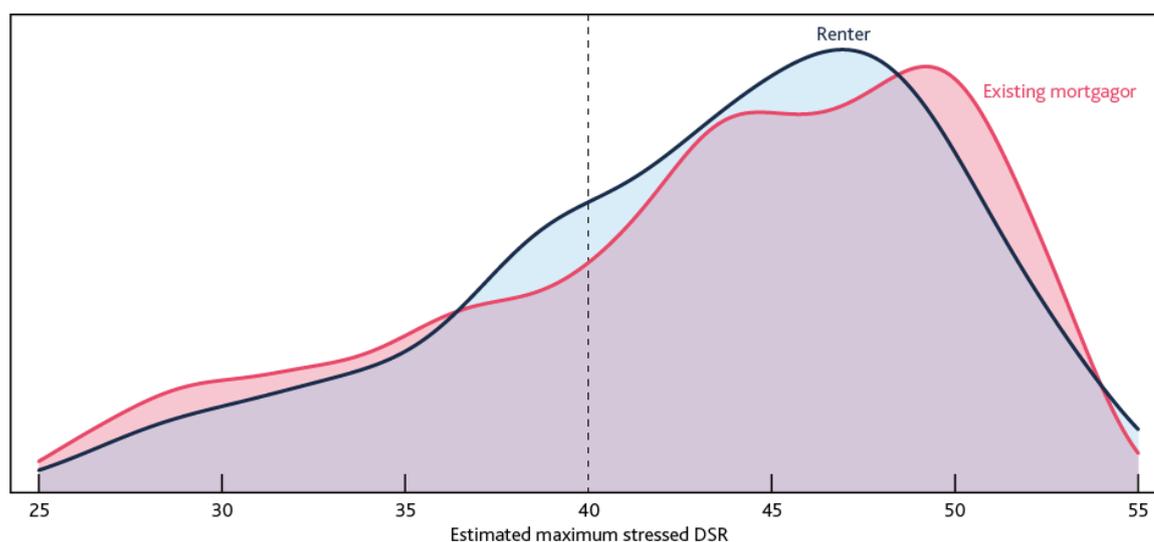
³⁰ See Section 2.4 of Levina et al.

³¹ We estimate separate kernel density functions for renters and existing mortgagors, to capture differences in characteristics between the two groups. In the model, maximum stressed DSRs for FTBs are drawn from the

each borrower is randomly allocated a maximum stressed DSR from the distribution that is relevant given their characteristics (e.g. FTB or home mover). This determines the point at which they fail lenders' affordability tests.

Chart 16: Based on differences in household composition and credit commitments, the affordability test implies a different maximum stressed DSR for different households

Distribution of estimated maximum stressed DSRs implied by the affordability test for renters and existing home owners in 2016-18 (a) (b)



Sources: Wealth and Assets Survey, ONS and Bank calculations.

(a) Using the algorithm described in Section 2.3 we calculate, for each household in our sample, the maximum stressed repayments allowed by the affordability test, based on household composition and data on existing credit commitments. Maximum DSRs are calculated by dividing maximum stressed repayments by gross household income.

(b) In order to focus on households who are most likely to take out a mortgage, we restrict our sample to: (i) renter households with at least £5,000 in liquid savings and where the head of household is below 45 years old, and (ii) existing mortgagors where the head of household is less than 65 years old.

Our estimates for the future flow and stock of mortgages take into account that the FPC's measures may limit house price growth in a scenario of rapid house price growth.

When modelling the impact of the FPC's measures in a scenario of rapid house price growth, we take into account the fact that the measures could directly or indirectly dampen house price growth. By restricting the number of households that can take out large mortgages relative to their incomes, lender risk management practices and the FPC's measures could reduce access to credit and therefore limit the demand for housing.³² This would be expected to put downward pressure on house prices, particularly given the low elasticity of housing supply in the UK (see, e.g. [Barker 2004](#)).

The effect of the mortgage market measures on house prices is modelled via a reduced-form link from mortgage approvals. In the model, the FPC's measures reduce the number of mortgage

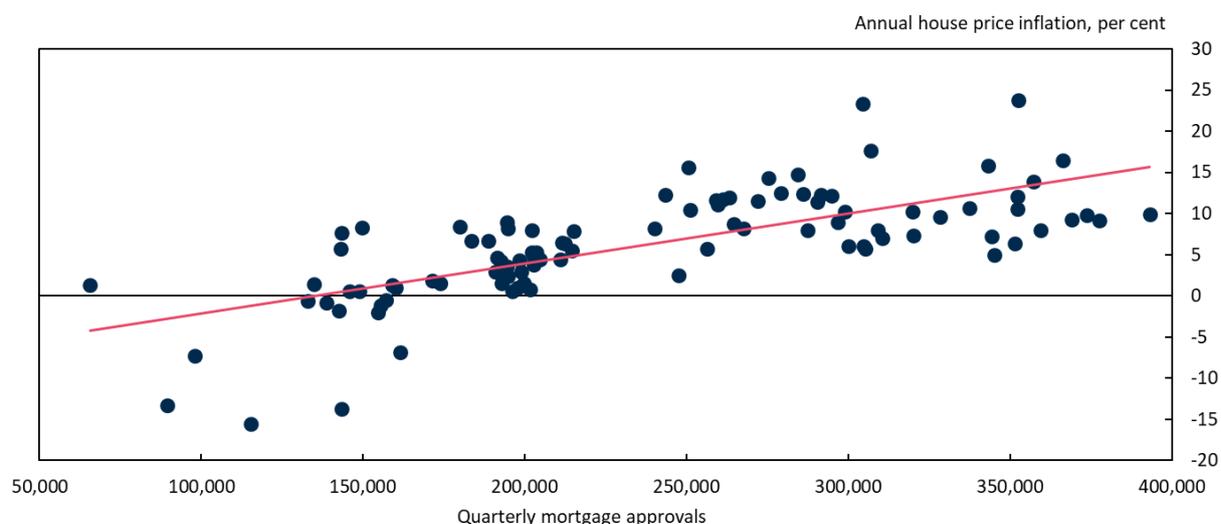
renters' distribution; maximum stressed DSRs for home movers and remortgagors are drawn from the existing mortgagors' distribution.

³² Assuming there is some degree of segmentation in UK housing markets, lower access to credit for some borrowers reduces demand for housing ([Greenwald 2021](#)).

approvals. We endogenously adjust the house price path in the rapid house price growth scenario to be consistent with the impact on approvals. This uses the historical relationship between approvals and house price inflation (**Chart 17**) as a simple proxy for how prices could adjust. A linear specification suggests that 10,000 fewer quarterly approvals has typically been associated with a 0.6 percentage point fall in price inflation. We use the adjusted house price path when updating borrower characteristics in the projections of the flow and stock of mortgages.

Chart 17: In the UK, periods of high mortgage approvals have tended to be associated with higher levels of house price inflation

Quarterly mortgage approvals for house purchase and annual UK house price inflation, 1997 Q1-2021 Q3



Sources: ONS, Bank of England and Bank calculations.

We estimate the impact of the stock of debt on GDP after an economic downturn using econometric evidence on the relationship between debt and consumption in downturns.

The final step of our analysis is to quantify the impact of changes in the mortgage stock at the end of the scenario of rapid house price growth, in terms of consumption and GDP outcomes following an economic downturn. We do this in two ways.

The first set of results draws on estimates of the relationship between pre-GFC mortgage LTI and post-GFC consumption at the household level in the UK ([Kovacs et al. 2018](#)).³³ We assume that the scenario of rapid house price growth is followed by an economic downturn similar in magnitude to the GFC and estimate the potential change in consumption for households with different LTI ratios and the impact this has on the level of GDP three years after the downturn. This method directly quantifies the channel through which household debt contributes to the aggregate demand externality via highly indebted households cutting consumption by more. However, it is likely to understate the total effect of household debt in worsening a downturn because it does not take into

³³ Micro studies have consistently established a relationship between household indebtedness and consumption cuts (see for example [Fagereng and Halvorsen \(2016\)](#) and [Dynan \(2013\)](#)). Further details on the available empirical evidence are set out in **Section 1**.

account the knock-on effects of lower spending by more highly indebted households to the wider economy and the spending of other households and businesses.

For that reason, we also quantify the effect of debt using an alternative approach. The second set of results draws on cross-country evidence of the impacts of increases in household debt on the GDP growth distribution ([Aikman et al. 2019](#)). We use the estimated relationship between increases in the household credit-to-GDP ratio at the end of the scenario and the 5th percentile outcome for GDP three years ahead, which we use as a proxy for a downturn. The results suggest that the measures have a larger GDP benefit during a downturn once we also account for the wider amplification effects on the economy associated with falls in consumption.

3.3: The scenario of rapid house price growth

In the scenario of rapid house price growth, mortgage approvals increase and house prices rise relative to household incomes.

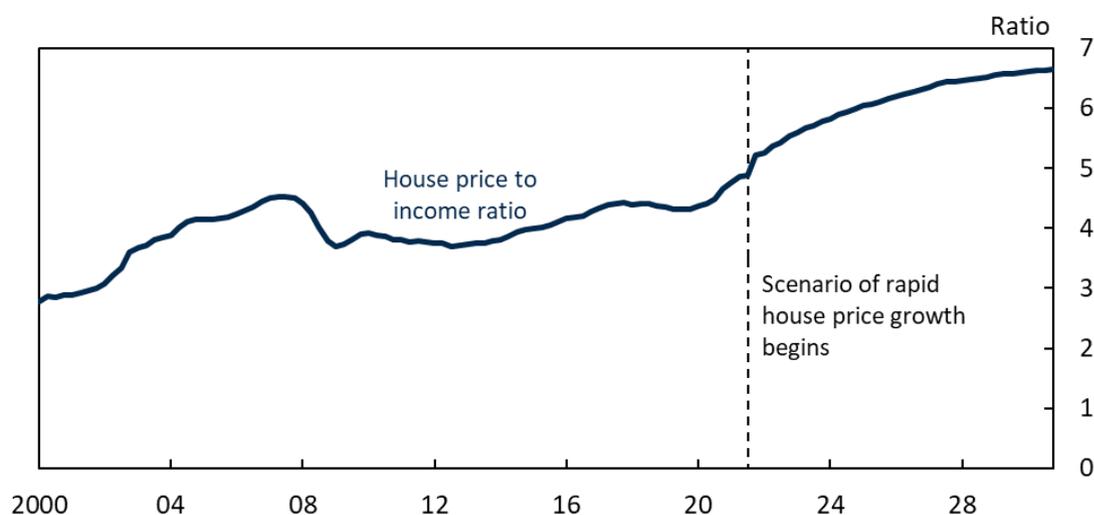
We model a 10 year rapid house price growth scenario up to end-2030, using the [November 2021 Monetary Policy Report](#) central projection as a starting point. In the scenario, with both of the FPC's mortgage market measures in place, we assume that lenders loosen their underwriting standards, consistent with what we have seen in housing booms historically in the UK (**Section 1**). On aggregate, lenders currently have a significant degree of headroom below the 15% flow limit (**Section 2**). In the scenario we assume that lenders maximise the share of new mortgages with LTIs of 4.5 or higher to just under the 15% LTI flow limit.³⁴ This pushes up aggregate mortgage lending.

Mortgage approvals rise by around 7% over the scenario. Approval levels for FTBs and home movers are 23% higher and 25% higher than end-2019 levels respectively. We also model an increase in the number of remortgagors taking on more debt. The growth of house prices relative to nominal incomes is significantly higher than the central projection but slightly less pronounced than it was before the GFC (**Chart 18**). The house price to income ratio grows by around 35% to the end of 2030, while house prices grew around 55% relative to incomes between 2001 and 2007.

³⁴ Note that it is still possible for the share of mortgages with LTIs of 4.5 or higher in the stock of mortgages to rise above 15%, given that some borrowers with lower LTIs will face negative income shocks that push up on their LTIs over time.

Chart 18: In the scenario of rapid house price growth the house price to income ratio increases materially from current levels

Mean house price to income ratio in the scenario of rapid house price growth (a) (b)



Sources: ONS and Bank calculations.

(a) The historic house price to income ratio is calculated using a four-quarter moving sum of gross disposable income of the UK household and non-profit sector per household as the denominator.

(b) To project forward the house price to income ratio in the scenario, we grow the latest numerator in line with the aggregate path for house prices, without taking into account the impact of FPC policy, and grow the denominator in line with the path for aggregate nominal household income.

We model two variants of the scenario: one in which reversion rates rise and the FPC's affordability test tightens, and one in which reversion rates remain at their current levels.

Bank Rate is expected to rise to 1.75% in the ten years of the rapid house price growth scenario, compared to levels around 4% pre-GFC (consistent with a structurally lower interest rate environment now). The impact of Bank Rate on the effect of policy will depend on the extent to which changes in Bank Rate are passed through to reversion rates. To model this, we consider two assumptions about the pass-through of Bank Rate to reversion rates. First, we assume any change in Bank Rate fully passes through to reversion rates, making the affordability test more binding as the stress rate rises to over 8%.³⁵ At the other extreme, we assume that changes in Bank Rate have no impact on the reversion rate, meaning the relative tightness of the affordability test remains unchanged. As noted in **Section 3** of the December 2021 Financial Stability Report (FSR), there is considerable uncertainty about how the affordability test stress rate might evolve.

3.4: Modelling results

Without the FPC mortgage market measures in place, the share of outstanding mortgages with 'high LTI' ratios is projected to triple in a scenario of rapid house price growth.

In the scenario of rapid house price growth described above, and without the mortgage market measures in place, the share of the stock of mortgages with an LTI ratio of 4.5 or higher is projected to rise from around 10% in the latest data (2021 Q3) to around 31% at the end of 2030. This deterioration of the stock of mortgages reflects the impact of house price growth on borrower

³⁵ A stressed DSR threshold of 38.5%, an 8% stress rate and a 25 year term implies a maximum LTI of 4.

indebtedness, combined with the usual churn in borrower incomes. The impact builds over time as changes in the flow of new mortgages gradually feed through to the stock of mortgages.

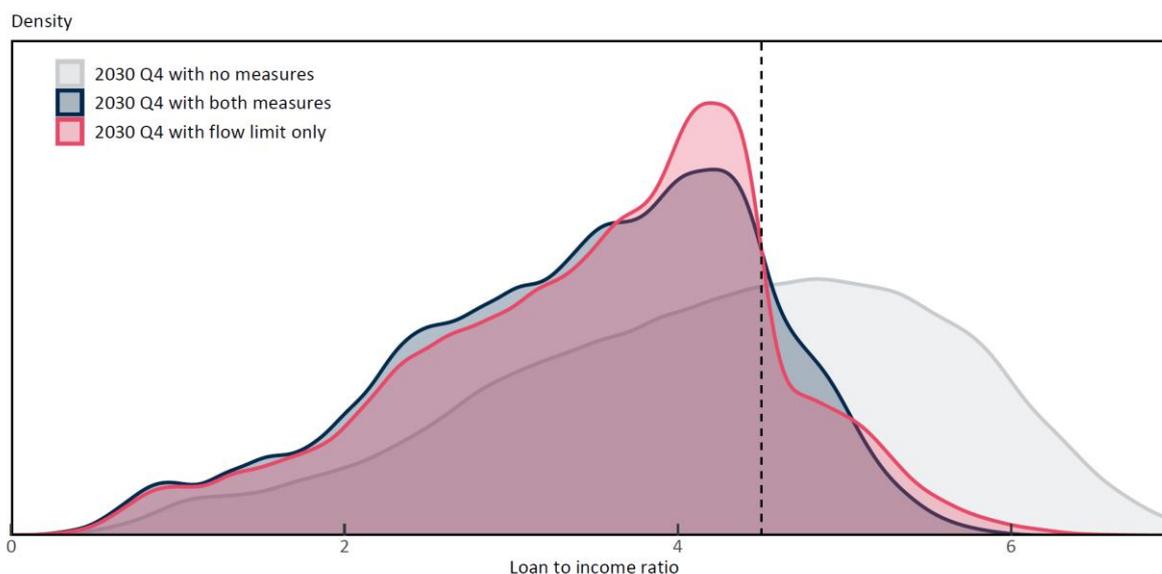
The overall level of household debt is also projected to rise significantly. The ratio of household debt to income, excluding student loans, rises from around 125% to around 210% at the end of 2030. This reflects both a sustained period of elevated mortgage market activity and an overall increase in the size of mortgages.

The FPC's mortgage market measures guard against a material increase in the number of highly-indebted households in a scenario of rapid house price growth.

The measures limit the build-up of debt in a scenario of rapid house price growth by restricting the number of new mortgages issued at 'high LTI' ratios (**Chart 19**). This feeds through to the stock of mortgages at the end of the scenario. With both measures in place, the share of the stock of mortgages with an LTI ratio of 4.5 or higher is projected to rise from around 10% to around 14.5% at the end of 2030, significantly below the 30% share projected in the absence of the measures (**Chart 20**). Similarly, the measures also limit the overall increase in household indebtedness. The ratio of household debt to income rises from around 125% to around 160% at the end of 2030.

Chart 19: Even in the absence of the FPC's affordability test, and relying on the LTI flow limit, there would be only a small increase in the flow of 'high LTI' mortgages in a scenario of rapid house price growth

LTI distribution of the flow of mortgages in a scenario of rapid house price growth



Sources: FCA Product Sales Database (PSD) and Bank calculations.

Withdrawing the FPC's affordability test would have a small impact on resilience in a scenario of rapid house price growth, as the LTI flow limit guards against a more significant deterioration.

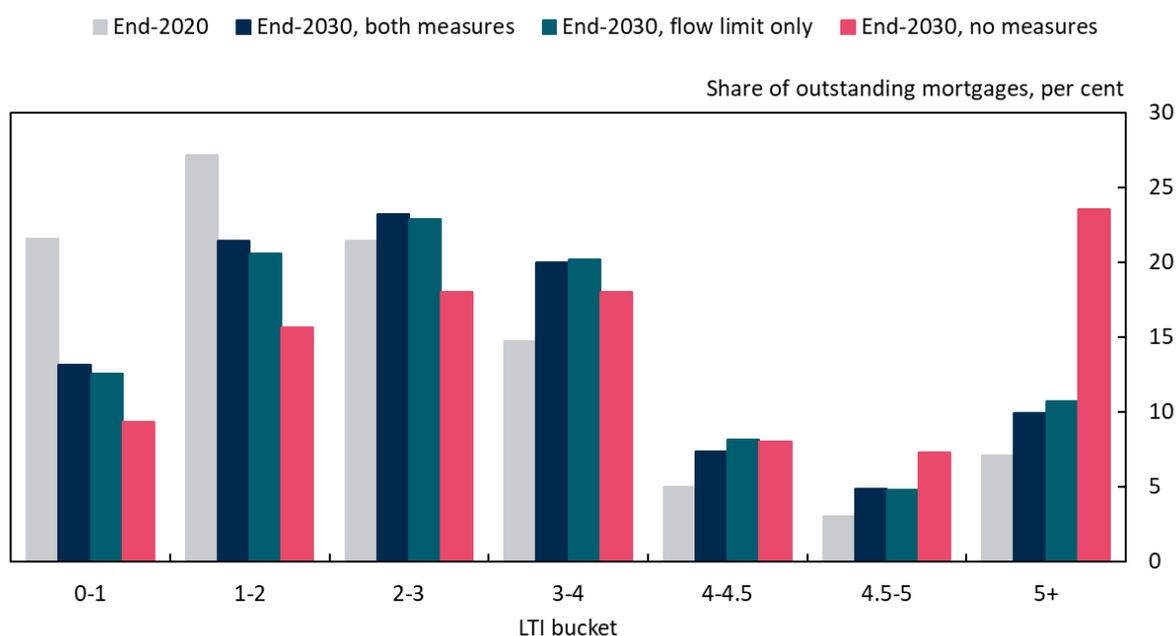
To understand the role played by each of the tools, we have modelled a hypothetical scenario where the FPC's affordability test Recommendation is not in place, but the LTI flow limit is still in place. In the absence of the FPC's affordability test, we assume that affordability testing follows the FCA's

MCOB rules. To estimate an upper bound for the impact of the affordability test, we assume that lenders apply a minimum stress buffer of 100 basis points over reversion rates.³⁶

In the scenario, the share of the stock of mortgages with an LTI ratio of 4.5 or higher rises to just over 15%, about 1 percentage point above the 14.5% share with both measures in place. The 1 percentage point increase from removing the affordability test is small relative to the 16pp increase that would result from removing both measures. This means that relying only on the LTI flow limit would prevent around 90% of the increase in this share that would occur in the absence of any measures. This would rise to close to 95% if we assumed no changes in reversion rates and therefore no mechanical tightening of the affordability test when Bank Rate rises.

Chart 20: Even in the absence of the FPC's affordability test, and relying on the LTI flow limit, there would only be a small increase in the stock of 'high LTI' mortgages in a scenario of rapid house price growth

LTI distribution of the stock of mortgages in a scenario of rapid house price growth



Sources: FCA Product Sales Database (PSD) and Bank calculations.

Withdrawing the affordability test Recommendation would also prevent aggregate household debt from increasing materially in a scenario of rapid house price growth.

A similar comparison suggests the LTI flow limit would also deliver most of the benefits of both measures in stopping a large rise in aggregate household debt. With both measures in place, the ratio of household debt to income is projected to rise by 29 percentage points, compared to a rise of 85 percentage points with no measures.³⁷ After removing the affordability test, the ratio is projected

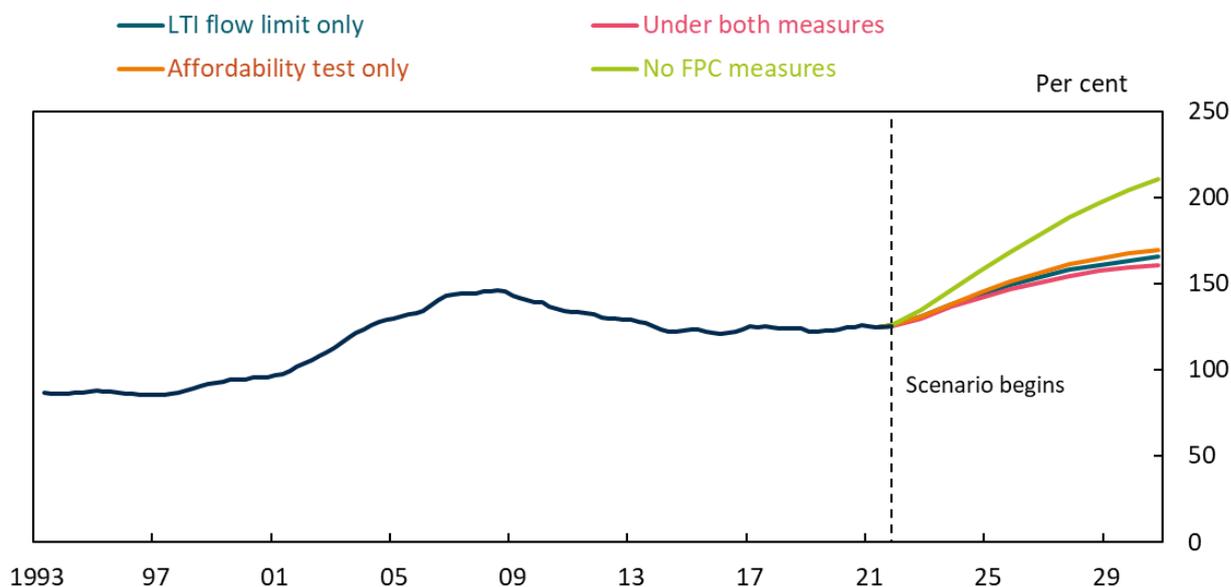
³⁶ The MCOB rules also require mortgage lenders to have regard to market expectations and any FPC measures, and to justify the basis they use to the FCA.

³⁷ Note that we assume no increase in the ratio of non-mortgage debt to household income.

to increase by only 32 percentage points. The LTI flow limit would therefore deliver 95% of the impact of both measures in limiting the rise in the household debt to income ratio (**Chart 21**).

Chart 21: In the absence of the FPC's affordability test there would be a much smaller increase in aggregate debt in a scenario of rapid house price growth

Total household debt to income ratio in scenario of rapid house price growth ^(a)



Sources: FCA Product Sales Database (PSD) and Bank calculations.

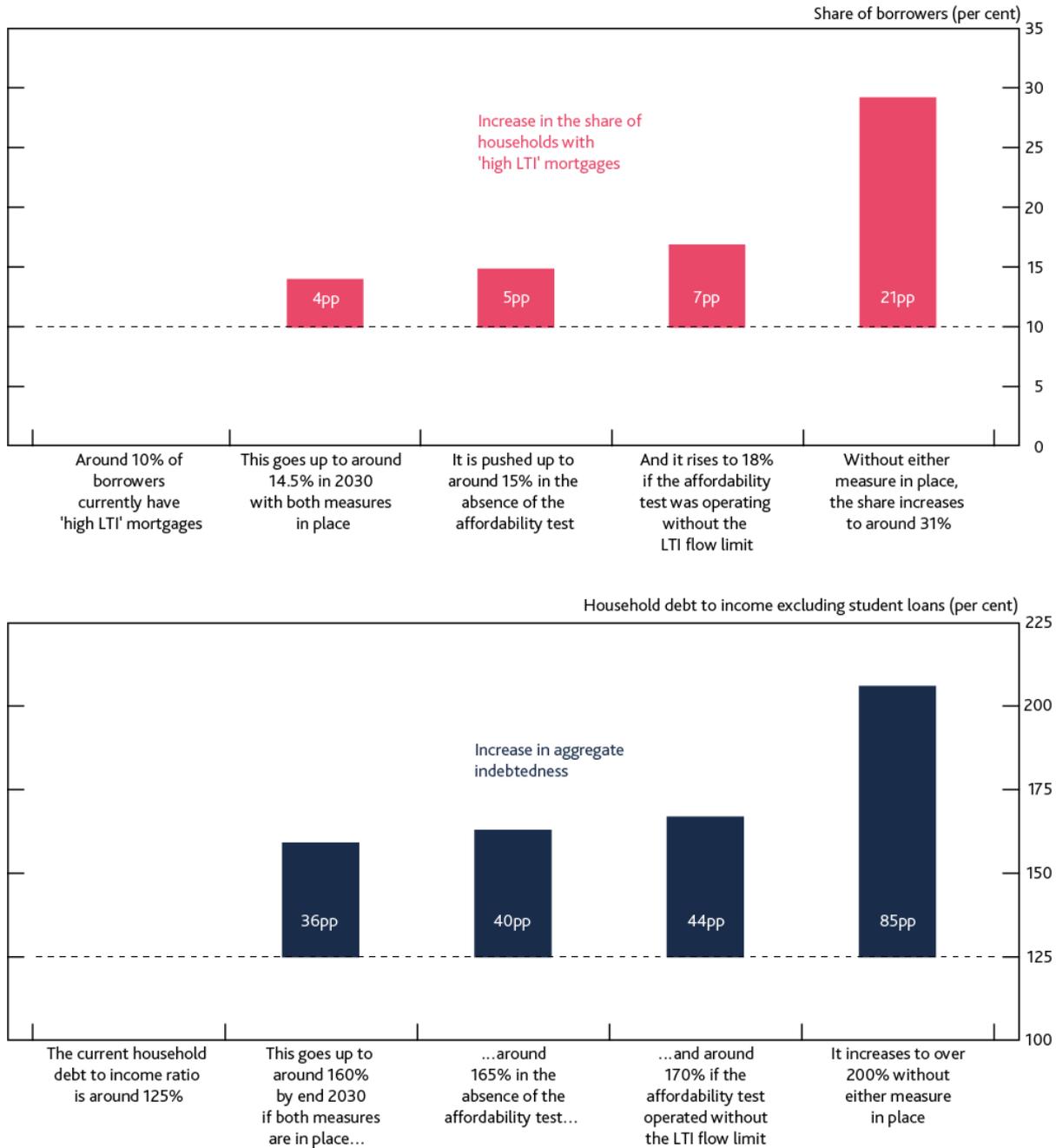
(a) Household debt other than mortgage debt has been assumed to grow as a constant share of household incomes over the scenario.

Withdrawing the LTI flow limit on its own would have a larger negative impact on resilience than withdrawing the FPC's affordability test.

An alternative scenario with the affordability test in place but without the LTI flow limit would lead to a slightly larger deterioration in the distribution of the stock of mortgages (**Chart 22**). The share of the stock of mortgages with an LTI ratio of 4.5 or higher would rise to around 18%, about 3 percentage points above the 15% share with both measures in place. Since the share is projected to rise to 31% in the absence of the measures, this means that the affordability test would still deliver around 80% of the benefits of both measures in limiting an increase in the 'high LTI' share. The household debt to income ratio would rise to around 170%, which equates to 90% of the impact of both measures.

Chart 22: The LTI flow limit plays a stronger role than the affordability test in limiting the stock of 'high LTI' mortgages in a scenario of rapid house price growth

Change in proportion of mortgages outstanding with an LTI ratio of 4.5 or higher in a scenario of rapid house price growth (scenario where reversion rates rise) ^(a)



Sources: FCA Product Sales Database (PSD), ONS and Bank calculations.

(a) Household debt other than mortgage debt has been assumed to grow as a constant share of household incomes over the scenario.

Both FPC measures play a similar role in limiting the number of households with high DSRs, because without the LTI flow limit borrowers might stretch term lengths to reduce their DSRs.

Both measures also play a role in reducing the proportion of households with high mortgage DSRs. In the scenario without the measures, the share of outstanding mortgagors with DSRs of at least 40% is projected to increase from its current level of 5% to around 8% by the end of 2030. Maintaining either of the measures mitigates this increase, as the share would only increase to around 6% with either of them in place.

The two measures play a similar role in limiting the number of high DSR households, despite the LTI flow limit having a larger impact on the number of ‘high LTI’ households. That is because we assume that many borrowers at high LTIs increase the term length on their mortgage to reduce their monthly repayments and pass the affordability test. In aggregate, this broadly offsets the increase in high DSRs caused by the increase in ‘high LTI’ lending that is permitted by withdrawing the LTI flow limit. But stretching terms in this way could introduce additional vulnerability to the stock of mortgage debt, as households would have less flexibility to reduce their repayments by extending the term length on their mortgage further in the event of a shock and mortgage debt would reduce more slowly.

We map from the impacts of the FPC’s measures on the mortgage debt distribution to impacts on the GDP in a downturn, using academic studies.

The measures are ultimately designed to improve financial stability by reducing the impact of household debt on the economy during an economic downturn. As described above, we have translated the impacts of different calibrations of the measures on the stock of mortgages in each of the scenarios into impacts on changes in the level of GDP during a downturn using estimates from two academic studies.

Taking this together, the impact of withdrawing the FPC’s affordability test on GDP when a downturn occurs would be relatively small.

Table A shows how the estimated impacts on mortgage debt translate into impacts on GDP under these two methods. Overall, these results suggest that there would only be a very small increase in the size of a downturn if the FPC’s affordability test was withdrawn and affordability testing followed the FCA’s MCOB rules. Withdrawing only the LTI flow limit would have a slightly bigger impact. Withdrawing both of the FPC’s measures would have a much bigger impact given the material deterioration in borrower resilience in a scenario of rapid house price growth.

The method that draws on the [Aikman et al. \(2019\)](#) study implies consistently larger impacts on GDP than the method that draws on the [Kovacs et al. \(2018\)](#) study, which is consistent with the fact that it is more likely to capture wider macroeconomic amplification effects of cuts in consumption by more indebted households during a downturn.

Table A: There would only be a small increase in the size of a downturn if the FPC’s affordability test were withdrawn and affordability testing followed the FCA’s MCOB rules
Estimated impacts on GDP in an economic downturn following a rapid house price growth scenario with different calibrations of the FPC’s measures

Calibration	Estimated boost to GDP 3 years after a downturn, relative to no FPC mortgage market measures	
	Scenario where reversion rates rise	Scenario with reversion rates flat
<u>Direct impact on GDP via consumption cuts (Kovacs et al. 2018)</u>		
Both measures	0.47%	0.46%
LTI flow limit only	0.43%	0.46%
FPC affordability test only	0.39%	0.23%
<u>Impact on GDP including amplification and other channels (Aikman et al. 2019)</u>		
Both measures	1.5%	1.5%
LTI flow limit only	1.5%	1.5%
FPC affordability test only	1.3%	1.0%

Sources: FCA Product Sales Database (PSD) and Bank calculations.

3.5: Sensitivity analysis

In order to test the robustness of our headline conclusions, we re-ran the analysis after layering on a number of assumptions designed to produce a “worst case” scenario.

Given modelling assumptions and sensitivities, there is some uncertainty about the effect that removing the affordability test might have in practice. In order to test the robustness of our headline conclusions, we have layered on a number of assumptions designed to increase the impact of withdrawing the affordability test.

This extreme ‘worst case’ scenario incorporates three assumptions that increase the impact of withdrawing the test, along with the assumption that reversion rates rise with Bank Rate:

- **A quarter of borrowers are encouraged to leverage up further from the signal of a looser affordability test.** In the baseline model, a rise in house price to incomes leads to higher demand for ‘high LTI’ products. In addition, we assume a further 25% of borrowers increase their leverage, over and above the effect from higher prices, encouraged by the signal from a looser affordability test.
- **There is a 10% boost to FTB approvals each year.** We increase the number of FTBs in the projection by a further 10%, in addition to the boost to approvals encapsulated in the rapid house price growth scenario. This is equivalent to all of those renters currently constrained

by the affordability test entering the market in each year of the scenario, and as such is likely to overstate any potential impact in the scenario.

- **The change in policy has a signalling effect that directly causes lenders to increase their risk appetite and manage their ‘high LTI’ lending closer to the 15% limit.** In the rapid house price growth scenario we assume that lenders would approach the 15% limit, irrespective of the affordability test. To increase the impact of withdrawing the test, we model an alternative where lenders maintain their current risk appetite for ‘high LTI’ lending and only increase their risk appetite if the measure is withdrawn.

Even in an extreme ‘worst case’ scenario, withdrawing the affordability test and relying on the LTI flow limit would still deliver around 75% of the benefits of having both tools.

Table B summarises the impact of these assumptions. Even if we apply all of the assumptions set out above into a “worst case” scenario the flow limit alone would still deliver a broadly similar impact on the LTI distribution in the stock of mortgages.

Table B: Even under extreme assumptions, the LTI flow limit would still deliver a large share of the benefits delivered by both measures together

Sensitivity analysis of the impact of the FPC’s measures in a scenario of rapid house price growth

Assumption	Share of the mortgage stock with $4.0 \leq \text{LTI} \leq 4.5$ at end-2030	Share of the mortgage stock with $\text{LTI} \geq 4.5$ at end-2030
<u>Both measures</u>		
Scenario of rapid house price growth	7.7%	14.6%
<u>LTI flow limit only</u>		
Scenario of rapid house price growth	8.1%	15.5%
Scenario of rapid house price growth + 10% extra approvals boost	8.3%	15.7%
Scenario of rapid house price growth + 25% of borrowers leverage up further	8.6%	16.6%
‘Worst case’ rapid house price growth scenario	8.7%	16.7%

Sources: FCA Product Sales Database (PSD) and Bank calculations.