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José-Luis Peydró,[1] Francesc Rodriguez-Tous,[2] Jagdish Tripathy[3] and Arzu Uluc[4]

Abstract

This paper provides an overview of evidence from a range of country-specific studies on the effectiveness of borrower-based macroprudential tools which limit household leverage at the borrower level. Most studies find these measures effective in breaking the self-enforcing loop between household leverage and house prices. These measures have beneficial effects in terms of lower defaults and less volatile house price dynamics during periods of economic distress. Their effects are heterogeneous across borrower types, with stronger impacts where leverage requirements are higher, such as among first-time buyers. Studies point to restrictions on household leverage having downstream effects on job search, location choice, homeownership, and exposure to income shocks. Looking ahead, further research is required to conduct a comprehensive cost benefit analysis of these measures, to adapt them to increased use of technology in financial intermediation, and to examine their broader societal effects, including political outcomes and mental health.

Key words: Macroprudential policy, borrower-based tools, distributional consequences, financial stability, wealth inequality.

JEL classification: E58, G01, G21, G51, R2.

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1 Introduction

The 2007–09 financial crisis revealed vulnerabilities in the financial sector that were not adequately addressed by existing regulation and supervision. It also revealed that microprudential regulation—prudential regulation of the solvency of individual institutions—risked missing the forest for the trees: by not paying attention to the financial system as a whole, regulators and supervisors could miss large risks stemming from correlated exposures. Since then, a range of macroprudential tools have been incorporated into the regulatory toolkit.

Macroprudential regulation aims at limiting the build-up of systemic risk in the financial sector. It recognises that institutions might appear to make sound decisions individually but these decisions can have strong negative externalities. For instance, lenders might provide mortgages with high loan-to-value ratios (LTV) at a time when default rates are very low. In the event of a negative shock, this lending will push many borrowers to cut consumption, exacerbating the economic contraction. Indeed, crises preceded by housing and credit booms tend to have higher costs for the economy (for instance, as discussed in Jordà et al. (2015)). Mitigating credit booms via macroprudential tools can partially counteract these negative externalities and achieve a softer landing.

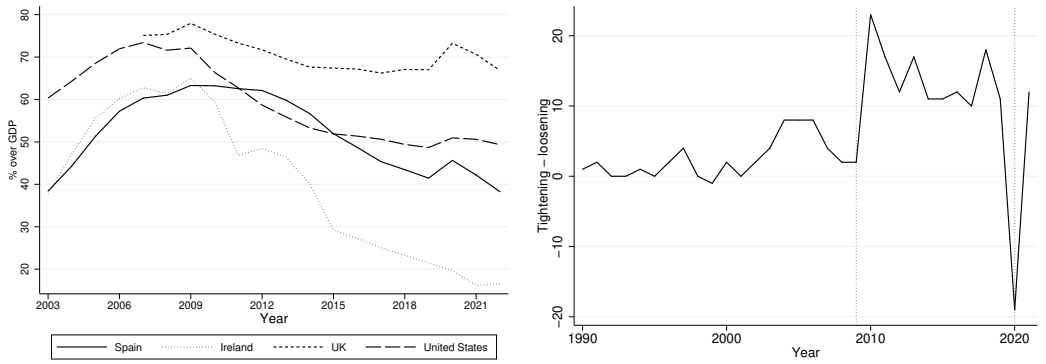
Macroprudential policies vary greatly in scale and scope. Some of these policies take the form of buffer requirements imposed on lenders, such as capital and liquidity requirements. The countercyclical capital buffer, for instance, requires banks to have higher levels of capital during good times. Macroprudential policies may also target specific sectors in lenders' balance sheets, such as sectoral capital requirements. And there is a class of policies which are aimed at preventing the build-up of leverage among households, policies which are otherwise known as "borrower-based" tools.

In this paper, we focus on the macroprudential regulation of household leverage through borrower-based measures, and the impact they have had on lending and on the macroeconomy. These macroprudential regulations are interesting for multiple reasons. First, economies undergoing financial crises associated with house price booms tend to fare worse, and borrower-based measures have been proposed as a means to break the escalatory link between mortgage lending and house price booms. Consequently, these measures have been quite popular since the Global Financial Crisis (GFC), as evidenced in Figure 1, which also shows the amount of mortgage lending (as % of GDP) for some countries that saw large-scale corrections during

2007-2009. These measures are typically introduced relative to collateral value (e.g. LTV) or income (e.g. LTI), with subtle differences in their channels of transmission to the economy and the specific policymaker objectives they are suited to achieve.

Figure 1
Trends in mortgage lending and borrower-based macroprudential interventions

(a) Mortgage as % of GDP (b) Use of household macroprudential policies



The left panel shows mortgage credit as a proportion of GDP during the period 2003 to 2022 for a selected group of countries. Sources: OECD, IMF, Financial Conduct Authority, and Central Bank of Ireland. The right panel shows net number of borrower-based measures being tightened in a given year. Source: iMaPP (IMF). The first vertical dotted line corresponds to the end of the global financial crisis (2009), the second vertical line corresponds to the beginning of the Covid-19 pandemic (2020).

Second, these borrower-based measures are redistributive in nature, since household leverage is not uniformly distributed in the population, and lower-income and younger borrowers typically require higher levels of leverage during mortgage origination. With more than 10 years of concurrent use of such policies across multiple jurisdictions, time is now ripe to consider the insights from the rapidly growing literature that has documented the transmission of these measures to credit intermediation, lender behaviour and macroeconomic outcomes such as house prices. A caveat is in order. The distributive effects do not suggest that access to credit has been a barrier to homeownership; evidence points to accumulating a deposit as the main barrier to homeownership.[1]

Overall, the experience from borrower-based measures introduced across different countries is that they are effective in breaking the loop between household leverage

[1]For recent evidence and discussion, see Bank of England (2025) and Institute for Fiscal Studies (2023). Ahlfeldt et al. (2024) show that house prices growing much faster than incomes is the main driver of rising mortgage-related household leverage in the UK.

and house prices. Consistent with theory, these measures are redistributive in the sense that they have a stronger impact on some borrowers, particularly lower-income, younger and first-time buyers, who are likely to require higher levels of leverage to get on the housing ladder. Restricting household leverage has further downstream effects on household choices related to job search, location choice, delayed homeownership, and susceptibility to income shocks. However, these tools have also had beneficial effects on the macroeconomy in terms of lower defaults and less volatile house prices during periods of economic distress. The beneficial effects provide evidence for the counterfactual that a higher amount of homeowners might otherwise undergo distress in the form of default and repossessions in the absence of borrower-based tools. There is substantial work to be done to inform policymakers on the overall welfare implications.

This paper is organised as follows. In Section 2, we review the literature that provides the intellectual case for borrower-based macroprudential tools. In Section 3, we discuss existing evidence, both theoretical and empirical, on the effects of these tools. In Section 4, we identify knowledge gaps and suggest avenues for further research. Section 5 concludes.

2 The case for borrower-based tools

The Global Financial Crisis (GFC) was preceded by a substantial expansion in mortgage intermediation, and the extant literature has pointed to credit supply factors and house-price expectations as the drivers of the boom. Some of the papers which have discussed the role of credit supply expansion in driving the house-price boom include Keys et al. (2010), Mian and Sufi (2011), Favara and Imbs (2015), Mian and Sufi (2022), and Greenwald and Guren (2021), among others. Adelino et al. (2018) have argued for the role of house-price expectations as a driver of the housing boom, based on the behaviour of both lenders and households during the boom period. Evidence from surveys has backed up this view of the housing boom and has shown that financial constraints affect home ownership decisions (Fuster and Zafar (2016)), long-term house-price expectations do not factor in mean-reversion (Armona et al. (2019)) and beliefs can drive leverage choice (Bailey et al. (2019)). Favilukis et al. (2017) use a theoretical model to support the case of credit expansion (as opposed to low interest rates) as the driver of the housing boom.

Across the board, the literature has documented negative outcomes in households that have a high level of leverage during the housing boom. Mian et al. (2013) find a substantial consumption response to the drop in housing wealth resulting from the housing bust. Adelino et al. (2016) document an increase in household leverage across the income distribution during the housing boom preceding the GFC in the US, and find leverage, rather than subprime lending, as the key driver of mortgage defaults during the bust. Corbae and Quintin (2015) estimate that high-leverage loans account for 60% of the increase in foreclosure rates during the bust. Gupta (2019) shows that each foreclosure has substantial local spillover effects and portends further foreclosures, which can trigger downward house-price spirals. Piskorski and Seru (2021) find that the effects of foreclosures have had long-lasting effects across US regions, with recovery to pre-crisis levels of consumption and output taking 5 years on average and longer for many regions. Cross-country studies of financial crises associated with housing booms also paint a bleak picture: Jordà et al. (2016) show that financial crises triggered by leveraged households lead to deeper recessions with slower recoveries; Mian et al. (2017) document that higher levels of household debt (as a proportion of GDP) are associated with lower subsequent output growth.

The corpus of empirical evidence has met with seminal contributions that have made the theoretical case for macroprudential limits on the build-up of household leverage in the economy through interventions such as borrower-based measures. Lorenzoni (2008) shows that competitive financial contracts can lead to excess borrowing ex-ante, and excess volatility ex-post: borrowers do not internalize the fact that additional credit will worsen fire sales if there is a crisis, which can lead to excessive credit compared to the constrained first-best. The literature which uses pecuniary externalities to motivate macroprudential regulation is vast; see, for instance, Caballero and Krishnamurthy (2001), Dávila and Korinek (2017), Jeanne and Korinek (2020), among many others.

Other papers have motivated macroprudential interventions based on aggregate demand externalities: situations in which the process of deleveraging by constrained agents necessitate a fall in interest rates to increase consumption by unconstrained agents, potentially leading to a liquidity trap. Farhi and Werning (2016) show that lenders do not internalize the distribution of wealth among constrained and unconstrained agents which negatively affects aggregate demand and output during a crisis given nominal rigidities and limitations to monetary policy (such as the zero-lower-bound or ZLB). Thus, they recommend ex-ante borrower-based limitations to

address aggregate demand externality which can further depress economic activity during housing busts. Korinek and Simsek (2016) argue that interest rates are inferior to macroprudential policy in tackling excess leverage: given the ZLB, interest rates cannot prevent an economy from going into a liquidity trap on their own. In these papers, the ex-ante limitation of leverage is constrained-efficient. In a more direct analysis of borrower-based tools, Ferrero et al. (Apr. 2023) study LTV limits and make the case for their countercyclical use to avoid liquidity traps specifically during housing busts associated with debt-deleveraging.

3 Effects of borrower-based tools

The potential effects of borrower-based macroprudential tools are multi-faceted. These tools may prevent some borrowers from obtaining "excessive" leverage, but also affect decisions around renting or buying and nudge households to purchase a smaller property that falls inside the imposed limit. Households may also use their liquid assets to increase the down payment to stay within the macroprudential limits or obtain credit from unregulated sources such as non-banks.

These behaviours have different implications for financial stability. In this section, we review the evidence on the success of borrower-based tools in reining in credit and house prices to meet their stated objective of financial stability. However, the distributional consequences of these tools have also become an important part of the discussion around their transmission since household leverage is not uniformly distributed across borrowers: lower-income and younger borrowers have lower liquid assets to put higher deposits and may be more affected by the tools. In this section, we discuss the distributional consequences of the tools, with implications for home ownership and location choice, and outcomes during economic distress.

3.1 Effect on overall lending and house prices

While there is some evidence suggesting that regulatory arbitrage can subvert intended effects of borrower-based tools (for instance Galan and Lamas (2023), which shows that lenders may use inflated house prices to lend higher loan amounts to existing homeowners), there is consistent evidence that borrower-based tools, at a first pass, have a countercyclical effect on lending to households. And consistent with the effect on lending, restricting access to higher leverage has the expected

macroeconomic effect of mitigating house price booms and busts by moderating the self-reinforcing loop between mortgage lending and house prices (higher mortgage credit can drive house prices higher, which in turn raise the collateral value of properties and expectations of future house prices, leading to more credit).

Igan and Kang (2011) is an early study on the overall effects of borrower-based tools right after the GFC. Using Korean micro-data, they find that tightening the tools leads to a substantial reduction in transactions, with results pointing to the tools dampening expectations of future house prices and leading to speculators (as opposed to first-time buyers) delaying house purchases.

L. Zhang and Zoli (2016) and Galán (2020) use cross-country data to study the effects of tightening and relaxing borrower-based tools. L. Zhang and Zoli (2016) use an event study approach to show that tightening the tools reduces house price and credit growth. In addition, they report that Asian economies were more active than the rest of the world in using these tools prior to and during the GFC. Galán (2020) use quantile regressions on GDP growth distribution and find that the timing of these policies matters: tightening borrower-based tools are more effective (than capital-based tools) during expansions, but relatively less effective when loosening during a crisis.

Aikman et al. (2019) provide estimates of the amount of mortgage borrowing that would have been directly impacted by different levels of some borrower-based tools in the US and the UK in the run-up to the GFC. Epure et al. (2024) study the impact of borrower-based tools using the household credit register in Romania to show that tightening the tools lead to a decline in the volume of household credit, and particularly so for riskier (*foreign* vs local currency) loans and in periods when the VIX is low. Crowe et al. (2013) and Biljanovska et al. (2023) also provide broad cross-country discussions of the evidence on the efficacy of borrower-based tools on lending and house prices: both argue that the tools are effective in reducing the risks associated with falling house prices if tightened during booms; the former also argues that macroprudential measures are more effective than fiscal measures such as capital gains and transaction taxes to rein in house prices.

Specifically on house prices, several empirical studies provide evidence for the dampening effect of borrower-based interventions on house price growth in a range of jurisdictions.[2] Some studies find insignificant effects of borrower-based interven-

[2]For instance, studies based on macroprudential interventions in South Korea by Igan and Kang (2011); 19 advanced economies by Crowe et al. (2013); 56 advanced and emerging economies by

tions on house price growth.[3] Different methodological approaches and identification strategies can account for these differences: the insignificant effects are based on cross-country studies, while the former articles often use granular, loan-level micro-data (which has significant benefits, importantly controlling for differences in both the composition of transacted houses and local house price cycles). In recent years, studies using agent-based models (ABMs) have examined the effects of borrower-based interventions on housing and mortgage markets, reporting similar dampening effects of these tools on house-price cycles.[4] Some of these ABMs provide calibrations of expected magnitudes of changes in lending and house prices to different levels of interventions. Bardoscia et al. (2024) develop an ABM model of the UK economy which shows that the decline in average house prices due to a LTI cap can lead borrowers to take out smaller mortgages, indicating adjustments at the intensive margin (smaller loan sizes).

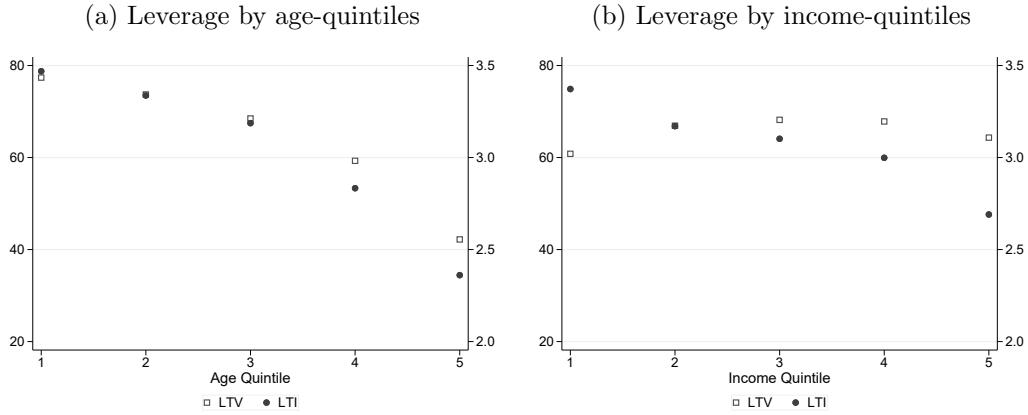
Borrower-based interventions can have distributional effects on house price dynamics. Peydró et al. (2024) find that local areas more exposed to the introduction of the loan-to-income (LTI) limit in the UK, measured by the prevalence of constrained lenders and low-income borrowers, experienced relative cooling in house-price growth after the policy's implementation. Interestingly, these effects are more pronounced in the lower quantiles of (transacted) house prices, i.e., cheaper houses. Acharya et al. (2022) also show localized effects of the measures introduced in Ireland with house-price growth switching from urban to rural counties. Further, Castellanos et al. (2024) find that the house price cooling in Ireland is associated with higher rental prices. Caloia (2024) and Chi et al. (2023) document a cooling in house prices in the more expensive property markets in the Netherlands and Taiwan, respectively. However, as we argue in Section 4.1, there is room for more work on the distributional impact of borrower-based tools on house price dynamics.

Richter et al. (2019); 13 Asian economies and 33 economies in other regions by L. Zhang and Zoli (2016); Hong Kong by Nielsen (2019); Brazil by De Araujo et al. (2020); Israel by Laufer and Tzur-Ilan (2021); Slovakia by Cesnak et al. (2021); Portugal by Neugebauer et al. (2021); Ireland by Acharya et al. (2022); Norway by Aastveit et al. (2022); Taiwan by Chi et al. (2023); Lithuania by Dirma and Karmelavičius (2023); and United Kingdom by Peydró et al. (2024).

[3] See Jácome and Mitra (2015), Kuttner and Shim (2016), Cerutti et al. (2017), Alam et al. (2019).

[4] For instance, the UK housing market studied by Baptista et al. (2016) and Carro et al. (2023), Denmark by Cokayne et al. (2024), Italy by Catapano et al. (2021), and Spain by Carro (2023).

Figure 2
Household leverage by age and income quintiles



This figure shows the average leverage (LTI and LTV) for mortgages originated in the UK during 2015–2017 by age (panel (a)) and income (panel (b)) quintiles. LTV is plotted along the y-axis on the left, LTI against the y-axis on the right. Source: Product Sales Data by Financial Conduct Authority.

3.2 Effect on lending across borrower sub-groups

Figure 2 shows that household leverage is not uniformly distributed across income and age-groups in the UK; younger and lower-income borrowers are more leveraged during mortgage origination. Similarly, first-time buyers, who tend to be younger and with lower-incomes, require a higher amount of household leverage while getting on the housing ladder. By their very nature of limiting household leverage, borrower-based tools are distributional. Here we provide an overview of papers that have studied the distributional consequences of borrower-based tools, and their implications for wealth inequality, through theoretical and empirical analysis.

Frost and van Stralen (2018) study borrower-based tools in 69 countries during 2000-2013 and investigate whether these interventions are associated with ex-post inequality. The authors find that borrower-based tools are associated with higher net inequality (i.e. GINI coefficient after taxes and transfers). Thus, this provides suggestive evidence using cross-country data that borrower-based tools can have consequences for inequality, particularly in emerging market economics.

There is a growing corpus of event studies that use high-quality micro-data (i.e. near-universe of new mortgages around a policy's introduction, combined with lender balance sheet and borrower's demographic information) to comment on the distributional consequences of borrower-based policies in specific jurisdictions. Peydró et al.

(2024) and Belgibayeva (2020) both study a cap on the proportion of high loan-to-income (LTI) mortgages lenders could issue every quarter in the UK. Lenders close to and beyond the limit ("constrained lenders") reduced their proportion of high-LTI lending, leading to an overall reduction in high-LTI lending, affecting lending to low-income, first-time and younger borrowers. Peydró et al. (2024) further show that the regulation also led to a reduction in the share of low-income borrowers in the fewer high-LTI loans issued by constrained lenders following the regulation. This led to a reduction in lending to low-income borrowers at the aggregate (i.e. the policy restricted leverage during a relatively benign phase of the financial cycle).

Acharya et al. (2022) study the impact of a suite of policies aimed at targeting household leverage by borrower-type (whether first-time buyer) and investment-type (owner-occupied, buy-to-let) in Ireland. Despite the regulation binding on a large share of the mortgage market, it did not affect overall mortgage issuance. The authors show that this takes place through a redistribution across borrowers and geographies to "conform" with the new limits: i.e. switch away from low- to high-income borrowers, and across areas with varying presence of constrained borrowers. Kinghan et al. (2022) find differences in the leverage behaviour of high and low-income borrowers around the thresholds set for LTV limits in the same Irish regulation.

While these empirical papers study the impact of one-off policies, Caloia (2024) uses time-varying LTI and LTV limits in Netherlands and finds stronger effects on lending for low-income and first-time buyers in the more expensive property markets. Laufer and Tzur-Ilan (2021) also find stronger house price effects in more expensive areas after an increase in risk weights on high-LTV mortgages in Israel.

Multiple agent-based models have studied mortgage access for first-time buyers in response to tightening of borrower-based macroprudential policies, and document a switch from first-time buyers to investors (buy-to-let). These are variously calibrated to UK mortgage and online real estate search data (Carro et al. (2023)), UK survey data (Tarne et al. (2022)), European household finance data (Laliotis et al. (2020)), and Spanish housing market data (Carro (2023)). Among these, Carro et al. (2023) study the interplay of change in supply and demand in owner-occupier and rental markets in response to macroprudential tightening, and Tarne et al. (2022) highlight the potential for higher wealth inequality and lower consumption volatility for first-time buyers.

3.3 Borrower response in job search, location choice and homeownership

As a corollary to their effect on access to credit and housing transactions, borrower-based measures have profound implications on homeownership, location choice and therefore aggregate employment and economic activity. Most studies discussed in this section have focused on LTV limits. Tzur-Ilan (2023) shows that the introduction of LTV limits in Israel led constrained borrowers to choose locations that are further away from the central business district, cheaper and in neighbourhoods with worse socio-economic conditions. Thus, the regulation led to an increase in commuting distances and costs, and movement to less-advantaged areas (with implications for long-term welfare as in Chetty et al. (2016)).

Aastveit et al. (2022) provide a counterpoint to how constrained borrowers may respond to restrictive LTV limits through channels apart from location choice. They use the Norwegian tax registry to show that borrowers restricted by LTV limits reduce the probability of a house purchase, and delay the eventual transaction. The paper proposes a liquidity-leverage trade-off for constrained households (also in Van Bekkum et al. (2023)): they may choose to wait longer to get on the housing ladder, and do so with higher down payments without compromising on the location, but with lower liquidity going forward. Such households fare worse conditional on unemployment shocks, leading to ambiguous effects of the LTV limits on consumption volatility. Castellanos et al. (2024) find complementary results in Ireland in terms of lower homeownership, although they also document higher rental prices (which will negatively affect households' ability to save). In contrast to the results from Norway, Van Bekkum et al. (2023) use Dutch tax records and find that such limits lead households to lower interest expenses, and experience less financial distress, better liquidity management, and less volatile consumption following income loss.

Similarly, Bolliger et al. (2025) use Swiss tax records and detailed demographic and financial information to document that an introduction of LTV limits led to a drop in transition to homeownership for younger households with lower incomes and wealth, and an increase in the importance of pre-death bequests in home purchases. Eerola et al. (2022) also show that an LTV limit decreased the transition to home ownership in Finland. Chi et al. (2023) document a shift in home purchases towards areas not targeted by LTV restrictions in Taiwan.

3.4 Effects during economic distress

Borrower-based measures aim to mitigate potential borrower defaults. Several empirical and theoretical studies find lower delinquency/default rates resulting from borrower-based measures.

Wong et al. (2011) find lower responsiveness of mortgage delinquency risk to changes in property prices and other macroeconomic fluctuations when comparing economies with LTV policies to those without. De Araujo et al. (2020) and Van Bekkum et al. (2023) find that LTV restrictions led to affected borrowers being less likely to be in arrears in Brazil and Netherlands, respectively. Dirma and Karmelavičius (2023) find that debt-service-to-income (DSTI) limits are effective in mitigating the probability of mortgage defaults in Lithuania. Peydró et al. (2024) show that low-income borrowers were less likely to be under default following the Brexit referendum, an event which led to a country-wide drop in house-price growth, in local-areas more affected by the UK LTI regulation. Neugebauer et al. (2021) investigate the impact of borrower-based measures implemented in Portugal in the context of the Covid-19 pandemic, and find that the measures lead to a drop in both the probability of default and loss given default.

Catapano et al. (2021) show that LTV and debt-service-to-income limits can reduce mortgage defaults using an ABM of the Italian housing market. Bardoscia et al. (2024) show that an LTI limit can decrease mortgage defaults with a macroeconomic ABM model of the UK housing market. Cokayne et al. (2024) show that tightening LTV requirements reduces the probability of default on mortgage loans in a DSGE model calibrated to Denmark.

3.5 Effect on lenders

The literature has documented interesting margins of adjustments through which borrower-based macroprudential policies impact the behaviour (and therefore the balance sheet) of lenders. Higher-leverage loans entail higher returns—hence restrictions on such loans also create incentives and opportunities for regulatory arbitrage. DeFusco et al. (2020) show that lenders responded to the introduction of a sharp increase in the cost of issuing high-leverage mortgages in the US by an extensive-margin decision to step away from the market, rather than raise interest rates. Consistently, the effect is stronger for lenders relying on third-parties to originate mortgage exposures. Similarly, Peydró et al. (2024) also show, using Oaxaca-Blinder decomposition,

that the majority of the adjustment took place via quantities and not prices.

Peydró et al. (2024) report that 'constrained' lenders increase the average size of the fewer high loan-to-income ratio mortgages they issued in response to loan-to-income restrictions, thereby steering high loan-to-income mortgages towards higher income borrowers. This paper also highlights that 'unconstrained lenders' may not always substitute for affected lenders. In the UK, the unconstrained lenders increased the interest rate of high loan-to-income loans issued to low-income borrowers in areas with high competition: rather than substitute for the constrained lenders, the unconstrained lenders were concerned about adverse selection among low-income applicants.

Agarwal et al. (2018) document regulatory arbitrage in the tightening of LTV ratio requirements in Singapore. They find that the regulation did not lead to a reduction in overall mortgage lending. The regulation led to excess funding resources amongst lenders, who appear to exercise lower discretion post-policy by extending conforming loans to borrowers with lower liquid assets, a higher likelihood of paying interest penalties on credit cards and lower credit scores. They argue for borrower-based tools directly targeting the balance sheet position of borrowers, akin to the affordability tests conducted in the UK since 2012.

Acharya et al. (2022) provide an interesting window into compositional effects on the portfolio of affected lenders in Ireland. They find that affected lenders increase risk taking in asset classes not targeted by the borrower-based measures. These lenders increase their holdings of high-yield securities more than less-affected banks (and compared to pre-policy periods), and increase their corporate holdings by targeting riskier borrowers while lowering the overall interest rate charged on the corporate holding. Thus, their findings are a mirror image of Chakraborty et al. (2018) who find crowding-out of the corporate portfolio during housing booms in the US.

4 Avenues for further research

While there is a growing literature, described above, studying the distributional impact of borrower-based tools, it is still nascent; we highlight in this section some research avenues that we consider of first-order importance to better understand the consequences of these policies.

4.1 House-price cycles and housing heterogeneity

Borrower-based tools restrict mortgage credit and reduce housing transactions, leading to lower house prices (Section 3.1). If borrower leverage going into a crisis is lower, there will be fewer "forced" sales, i.e., fewer borrowers selling their home because they can no longer afford the mortgage. Thus, an ex-ante cooling (lower leverage) should lead to a smaller correction in house prices ex-post. Moreover, precisely because borrower-based policies restrict lending to the most leveraged borrowers, the benefits during a downturn may overcome the countercyclical costs (lower house price growth and distributional consequences).

Peydró et al. (2024) provide evidence of the effectiveness of borrower-based tools in modulating house prices over an entire financial cycle; that is, not just immediately after the introduction of a loan-to-income (LTI) limit. The paper uses the UK Brexit referendum as a negative shock to the housing market, which translated into significantly lower house price growth. Following the Brexit referendum, when there is a UK-wide house price cooling, the growth rate in local areas more affected by the LTI regulation is on average around 1pp higher than the regional trend.

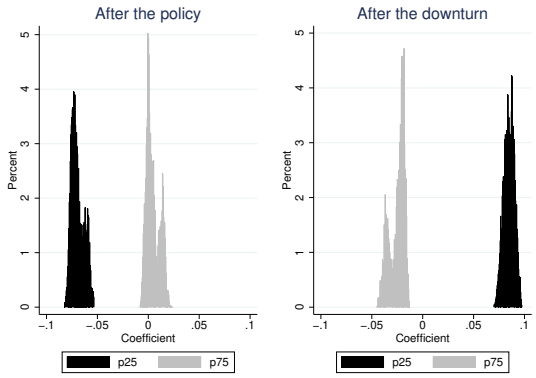
Many countries have not experienced a full financial cycle since the Global Financial Crisis (reflecting the relative recency of the literature) other than the Covid-19 pandemic, which has many other confounders, and a deeper understanding of how effective these tools are during downturns is likely to be a productive avenue of research in years to come.

Peydró et al. (2024) further show that different parts of the house-price distribution react differently to borrower-based tools. Figure 3 shows changes in different parts of the house price distribution (the 25th and 75th percentile) that cannot be trivially attributed to changes in the mix of transacted houses, and are robust to the inclusion of a wide range of controls.[5] The figure shows change in house price growth (compared to a counterfactual trend) in affected areas after introduction of the LTI limit.

Two things stand out. First, in affected areas, house price growth at the 25th

[5]In order to obtain a house-price distribution which is unaffected by the type of properties being transacted, Peydró et al. (2024) use a novel, granular "repeat postcode-type" house-price index. For each index (i.e. the 25th and 75th percentile of the resulting distribution at a local-area level), coefficients are reported using regressions based on all possible combinations of the following local-area controls: average age, density, population, earnings, unemployment, correlation with the regional cycle, percentage of developed land, and a proxy for distance from the coast). More information can be found in the paper's Online Appendix.

Figure 3
Borrower-based tools and house price growth



This figure shows the histogram of different coefficients reflecting how house-price growth behaves after the policy and after the Brexit referendum in local areas more affected by the macroprudential policy for different house price indexes. All the house price indices are calculated using the repeat postcode-type approach from Peydró et al. (2024). The index is calculated for the left tail (25th percentile, in black) and right tail (75th percentile, in grey) of the house-price distribution.

percentile turns negative relative to less-affected areas after the policy's introduction, but shifts positive following the UK Brexit referendum. Second, there are no significant differences for the 75th percentile of the house price distribution: the coefficient is close to zero both after the policy and the referendum, and statistically insignificant.

The results suggest that cheaper houses react more strongly to macroprudential policy (lower price growth after the policy, but also lower troughs during downturns). It is therefore important to focus on the impact of borrower-based tools on both the house-price cycle and the types of properties affected by these tools.

4.2 Calibrating costs and benefits

Effective calibration of borrower-based macroprudential tools requires a comprehensive understanding of their costs and benefits. While the academic literature offers valuable insights—highlighting various transmission channels—these findings focus on specific dimensions, and there is a need for a holistic framework that integrates these diverse strands of evidence into a coherent cost-benefit analysis.

Structural models can help policymakers with an understanding of the costs and benefits of these borrower-based tools. There are currently multiple structural models of the mortgage market (e.g., Benetton (2021), Robles-Garcia (2019), Fisher et

al. (2024), Taburet et al. (2024), and Miles et al. (2024)) for the UK; and D. Zhang (2022) and Berger et al. (2024) for the US), but none that specifically models both the demand and supply issues around household leverage.

A structural model aimed at capturing the key features of borrower-based measures, we expect, would have the following features. It should model the demand for household leverage as a function of borrower income/wealth. Lender supply for higher leverage should carry higher compensation for risk, and any policy interventions that curtail higher leverage should allow for adjustments via both quantities and prices in the mortgage market. The model should be able to break down the impact of the regulation on lending into the intensive (change in the size of loans) and the extensive margin (change in the number or availability of loans). The model should also be able to aggregate mortgage loans to run suitable counterfactuals with alternate levels of borrower-based macroprudential policies: the resulting welfare losses can then be compared with the potential benefits in terms of lower likelihood of crisis, or better outcomes conditional on a crisis. Finally, such a model would also allow for identifying groups most vulnerable to the effects of tighter borrower-based measures, and a planner may consider transfers to spread more widely the societal gains from these measures.

4.3 Political economy of borrower-based tools

Recent literature has highlighted the effect of banking crises and debtor distress on political outcomes (for instance Doerr et al. (2022) and Gyöngyösi and Verner (2022)). Given the topicality of house prices and housing affordability, borrower-based tools could potentially influence political outcomes.

Piskorski and Seru (2021) make a strong case for the consideration of country-specific mortgage market features—such as likelihood of debt-relief, foreclosures, fixed-rate vs adjustable-rate mortgages, refinancing constraints, etc. which vary across jurisdictions—when designing macroprudential interventions. In a similar vein, there is need for further research on the impact of these mortgage market features on the efficacy of borrower-based tools.

The risks posed by climate change loom large as a source of wide-spread financial and macroeconomic instability in the future. For instance, Sastry et al. (2023) document that traditional insurers have started exiting high-risk areas in the US, with insurance counterparty risk being passed on to Government Sponsored Enterprises.

The design of optimal macroprudential interventions in response to how lenders, insurers, and borrowers react to climate risk will likely become a topic of significant interest in the future.

Finally, given the welfare implications from the effect of the tools on housing transactions and home ownership, a macroprudential regulator may also consider the underlying drivers of house prices that may decouple house price growth from income growth and lead to a secular increase in the amount of leverage required to get on the housing ladder. What, if any, is the role of a macroprudential regulator in addressing structural factors such as the supply of housing, and should the macroprudential regulator coordinate with fiscal authorities in addressing these factors?

4.4 Role of technology and fintech lenders

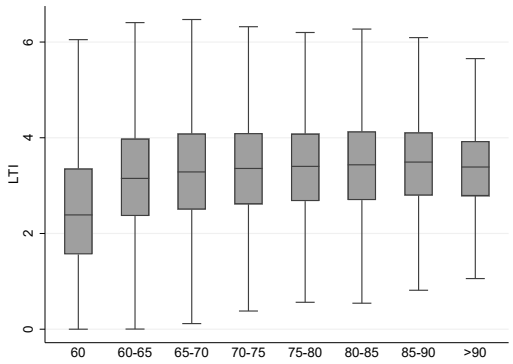
The continued, and ever more rapid, adoption of technology in financial intermediation may fundamentally alter the way borrower-based tools are operationalised in the future. We have discussed the distributional effects of these tools, with stronger effects on lower-income and first-time borrowers. What, if any, are the implications for redistribution when lenders themselves start using sophisticated algorithms to rebalance their portfolio to comply with leverage regulations?

Fuster et al. (2022) highlight that Black and Hispanic borrowers are disproportionately less likely to gain from the introduction of machine learning to adjudicate loan application outcomes. Would such technologies worsen the distributional consequences of borrower-based measures, or would algorithms get better at spotting "invisible primes" (as in Di Maggio et al. (2022)) and reduce the mass of potential borrowers shut out of homeownership because of regulatory measures? Overall, increased adoption of algorithms in financial intermediation may call for a recalibration of the desired level of the different borrower-based tools, and their costs and benefits in different states of the financial cycle. Indeed, the interaction between algorithmic lending and borrower-based tools, and their distributional consequences, is expected to be different from the status-quo and promises to be a highly active field of research in the future.

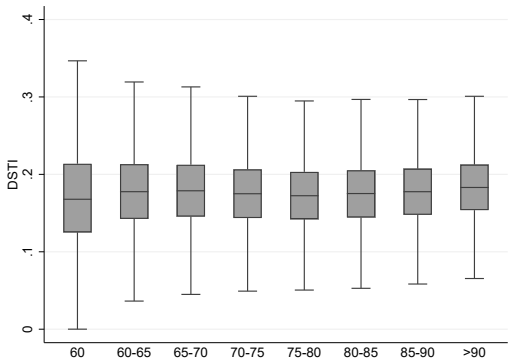
The broader literature has documented the rise of non-banks in mortgage origination, particularly fintech lenders. Buchak et al. (2018) argues that such fintech lenders use a different information set than traditional lenders, target more creditworthy borrowers, and charge higher spreads. The role of borrower-based measures

Figure 4
Correlation between different measures of household leverage

(a) LTI by LTV-bands



(b) DSTI by LTV-bands



The above figure shows box plots of loan-to-income (LTI) and debt-service-to-income (DSTI) by loan-to-value bands for mortgages originated in the UK during 2015-2017. Source: Product Sales Data by Financial Conduct Authority.

in the presence of fintech lenders deserves greater scrutiny going forward, as these lenders may allow for the leakage of high leverage burden across regulatory regimes.

4.5 Choosing among the policy levers

Policymakers have primarily used four distinct borrower-based policy levers to limit household leverage: limits on loan-to-values (LTV), loan-to-income (LTI), debt-service-ratios (DSTI), and affordability tests. Figure 4 shows that these variables tend to be correlated (high LTV ratios also imply higher LTI ratios, though the relation with DSTI is weaker). However, there is an interesting variation in the range of LTIs and DSTIs present across the different LTV bands, which suggests that targeting one variable does not effectively target the other measures of household leverage. Therefore, the choice between targeting either LTV or LTI ratios is quite fundamental to achieving specific policy objectives. The CGFS (2023) study on the use of macroprudential tools to mitigate risks from housing also emphasizes the need for further work to guide the optimal use of multiple tools and precise estimation of their costs and benefits.

Each lever targets different aspects of the risks that high levels of household leverage presents to macroprudential stability. For instance, for a given LTV limit, increases in house prices allow borrowers to increase their borrowing, and hence might

be imperfect targets to ensure debt-service capacity among households. Kuang et al. (2023) use survey data to document that LTV ratios may also restrict borrowing capacity by dampening expectations of future house price growth. On the contrary, while LTI ratios directly target debt-servicing capacity, it is not clear whether they are a more efficient tool in targeting the volume of potential delinquencies or loss-given-default given the strong evidence on their distributional impact on low-income borrowers and first-time-buyers.

Thus, these policy levers carry trade-offs and there is need for further guidance to help practitioners choose among them in tune with policy objectives, jurisdiction specific features such as cultural attitudes to homeownership and indebtedness, broader macroeconomic situation and interaction with monetary policy. Chen et al. (2023) is one such contribution: they use a New Keynesian model to show that when monetary policy is not accommodating and debt is high, LTV limits are far more contractionary than LTI ratios since they are more successful in lowering house prices, further lowering the borrowing capacity and aggregate demand of the economy. However, the focus on aggregate borrowing does not take into account the distribution of debt-service capacity and there is room for more sophisticated models which have features to trade-off the benefits and limitations of these two levers under different macroeconomic and monetary scenarios.

4.6 Health outcomes

Recent contributions have explored the links between the financial sector and health outcomes for households. Cramer (June 2025), for instance, shows that increasing the presence of bank branches in India leads to better health outcomes via two distinct channels: banks provide health insurance to households and credit to health providers. Policies that limit credit or more generally banking activities might impair these channels.

In contrast, Iyer et al. (2022) show that higher leverage is associated with higher mental health fragility. Following negative life events, both health and job related, households with higher leverage experience stronger mental health deterioration. Borrower-based tools, by limiting the amount of leverage that households can obtain, may therefore improve these outcomes.

A lot more work is needed to link these tools to health outcomes. However, this is a crucial line of work since this is an aspect that is likely to get overlooked in the

absence of compelling evidence on the effect of such policies on mental health.

5 Conclusion

In this paper, we discuss the existing literature on the rationale and effectiveness of borrower-based macroprudential tools which limit household leverage at a borrower-level, with a focus on their distributional consequences.

Overall, the evidence from implementing borrower-based measures across countries is that they are effective in breaking the loop between household leverage and house prices. Consistent with theory, these measures are redistributive in the sense that they have a stronger impact on some borrowers, particularly lower-income, younger or first-time buyers, who are likely to require higher levels of leverage. Restricting household leverage has further downstream effects on household choices related to job search, location choice, delayed homeownership and susceptibility to income shocks. However, these tools have also had beneficial effects on the macroeconomy in terms of lower defaults and less volatile house prices during periods of economic distress, providing a window into a counterfactual world with higher defaults and repossessions without borrower-based tools.

That said, there is substantial room for a deeper analysis of the welfare implications of the tools as well as other dimensions of their consequences, which could inform policymakers on the optimal level of borrower-based measures.

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