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Household savings constraints, uncertainty and macroprudential policy

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Abstract

We investigate the impact of macroprudential policy on Irish households' perception of savings adequacy, with a particular focus on households intending to purchase a home. These measures tighten loan-to-value ratios and raise the entry cost for home purchase. We find that the measures have had a significant impact on savings constraints. Indeed, constrained potential buyers, who are planning to purchase, but not presently saving to buy a home, are the group most affected as the macroprudential rules increase the downpayment size required. Heterogeneous effects across households indicate younger, private renting households, and those with relatively uncertain cash flows.

KEYWORDS
savings, uncertainty, macroprudential policy

JEL CLASSIFICATION
D14; G28

1 | INTRODUCTION

The adoption of macroprudential policy (MPP) measures across a number of jurisdictions over the past 10 years is an increasingly popular response to the credit-fuelled nature of the property bubbles, which had emerged in the run up to 2007/2008. As Clement (2010) highlights, though the term macroprudential policy had been used publically since the 1980s, there was a sharp increase in the term's use following the immediate impact of the global financial crisis. From 1991, limits on loan-to-value (LTV) and debt-to-income (DTI) ratios have been used by authorities in Hong Kong, China, Korea, Singapore and other emerging market economies as a counter-cyclical credit tool (Wong et al., 2011; Zhang & Zoli, 2016). The significant increase in mortgage credit which preceded the international, financial crisis resulted in the financial systems of a number of countries being especially vulnerable to disruptions in global financial markets experienced at that time. As a result, regulatory authorities in Hungary,

Norway, Sweden, Finland and Ireland have all adopted these types of MPP measures. These instruments are specifically aimed at curtailing the excess provision of credit and providing financial buffers for both households and credit institutions to mitigate the impacts of future downturns in housing markets.

While an increasing array of studies have examined the effectiveness of loan to value among other MPP restrictions from a financial stability perspective (Cerutti et al., 2017; Claessens et al., 2013; IMF, 2011), few have examined the implications of such measures for household finance and in particular the savings decisions of households. However, as homeownership remains a strong preference among households in many economies, it is likely that the introduction, and possible subsequent variation in MPP requirements, will impact the determinants of households' savings.

If LTV limits strengthen through the introduction of MPP, the downpayment required by households to purchase a given home will immediately increase. For a given pool of savings, this policy adjustment effectively lessens the buying power of households, leaving them in a more constrained position. Ceteris paribus, an increase in the households' savings rate is required to maintain home purchase plans. Alternatively, households would have to increase the length of time required to accumulate the deposit. In cases where households are unable to increase the savings rate, or must delay purchase, these households are expected to lower their perception of savings adequacy. As a consequence, a tightening of MPP could increase the share of households who consider themselves to be constrained in their ability to save effectively for homeownership. This experience is likely to be most strongly felt in the short run, given the countervailing long-run effects of MPP limiting demand for houses, resulting in the long-run slowdown in house price inflation (Johnson, 2019). Should house prices decline sufficiently in the long run, overall downpayment requirements may not be as taxing for households intending to purchase a home. However, given the persistent increases in house prices as a result of many years of limited supply of housing completions in Ireland, further time may be required to eventually experience these house price declines. In the meantime, this study focuses upon the short-run effects of MPP on household perceptions of saving adequacy.

These mechanisms in a sense provide a proxy for liquidity constraints, that is households which need to raise the savings rate to complete a planned purchase due to tighter credit requirements. Previous research has focused on liquidity constraints for households (Carroll & Kimball, 2001; Samwick, 2003; Zeldes, 1989), noting that when "liquidity constraint is added to the standard consumption problem, the resulting value function exhibits increased prudence around the level of wealth where the constraint becomes binding." Therefore, the extent to which households experience liquidity constraints can have a major impact on their savings decisions and in turn on investment and consumption. In general, however, due to the paucity of detailed information on households' savings decisions, it is difficult to find empirical evidence of these features.

In this paper, we draw on a novel data set of household savings which measures households' perceptions as to whether their current savings behaviour is "optimal." One challenge of studying savings behaviour among households is the notion that each individual respondent may react different to a fixed level of savings. Factors such as variations in family circumstances, planning decisions and expectations of future economy circumstances can augment the satisfaction particular acts of saving may enable. This specific data set, taken from the Economic and Social Research Institute's Economic Sentiment Monitor (ESM), allows us to define households as facing savings constraints if they indicate they are not content with their current savings behaviour. The data also allow us to disentangle whether or not households have a demand for housing and whether their savings behaviour is linked to the need to acquire a downpayment for the house purchase. We couple this with a quasi-natural experiment through the unexpected introduction of MPP loan-to-value and loan-to-income measures in the Irish mortgage market to test how the increased downpayment requirement impacts households' savings constraints.

More specifically, using these unique, nationally representative survey data from Irish households, before and after the introduction of the new regulations, we exploit the variation across households in their exposure to downpayment constraints to test (a) how MPP impacts household perceptions of saving adequacy and (b) how uncertainty and precautionary behaviour shape the distributional response to the policy across households.

In examining the impact of MPP on savings decisions, our contribution builds on a new strand of the literature which focusses on the role of uncertainty and highlights how precautionary savings may amplify losses of perceived savings adequacy. Our perspective on saving is influenced largely by Keynes (1936), which explores eight motives of saving, including the precautionary motive, along with Browning and Lusardi (1996) which also considers downpayments. Uncertainty is particularly important in the context of households' savings with Carroll and Kimball (2006) defining precautionary saving as resulting from the knowledge that the future is uncertain; households adjust their savings to smooth consumption over their lifecycle. Typically in the savings literature, uncertainty has been examined in the context of earnings, medical expenses and lifespan (Guiso et al., 1992; Hubbard et al., 1994); however, a more recent literature has focussed on the role played by policy uncertainty (Giavazzi and McMahon (2012) where political uncertainty in terms of labour market reform plays a critical role in determining the degree of precautionary behaviour. Households with uncertain cash flows would be expected, a priori, to maintain greater savings due to precautionary motives. In our setting, this would translate into a greater perceived savings inadequacy among households with uncertain future cash flows, relative to other households, following the introduction of MPP measures.

Ireland is of particular interest in terms of identifying the uncertainty channel. As noted in McQuinn (2017), among OECD countries, the Irish residential sector experienced the largest increase in house prices over the period 1995–2007 and conversely suffered the most significant decline in prices between 2008 and 2013. Given the increases in both prices and activity levels, the housing market had by 2007 assumed a disproportionate importance vis-á-vis the overall economy with the Irish financial sector particularly vulnerable to the subsequent international financial downturn. Consequently, the variation in key housing market indicators had significant implications for Irish households.

In our analysis, we define two groups of savings constrained households: (a) *constrained savers*—households who are currently saving for a home but perceive their saving activity as inadequate and (b) *constrained non-savers*—households which intend to buy a house in the next 2 years but are not actively saving for a home. Constrained households are therefore those which both intend to purchase a home and perceive their current savings activity as inadequate. Using these definitions, our identification strategy is threefold. First, we use a simple event window analysis, which considers the change in the share of constrained households before and after the policy. Second, we take two groups who are suggested by research as being more exposed to housing downpayment constraints namely younger households, and those in the private rental sector, and use these groups to apply a quasi-experimental difference-in-difference method. Third, to test the impact of uncertainty, we follow Giavazzi and McMahon (2012) and use the public sector/private sector split to distinguish between households with different cash flow uncertainty. We also use a survey-based indicator for those households who have concerns about future incomes/affordability as a further means of identifying households with varying degrees of uncertain income. These three strategies allow our study to quantify the impact of MPP on the share of prospective homeowners which experience perceived savings constraints.

Our results suggest an increase in the share of constrained households among non-savers following the increase in the policy. These findings are intuitive and indicate the impact of these regulations is borne most by those who intend to buy a house but is most constrained in their savings behaviour at present. From our quasi-experimental testing, we find that the effects are largest for younger households and those in the private rental market. Both are groups of households most likely to face downpayment constraints when entering the housing market. In terms of uncertainty, we find private sector households are more affected relative to income-secure public sector households, as are those with explicit concerns around future income affordability. These findings would suggest that uncertainty exacerbates the constraint channel following a downpayment shock.

A key finding from our research is that the most constrained group of households are those who are hoping to buy a home but are not in the process of currently saving. If one thinks of these households over the life cycle, given the loan-to-value ratio, they may have already accumulated what they believed were sufficient savings to purchase in the future and they may have had a timeline across their purchase horizon to set out a savings

plan in order to achieve this. However, when the shock comes with the introduction of tighter LTV ratios, these households now realise their previous savings activity is inadequate, or their forward looking savings plans are insufficient and are more constrained.

We feel this group of households is critical to the story of macroprudential policies and their impact on households' constraints. If one thinks of these households over the lifecycle, they may have already accumulated what they believed were sufficient savings or were content with their current consumption basket with knowledge of the loan-to-value ratio needed in the market to purchase in the future and had a timeline across their purchase horizon to set out a savings plan to achieve this. They do not necessarily need to be saving presently. However, when the shock comes with the introduction of tighter LTV ratios, these households now realise their previous savings activity is inadequate, or their forward looking savings plans are insufficient, and are more constrained. This group is a key part of the demand for housing.

To test the robustness of our findings, we undertake two important tests. First, we include controls for the economic cycle that vary by time and region to ensure that our findings are not driven by any change in underlying economic trends. Second, we ensure that the two treatment groups that we use (younger households and those in the rental sector) were not themselves affected by the regulatory change by using a multinomial logit inverse probability weighting technique as presented by Stuart et al. (2014) and used by McCann and O'Toole (2019) to deal with a similar issue relating to MPP. In both cases, our baseline results are robust to the additional controls.

Our findings have important implications for the political economy acceptance of a mortgage-based MPP regime. In some cases, the introduction of LTV and LTI regulations can be perceived as impairing the ability of households to "own their own home"[1] even if the actual change brought about by the regulations may be somewhat less severe than expected. In the Irish case, the calibration of the rules closely to the market credit conditions meant that the actual shock was not extreme due in particular to the sliding scale rule for LTV and the system of proportionate allowances. Our findings suggest that savings constraints increased for younger, renting households exactly those households most expected to be affected based on existing research. From a policy perspective, clear communication of the impacts of the regulations on such borrowers may increase the political economy acceptance of the measures and ensure such frameworks are long-lasting.

The paper is structured as follows. Section 2 briefly describes the role of uncertainty in household savings literature before clarifying Ireland's experience with MPP. Section 3 describes our methodology and data set. Section 4 details the empirical findings of our approach, while Section 5 deploys robustness checks in order to verify the validity of these results. The final section summarises our concluding remarks and policy implications, based on these findings.

2 | BACKGROUND AND CONTEXT

2.1 | Macroprudential regulations as an uncertain downpayment shock

The introduction of MPP measures after the financial crisis sought to safeguard the stability of the financial sector by breaking the link between house price fluctuations, credit growth and banking sector stress (Arregui et al., 2013; Nabar & Ahuja, 2011; Vandenbussche et al., 2015). A central component of the new policy measures introduced has been the deployment of borrower-based instruments in the mortgage market, which limit underlying credit conditions at loan origination. The most frequently used instruments in this toolkit are LTV and LTI ratios,

[1]Clear evidence can be found for this from the response to consultations by the public, political parties, Ministries and government bodies to the proposed introduction of these measures by the Irish Central Bank which can be found here: https://www.centralbank.ie/publication/consultation-papers/consultation-paper-detail/cp87-macro-prudential-policy-for-residential-mortgage-lending.

which impose a regulatory downpayment constraint and income affordability limit, respectively.[2] Loan-to-value ratios, in particular, require prospective homeowners to increase liquidity upfront at the time of purchase.

These measures therefore impose regulatory income and downpayment constraints for households looking to become mortgaged homeowners. In the literature, there is a considerable focus on which households face binding downpayment constraints and the impact on homeownership (Barakova et al., 2014). Our paper is the first to bridge this traditional literature on downpayment constraints with the impact of MPP on household savings.

In 2015, given the strong pick-up in Irish house prices apparent since 2013, the Central Bank of Ireland announced the introduction of MPP measures aimed at preventing the emergence of another credit bubble. A full outline of these regulations can be found in Keenan et al. (2016); however, a short summary at this juncture is useful. The regulations introduced a maximum LTV ratio for first-time buyers to 90% for house purchases under 220,000 euros and to 80% for every euro over 220,000. Kinghan et al. (2019) show this led to a LTV shock of approximately 2 percentage points overall. Second-time buyers were subject to a maximum 80% loan-to-value (LTV) ratios. A system of proportionate allowances was also introduced such that lenders could exempt 15% of total lending from the regulations. In addition to the LTV restrictions, a loan-to-income restriction of 3.5 times gross income was also implemented. The LTV measure directly increases the required amount of downpayment for a household to purchase a house given the fixed value of the house. However, the LTI measure introduced on the same day does not directly affect the downpayment requirement. Instead, the LTI limit reduces the amount a consumer or household can borrow, given a fixed amount of income. While an LTV ratio may simply delay one's approach towards homeownership through a more arduous and lengthy saving regime, an LTI ratio could entirely exclude households from the potential ownership of relatively higher priced properties.

Proportionate allowances to this rule allowed 20% of total lending to be exempt from this measure. While welcome from a financial stability perspective, these policy measures do, for a number of reasons, increase the degree of uncertainty for prospective homeowners:

1. The measures, when introduced, were unanticipated and, as such, can be seen as an exogenous increase in credit constraints,
2. Uncertainty about the actual application of the measures; financial institutions may grant exemptions to a certain number of households, who would then not face any downpayment or income limits. However, it is unclear which households would be eligible,
3. The possibility that the regulations may change in the future.[3]

In all of these cases, the rules counted as an actual increase in credit constraints in the mortgage market in Ireland. It is also likely that borrowers with a greater degree of uncertainty in forecasting their cash flows would be more likely to feel a heightened uncertainty when the rules were introduced.

With these considerations, the heterogeneous impacts of these policies across households are likely to be significant; given differences in the distribution of income and wealth across the economy, it is unlikely that a uniform effect would be found. Two particular factors are likely to attenuate the impact for specific borrower groups: (a) their relative demand for homeownership and degree of financing constraints and (b) uncertainty. For the former group, it is likely younger borrowers and those in the private rental market looking to purchase homes would be most affected, whereas in the latter divide, income–uncertain households are more prone to face perceived savings inadequacy.

[2]Other measures can include specific limits on debt-to-service ratios or loan term restrictions. These MPP measures were adopted on a widespread basis in Asian economies following the onset of the financial crisis in 1997 (Zhang & Zoli, 2016).

[3]Subsequently, the Central Bank of Ireland announced an annual review of the measures, where certain changes have been made.

2.2 | Macroprudential policies and homeownership: a trade-off

There is a natural tension between the imposition of strict macroprudential regulations and access to credit for homeownership. By imposing a regulatory credit constraint, borrower-based regulations such as loan-to-value ratios naturally impose higher credit access hurdles. This limits homeownership but reduces systemic risk and builds resilience for borrowers. This trade-off can regularly cause tensions in terms of the political economy of setting macroprudential regulations (see Kelly et al. (2015) for a discussion).

In relation to the literature on homeownership and credit access, there are a number of studies which point to the importance of downpayment and other constraints on credit access resulting in lower homeownership rates. Barakova et al. (2014) and Blickle and Brown (2019) use microdata to highlight the role of liquidity constraints on homeownership, while Kaplan et al. (2020) use a US macroeconomic model to demonstrate one of the main impacts of tighter credit access was an impact on homeownership.

Few studies specifically demonstrate a link between macroprudential policies and homeownership, but there are a number whom which demonstrate the impact of such policies on borrowing behaviour. Focusing again on Blickle and Brown (2019), they show strong impact of liquidity constraints on homeownership, but their research does not consider the imposition of macroprudential regulations as the shock. Kinghan et al. (2019) show that wealth constraints matter in terms of loan-to-value caps as lower-income households were less likely to be able to increase down payments following the introduction of regulations in Ireland. However, their study is not able to consider the impact on non-participants in the mortgage market (those who were not able to access credit). Our contribution to this debate highlights the increase in savings constraints following macroprudential rules which is likely to postpone (if not prevent) households becoming homeowners.

2.3 | Precautionary behaviour, uncertainty and household savings

An important feature of our research is to examine the impact of uncertainty due to downpayment shocks. The literature on precautionary behaviour and savings is particularly important in that regard.

The role of uncertainty and, particularly, that of the precautionary motive in influencing savings have received considerable treatment from both a theoretical perspective and empirical perspective. Leland (1968) and Sandmo (1970) were among the first studies to provide an analytical framework illustrating how savings could be a positive function of future income uncertainty. Skinner (1988), Dynan (1993) and Banks et al. (2001) all analyse the magnitude of the precautionary effect using Euler equations, while Caballero (1991) and Deaton (1991) provide further theoretical justification for the presence of the precautionary motive—the latter focussing on the interaction between the precautionary effect and borrowing constraints.

From an empirical perspective, a significant number of studies at the micro-household level provide support for precautionary savings, and these include Carroll (1997), Engen and Gruber (2001), Gourinchas and Parker (2002), Cagetti (2003), Kennickell and Lusardi (2004), and Deidda (2014).

More recently, the potential causes of uncertainty have been broadened out to include policy or political considerations; Giavazzi and McMahon (2012) examine the implications for German household savings due to potential labour market reforms, while Aaberge et al. (2017) find that an increase in political uncertainty resulted in significant temporary increases in savings among urban Chinese households in 1989. As Fan and Yavas (2017) highlights, uncertainty differs between mortgage holders and those still hoping to receive a mortgage, given that the latter cohort face "uncertain purchase prices and uncertain downpayments at an uncertain purchase date." Precautionary savings behaviour is therefore likely to also contribute to differences in perceived savings inadequacies between different tenure groups following the introduction of MPP.

Our contribution to this literature is to further shed light on the uncertainty–savings relationship and show that households with greater income uncertainty are more affected by downpayment constraints when trying to save for mortgaged homeownership.

3 | DATA AND IDENTIFICATION STRATEGY

3.1 | Data and measurement

The non-panel data set used is taken from the ESRI's monthly Economic Sentiment Monitor (ESM), which is a survey of 800 Irish households per month. The survey is a nationally representative telephone survey (including both landline and mobile elements) and has primarily been used in the compilation of national macroeconomic monitoring indices, including consumer sentiment, savings and investment and housing market sentiment. The sample is set to be representative by age, gender, region and economic status, the weights for which are taken from the Irish Census of Population. It has historically been used as the European Commission's consumer sentiment input for Ireland. The questions included track attitudes towards the Irish economy, housing-related matters, savings behaviour and background queries to establish a broad set of demographic details.

In this particular study, we focus upon savings behaviour through the identification of key household groups listed in Table 1. These groups are then used as dependent dummy variables in the empirical application of our study.

The indicators 1–6 in each variable are explained as follows: the first set of dependent variables takes into account different forms of savings behaviour, distinguishing between savers before splitting groups further based on their self-assessed adequacy of savings behaviour and homeownership goals. $Save_i^{1t}$ draws from a survey question of "Do you save regularly, occasionally or not at all these days?" The variable is set as a dummy where, irrespective of saving frequency, any form of saving sets “Save” equal to one. $SaveHouse_i^{2t}$ takes these savers and asks "What are you saving for?", where the selection of choices includes “To buy or renovate a home,” “To make a large purchase,” “For a holiday,” “For a special event,” “For education,” “In case my income falls in the future” and “To have something put by for unexpected expenses.” Respondents with a value equal to one are households saving for a home. Our third dependent variable, $PotentialBuyer_i^{3t}$, is equal to one when households, whom do not save, state that they intend to purchase a home within 2 years in a completely separate question.

The second set of dependent variables focuses on those interested in the housing market and identifies savings-constrained individuals within this subset of the sample. The ESM survey asks, “Thinking of your savings now, which of these phrases best describes how you feel about the amount that you save?” We identify a household as “saving constrained” if it perceives savings behaviour as inadequate through responses of “Nowhere near as much as I should” or “At bit less than I should.” This accounts for whether or not respondents are satisfied with their current level of savings, inclusive of savers and non-savers. $ConSaveHouse_i^{5t}$ acts as a subset of $SaveHouse_i^{2t}$, focusing on savers experiencing a savings constraint. $ConPotentialBuyer_i^{6t}$ is a subset of $PotentialBuyer_i^{3t}$, identifying those dissatisfied with their status as non-savers within the group. $ConHouse_i^{4t}$ captures both of these dummy variables, identifying savings constrained individuals that have actively saved to buy a home and non-savers signalling their intent to purchase a home within 2 years while simultaneously discontent with their current saving behaviour. In other words, $ConHouse_i^{4t}$ takes the value of 1 if an individual is either a constrained house saver $ConSaveHouse_i^{5t} = 1$ or constrained potential buyer ($ConPotentialBuyer_i^{6t} = 1$). It can be seen as capturing all constrained individuals with housing demand.

These six dummy variables will feature as dependent variables in the models of the identification strategy. When identifying heterogeneous effects, the empirical section will highlight differences among the set of three constrained dummy variables.

TABLE 1 Overview of savings indicators

Variable	Definition
$Save_i^{1t}$	Variable = 1 if household saves either regularly or occasionally, 0 otherwise
$SaveHouse_i^{2t}$	Variable = 1 if household is saving to purchase a house, 0 otherwise
$PotentialBuyer_i^{3t}$	Variable = 1 if non-saving household intends to purchase a home within 2 years, 0 otherwise
$ConHouse_i^{4t}$	Variable = 1 if saving for a house or a potential buyer and is not satisfied with its current level of saving 0 otherwise
$ConSaveHouse_i^{5t}$	Variable = 1 if household saving to buy a house and is not satisfied with its current level of saving 0 otherwise
$ConPotentialBuyer_i^{6t}$	Variable = 1 if household intends to buy a home within two years and is not satisfied with its current level of saving 0 otherwise

Figure 1 displays a flow chart of dependent variable groups, to more easily convey how they segment. After households are classified between saving and not saving, further classifications indicate whether the household is "interested" in the housing market either through specifically saving for a house or through indications of being a potential buyer within the next 2 years. For both types of housing market participants, we examine the likelihood of experiencing savings constraints.

Our main hypothesis under examination is that the share of constrained households (with some demand for housing) increases following the introduction of the measures. In the graphic, this would be identified by an increase in the share of households indicating they are constrained *within* the groups House Saver and Potential Buyer.

3.2 | Identification strategy

Our research question involves testing whether the introduction of MPP measures led to an increase in the degree to which Irish households perceived savings constraints to be binding. Given the cross-sectional nature of our data, our approach to identification is twofold. To estimate the average effect of the policy change, we (a) undertake a simple event study and (b) use specific groups suggested by theory and existing literature as quasi-natural control groups.

3.2.1 | Event study analysis

As presented in Table 1, the saving indicator in all cases is binary and therefore requires the use of a probability model. Before identifying heterogeneities between different groups, we establish a baseline model to capture the average policy effect when controlling for key variables. We use a standard logit model with pooled cross-sectional data which tests the effects of the introduction of MPP.

$$Pr(SC^j = 1)_i^t = \alpha + \beta_1 Post + \omega \mathbf{X_i^t} + \theta_t + \theta_r + \varepsilon_i^t, \quad (1)$$

where i identifies the individual respondents and t is a date based on the specific month and year each observation was collected. The superscipt j captures the variables 1–6 in Table 1 above. The key variable for our identification strategy is the dummy, *Post*. This indicator variable takes a value of 1 for any response captured after the 9 February 2015, when the MPP regulations were introduced, and 0 otherwise. As per our main hypotheses, we would expect that, if the regulations have increased household perceptions of savings constraints, then $\beta_1 > 0$. In order to maintain comparativeness with other Irish studies of MPP (Kinghan et al., 2016), an 18-month time window is applied to both the pre-treatment and post-treatment periods. The vector X_i^t includes our baseline controls, including household characteristics such as gender, education status, marital status, housing tenure, whether the individual has children (binary), occupation and working status. We also include the age in years of the household head (respondent). Additionally, we include sentiment controls for the personal financial positions of individuals, their future expectations of their personal finances and expectations towards the labour market. A full listing of these variables and their descriptions can be found in Appendix. Lastly, the model also factors in monthly (θ_t) and regional (θ_r) fixed effects.

3.2.2 | Quasi-natural difference in difference

Following baseline results, we evaluate how different demographic cohorts of the survey were affected by the introduction of MPP measures, relative to their counterparts. As part of the identification strategy, we explore heterogeneities occurring across age and tenure. Indeed, younger households and those engaged in private renting have been found in the existing literature to have been most affected by downpayment constraints (Acolin et al., 2016; Barakova et al., 2014; Haurin et al., 1997).

Using these characteristics, we split our data into two groups: young (< 43)[4] and old, renter and homeowner. We then use these two groups in a quasi difference-in-difference regression to explore their relative exposure to the policy treatment. This approach imposes quasi difference-in-difference estimator method upon the standard logit model:

$$Pr(SC^j = 1)_i^t = \alpha + \beta_1 Post + \beta_2 Z_i + (\beta_3 Post \times Z_i) + \omega \mathbf{X_i^t} + \theta_t + \theta_r + \varepsilon_{it}, \quad (2)$$

where Z_i relates to the age or rental market status of household i. As above, the superscript j captures the variables 1–6 in Table 1. We repeat the use of the model above, distinguishing based on two proxies for income uncertainty. Similarly to Giavazzi and McMahon (2012), which controls for whether respondents are civil servants, our study addresses income uncertainty through employment sectors. Public servants are assumed to benefit from greater job security, relative to those employed in the private sector.[5] As a second approach, we also compare against those who list "Worries about future income/affordability" as their main risk with respect to homeownership.

3.2.3 | Methodological note

In this paper, we are assuming that the answer not enough is an indicator of constrained behaviour. Indeed, we are making the assumption that this indicator is correlated with actual constraints which households face and this captures the households who are unable to accumulate deposits rather than those who suffer present bias

[4]Age 43 is the age, which represents the bottom 25% of our data.

[5]One benefit from using the public/private split in terms of identifying the policy impacts are that the risk of endogeneity between the policy and employment status is low, that is it is unlikely that many households changed their sector of employment as a response to the policy. If this were to happen, it would bias the estimated effect on constraints by shifting the group composition.

TABLE 2 Summary statistics for saver data

	Pre-policy	Post-policy
$Save_i^{1t}$	0.596 (0.491)	0.646 (0.478)
$SaveHouse_i^{2t}$	0.059 (0.299)	0.066 (0.302)
$PotentialBuyer_i^{3t}$	0.102 (0.434)	0.094 (0.442)
$ConHouse_i^{4t}$	0.094 (0.492)	0.090 (0.496)
$ConSaveHouse_i^{5t}$	0.025 (0.494)	0.024 (0.481)
$ConPotentialBuyer_i^{6t}$	0.070 (0.464)	0.066 (0.457)
Observations	5,191	5,565

on their savings behaviour and are unable to control spending. However, even if this assumption is too strict in a general sense, our identification strategy for the main findings exploits differences across subgroups of the population (who should be most affected by the policy change) after the introduction of the macroprudential regulations. In this sense, any increase in this indicator that is correlated with the policy change and is greater for a priori constrained population groups (who are theoretically and empirically suggested to be constrained) should give us confidence that the findings do relate to actual changes in constraints. While our base indicator may pick up some level effect of households who suffer from present bias Xiao and Porto (2019), it would be highly unlikely these behavioural factors would change for specific subgroups after the policies were introduced. This gives us confidence in our strategy. Furthermore, the subgroups we have chosen to focus on (younger households, renters) have been found to face considerable but stable affordability challenges in Ireland across the narrow time frame of our study (Corrigan et al., 2019). This suggests less an inability to manage expenditure and rather a difficulty in accumulating wealth given the cost of living within the new constrained environment.

3.3 | Summary statistics

In evaluating the effects of MPP measures, it is first important to review the distribution of our key groups across the sample. Table 2 presents an overview of the distributions under pre- and post-policy conditions on the basis of the different dependent variables. Pre- and post-policy time windows capture observations between August 2013 and July 2016, an 18-month time window in the pre- and post-policy periods.

The majority of the sample, 59.6%, has reported either regular or occasional acts of saving before policy implementation. However, after the introduction of MPP the number of saving households increased to 64.6% of the population. Prior to the introduction of these measures, individuals saving to buy a house accounted for 5.9% of the sample. This share rose to 6.6% for the post-policy sample. While the share of both these types of savers increases, fewer non-saving households intended to purchase a home within 2 years following the introduction of MPP measures. An average of 10.2% of pre-policy respondents indicated an interest, declining to 9% post-policy. The general improvement in macroeconomic conditions appears to have slightly eased perceived saving constraints among respondents, as reflected by the decline in the share of constrained households from 9.4% to 9.0%.

Table 3 presents summary statistics for the regression sample. Overall, there were 10,756 individual household responses over the 3-year timespan of the analysis. Roughly half of the sample is female, with 42.8% of respondents maintaining a third-level education. While Dublin captured the largest share of respondents, the overall

TABLE 3 Summary statistics for controls

Variable	Mean	Variable	Mean
Female = 1	50.9%	HH no. of adults at work (over 18)	
Third-level Educ. = 1	42.8%	0	29.2%
		1	29.7%
Border	10.6%	2+	41.1%
Dublin	28.8%		
Mid-East	11.2%	Have children	31.7%
Midland	5.5%	No children	68.3%
Mid-West	7.6%		
Southeast	10.6%	Occupation	
Southwest	16.2%	Professional/technical	57.1%
West	9.7%	Manual	42.9%
Married/partner	69.6%	Employee	41.2%
Single	17.6%	Self-employed	13.0%
Widowed/divorced/separated	12.8%	Other	45.8%
Age	53	Expected financial position in 1YR	
		Difficulty	19.2%
Homeowner	92.7%	Neither	68.1%
Private renter	7.3%	Ease	12.7%
		Observations	10,756

distribution of households closely mirrors percentage shares implied by Census 2016.[6] Approximately 70% of respondents are married, averaging 53 years of age, most of which are homeowners.

Table 4 provides the average of a range of key demographic variables to distinguish who are the constrained and unconstrained households in each of the main two variables (constrained house savers and constrained potential buyers). It is clear from the data that for constrained potential buyers these households are younger and more likely to have children. However, they are marginally less likely to be private renters and more likely to live outside Dublin, in the mid-East region. This is a very interesting finding as the demographic of younger homeowners living in the mid-East area of Ireland during the period we are considering is the exact household group that was most affected by the property crisis in Ireland and thus to have negative equity (i.e. equity constrained): younger homeowners who moved just outside Dublin to the mid-Eastern region of the country to get on the property ladder. Many of these households had low or negative equity in their properties as they would have first purchased at high loan-to-value during the boom in 2005/2006. They would have been hoping to use the equity from this first purchase towards the downpayment in any second property move. The rules brought in by the Central Bank of Ireland (which lower the LTV allowable from 90% to 80%) would have, ceteris paribus, had an adverse impact on the ability of this group to access credit.

For those households who are constrained and currently saving for a home, they are younger, marginally more likely to be renters and living in Dublin. These demographics point towards this constrained group being closer to your typical young, constrained home buyer.

[6]The Central Statistics Office prepared "Census 2016 – Part 1", which provides details on overall population change, age, marital status, households and families, nationalities, foreign languages, the Irish language, religion and housing.

TABLE 4 Summary statistics for constrained and unconstrained groups

	$ConPotentialBuyer_i^t$		$ConSaveHouse_i^t$	
	Constrained	Unconstrained	Constrained	Unconstrained
Female	0.518	0.391	0.567	0.426
% Age less than 43	0.363	0.3	0.563	0.491
Average age	48.036	51.634	43.575	45.676
Children	0.405	0.309	0.36	0.367
Private Renters	0.149	0.166	0.272	0.258
Border	0.114	0.116	0.061	0.092
Dublin	0.19	0.409	0.383	0.341
Mid-East	0.227	0.109	0.119	0.163
Midland	0.1	0.053	0.042	0.071
Mid-West	0.063	0.044	0.046	0.049
Southeast	0.083	0.097	0.084	0.071
Southwest	0.096	0.1	0.157	0.153
West	0.127	0.072	0.107	0.061

4 | EMPIRICAL FINDINGS

In the following section, we present the main findings from the estimation of equations (1) and (2). In equation (1), the baseline model of this paper, we capture the overall effect of the introduction of MPP on the net change in the likelihoods of households actively saving. For savers, we also explore how households specifically saving for a house were affected. Among non-saver households, we examine how those intending to purchase a home within 2 years were affected.

We then investigate the heterogeneous effects across age and ownership status to explore how these constraints were distributed. We use several proxies for different types of income uncertainties. In particular, we compare savings behaviour across employment sectors and income risk with respect to mortgaged homeownership. In the estimates presented in this section, we narrow in on specific subgroups of the main population. This explains why the number of observations reported in different specifications changes. All probability models are estimated using a logit model with robust standard errors.

4.1 | Testing for effects on overall savings and potential buyers

We begin by testing whether or not the rules impacted the share of home savers or the share of potential buyers in the market. Ruling out changes in these metrics is important to identifying the effect of the policy on constraints. If the policy had changed these underlying groups, any findings on constraints could have been due to differences in the samples saving for, or looking to purchase, a house.

Table 5 provides the initial set of estimates from equation (1) where $Pr(SC = 1)_{it}$ includes savers, house savers and non-saving potential buyers. The term *Post* corresponds to β_1 from equation (1). The interpretation of the coefficients is that, controlling for borrower specific characteristics,[7] there is no significant effect of MPP implementation on savings objectives towards the housing market nor on saving levels in general. These coefficients and all

[7]Including aforementioned household and sentiment controls; gender, education, working conditions, economic and personal financial situations within $${X}_{it}$$, and regional and monthly dummy variables.

TABLE 5 Policy volume effect—savings behaviour

	(1)	(2)	(3)
	Saving	House saver	Potential buyer
Post	−0.0052 (0.013)	0.0077 (0.011)	0.0021 (0.020)
Observations	10,474	6,542	3,935
Sentiment controls	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Household controls	Yes	Yes	Yes

Standard errors in parentheses, *p < .1; ** p < .05; ***p < .01.

TABLE 6 Policy volume effect—savings constrained behaviour

	(1)	(2)	(3)
	House saver (Con)	Potential buyer (Con)	Constrained
Policy = 1	−0.0065 (0.047)	0.1032 (0.033)**	0.0496 (0.029)*
Observations	662	1,013	1,675
Sentiment Controls	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Household controls	Yes	Yes	Yes

Note: Robust standard errors in parentheses, *p < .1; **p < .05; ***p < .01.

those that follow have converted log odds into proportions in order to present a more readily interpretable set of results.

4.2 | Testing for effects on constrained buyers

Table 6 presents the estimates of our main specifications for the event study. In column (1), we present the coefficient on the Post for the model where the dependent variable is the share of constrained households which are saving for a house. In column (2), we present the coefficient on Post with the dependent variable for constrained potential buyers, those who (a) do not save, (b) feel they should be saving and (c) intend to purchase a home within 2 years. In column (3), we present the estimate for overall constrained households featured in columns (1) and (2). All models are estimated with the vector of household controls, month fixed effects, region fixed effects and sentiment controls.

The results in Table 7 suggest the introduction of MPP measures has resulted in greater perceptions of savings inadequacy among households. Given the larger downpayment requirements the policy applies, it is likely that a greater cohort of those intending to purchase a home have become discontent with the current amounts that they save. For potential buyers, the post-policy likelihood of perceiving savings as inadequate increased by 10.3 percentage points. Given that 7% of respondents were constrained potential buyers prior to the policy, this suggests that, ceteris paribus, MPP measures resulted in the share of savings constrained potential buyers increasing by approximately 1.5 times.

TABLE 7 Differences across age for the savings constrained

	(1)	(2)	(3)
	House saver (Con)	Potential buyer (Con)	Constrained
Age (< 42)=0	−0.0118 (0.066)	0.0628 (0.040)	0.0372 (0.037)
Age (< 42)=1	−0.0049 (0.058)	0.1411 (0.049)**	0.0574 (0.039)
Observations	662	1,013	1,675
Sentiment controls	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Household controls	Yes	Yes	Yes

Coefficient presented is marginal effect of Post (at values of age).
Standard errors in parentheses, *p < .1; ** p < .05; ***p < .01.

4.3 | Exploring heterogeneous effects

4.3.1 | How were younger households affected?

The permanent income hypothesis indicates that, as an individual ages, they shift from acting as an intertemporal borrower from their future self towards assuming the role of the intertemporal lender to their past self (Friedman, 1957). Consumption and the remaining portion of savings are intended to remain smooth over time, with expenditure levels rationally based on the even distribution of lifetime wealth an individual expects to generate rather than the current income they earn. Therefore, the increased downpayment burden introduced by MPP is expected to be particularly constraining on younger age groups.

Results in Table 7 capture a clear disparity between likelihood of saving constraints among younger and older members of society. To test these effects, we define an indicator variable that takes the value of 1 if individuals are aged less than 42 and 0 otherwise. The findings present the average effect of the treatment for both the treated and control groups of young (less than 42) and old (over 42). Those below the age of 42 appear to be 14.1 percentage points more likely to experience savings constraints following the introduction of MPP measures. The fact that constraints are heightened for younger households following the introduction of a MPP shock to downpayments is in line our expectations and the existing literature Acolin (2016) and Haurin (1997).

To provide more granular insight into the effect of age, we interact the post dummy with a continuous age variable and pull out the average marginal effect of the treatment at different values of age. While the underlying model estimated for Table 8 uses a continuous interaction of age and post, we present only the marginal effect of Post at specific age levels with gaps. This is due to the fact that the table would be very cluttered if all effects were presented and little variation exists in coefficients for individual years that are not captured in the trend age levels presented.

The findings are presented in Table 8. We find that the effect is highest for younger households and declines steadily with age. Savings constraints range from a 7.8 percentage points rise at the age of 50 to a peak of 16.6 percentage points among the youngest category of potential buyers. The younger the household, the greater the likelihood of self-assessed savings inadequacy with respect to prospective homeownership. Though this pattern across age groups also emerges within the more restricted sample of 662 constrained house savers, the results are insignificant, suggesting only young potential buyers were significantly affected by MPP.

TABLE 8 Differences across age for the savings constrained

	(1)	(2)	(3)
	House saver (Con)	Potential buyer (Con)	Constrained
Age = 25	0.0239 (0.072)	0.1659 (0.052)**	0.0859 (0.045)*
Age = 30	0.0124 (0.060)	0.1485** (0.045)	0.0740 (0.038)*
Age = 35	0.0010 (0.051)	0.1310 (0.039)***	0.0621 (0.033)*
Age = 40	−0.0103 (0.046)	0.1133 (0.035)**	0.0503 (0.029)*
Age = 45	−0.0214 (0.047)	0.0956 (0.032)**	0.0384 (0.027)
Age = 50	−0.0324 (0.053)	0.0776 (0.032)**	0.0265 (0.028)
Observations	662	1,013	1,675
Sentiment Controls	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Household controls	Yes	Yes	Yes

Standard errors in parentheses, *$p < .1$; ** $p < .05$; ***$p < .01$.

4.3.2 | How were private renters affected?

The introduction of MPP is estimated to have had a significant impact on renters, when observing the likelihood of potential buyers becoming savings constrained. According to Table 9, the likelihood of an individual being constrained increased by 8.9% among homeowners and 15.9% among private renters after the policy measures were introduced.[8]

4.4 | Heterogeneity based on income uncertainty

As has been previously discussed, precautionary savings behaviour may occur as a result of policy uncertainty (Giavazzi & McMahon, 2012). Given the change in MPP, it is important to observe how savings behaviour varied between groups with different levels of income uncertainty. Ceteris paribus, the precautionary savings effect would interact and possibly compete with the demand for a now larger downpayment. Under this theory, those more likely to be subject to greater income uncertainty would be particularly exposed to greater savings constraints.

In Table 10, we present the differences between households in different sectors of employment. It is assumed that greater job security implies greater income uncertainty; therefore, the private sector is expected to be particularly exposed in terms of savings constraints. We find that MPP contributed to a 14.3 percentage point increase in the likelihood of potential buyers experiencing a savings constraint, relative to the public sector.

As a final proxy for income uncertainty, Table 11 examines responses to what individuals would consider their main risk when approaching the housing market.[9] Those subject to affordability risks exhibit an increased likelihood of being "constrained" among potential buyers with a 10.8 percentage point increase following the

[8]A lack of observations for private renters, 7.3% of overall household responses, appears to be driving the relatively low significance of results in Table 8.

[9]Our sub-sample of individuals facing affordability risks is noticeably thinner at this stage of our analysis, which may be contributing to the marginal significance observed in our results.

TABLE 9 Differences across tenure for the savings constrained

	(1)	(2)	(3)
	House saver (Con)	Potential buyer (Con)	Constrained
Homeowner	0.0306 (0.056)	0.0892 (0.034)**	0.0544 (0.031)*
Private renter	−0.0872 (0.082)	0.1591 (0.088)*	0.0372 (0.063)
Observations	662	1,013	1,675
Sentiment controls	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Household controls	Yes	Yes	Yes

Coefficient presented is marginal effect of Post.
Standard errors in parentheses, *$p < .1$; ** $p < .05$; ***$p < .01$.

TABLE 10 Uncertainty: differences by employment sector

	(1)	(2)	(3)
	House saver (Con)	Potential buyer (Con)	Constrained
Public sector	−0.0478 (0.097)	0.0851 (0.103)	0.0195 (0.079)
Private sector	0.0182 (0.069)	0.1427 (0.053)**	0.0710 (0.044)
Observations	338	336	678
Sentiment controls	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Household controls	Yes	Yes	Yes

Coefficient presented is marginal effect of Post.
Standard errors in parentheses, *$p < .1$; ** $p < .05$; ***$p < .01$.

introduction of policy measures. In both cases, it appears those exposed to greater degrees of income uncertainty reacted far more strongly following the introduction of MPP measures. The combination of requiring a thicker layer of insulation against financial shocks through greater levels of precautionary saving and the introduction of a policy measure which placed greater demands on individuals to produce a larger downpayment culminate into likelihoods of experiencing self-perceived savings constraints.

In contrast to the constrained potential buyers, the constrained house savers coefficient is negative and significant. An economic intuition for this finding is that current house savers who face affordability risks may be already planning to over save (in the short run) in their house purchase decision as their income stream is more uncertain. In that case, they may have had a higher savings rate to begin with. When hit with the macroprudential policy shock, these households may have decided to lower their planned house purchase price so that their current savings were sufficient even in the tighter environment, that is if they viewed the regulatory changes as being accompanied by stricter lending conditions, this group may have decided to permanently lower their leverage target and house purchase price. This would have led to a lower sense of financial constraints following the rules.

TABLE 11 Uncertainty: differences by main risk

	(1)	(2)	(3)
	House saver (Con)	Potential buyer (Con)	Constrained
Affordability risk = 1	−0.1678 (0.077)**	0.1083 (0.056)*	−0.0166 (0.052)
Observations	343	349	696

Coefficient presented is marginal effect of Post.
Standard errors in parentheses, *p < .1; ** p < .05; ***p < .01.

TABLE 12 Financial position findings: marginal effects

	(1)	(2)
	House saver (Con)	Potential buyer (Con)
Effect of policy variable		
Financial Position Good = 0	0.0093 (0.051)	0.0981 (0.034)**
Financial Position Good = 1	−0.1256 (0.106)	0.3089 (0.176)*
Observations	662	1,013

Coefficient presented is marginal effect of Post.
Standard errors in parentheses, *p < .1; ** p < .05; ***p < .01.

4.5 | Does financial position matter?

In this subsection, we compare the impact of the policy change timing variable on constrained house savers and constrained potential buyers separately for those households who indicate their perceived financial position was "Easily make ends meet" relative to other households. We define this group as those being in a "good" financial position. These households are the most likely to have more financial resources generally; thus, this variable is likely correlated with accumulated wealth. The findings are presented in table 12.

We find that the marginal effect of our policy change timing variable for the post-policy period is positive and significant for constrained potential buyers for both those with a good financial position and other households. However, the relative magnitude is large for households with a good financial position. While this may be counterintuitive, the finding is likely to be driven by the fact that this group were much less constrained before the policy change (33%–69%), which makes any increase relatively larger (42%–71%). Furthermore, the fact that the severity of the tightening of loan-to-value ratios was such that, even for those with good financial positions, the deposit required was increased considerably by the Central Bank (from 10% equity to 20% equity). Therefore, even those households with a good financial position would face a serious constraint following the introduction of the regulations. Indeed, Kinghan et al. (2019) show the impacts of the Irish LTV rules were felt across the income distribution, and while the highest income households could adjust down payments without purchasing cheaper properties (purchase the same property with a lower LTV), many middle-income households had to lower the price at which they purchased. Their work is in line with our conclusions.

TABLE 13 Inclusion of macro-time-varying factors

	(1)	(2)	(3)
	House saver (Con)	Potential buyer (Con)	Constrained
ΔHP_{rt-1}	−0.0003 (0.002)	0.0018 (0.002)	0.0011 (0.001)
$UneRate_{rt-1}$	−0.0021 (0.014)	0.0057 (0.009)	0.0012 (0.008)
Post	−0.0227 (0.059)	0.1105 (0.046)**	0.0460 (0.037)
Observations	662	1,013	1,675

Note: Standard errors in parentheses, *p < .1; **p < .05; ***p < .01.

5 | ROBUSTNESS CHECKS

In this section, we present two robustness checks on our estimates. We first explore whether adding additional controls for the macroeconomic cycle affect our findings. Second, we attempt to deal with some cross-sectional sample selection issues that may arise.

5.1 | Time-varying macroeconomic factors: adjusting for the cycle

The variation that identifies our main findings is changes in savings constraints over time across groups. While our use of theoretically suggested groups as treatment and control provide for a good identification approach, there is a possibility that changes across these groups could come through general changes in the macroeconomy that alters the relative constraints. To control for such changes, we include region–time-varying macroeconomic factors that should account for differences in trends in the local economies where the households are residing. The variables we include are house price growth (ΔHP_{rt-1}) and the unemployment rate ($UneRate_{rt-1}$), which should capture housing market and labour market developments at the region–time level. These are included in Table 13. Both of these factors are included with a one quarter lag to the survey period to reduce the presence of simultaneity bias. While these variables are insignificant, the main effect still holds at the 5% significance level. This suggests our findings are not driven by divergent economic trends before and after the regulations were introduced.

5.2 | Testing for sample selection effects

Our main analytical evaluation tests the impact that MPP had on savings constraints using both younger households and those in the rental sector as the treatment groups. While our baseline findings control for a range of factors including borrower controls, a potential issue arises in relation to whether the underlying composition of the sample in terms of age or tenure could have shifted as a consequence of the policy. If this is the case, then using these variables as treatment groups could lead to some bias in the estimate of the impact of the policy. Indeed, given the MPP regulations were aimed at increasing downpayment constraints it is likely that the policy may have increased the share of households in the "renting" category. It is less likely the policies impacted the age structure of the population, particularly in the short run.

To deal with this potential issue, we draw on an inverse probability weighting approach suggested by Stuart et al. (2014) for estimating difference-in-difference models using cross-sectional data. The rest of this section presents a short overview of the technique and the results of the robustness checks.

5.3 | Multi-group cross-sectional matching

Given the cross-sectional nature of our data, and the fact that we do not observe the same households over time, it is likely that in each repeated cross section, the sample composition may differ across household characteristics. The share of renter households or younger households could shift across the survey waves and, in particular, could have changed after the introduction of the policies. Furthermore, using age and renter as classification variables could lead to biases if these groups are systematically different and the difference is linked to credit access or savings behaviour.

If either of these sample issues are occurring, then it is likely the estimates are biased due to the sample selection. Some of the sample selection issues will be controlled for by the inclusion of the range of covariates in our estimates. However, Stuart et al. (2014) note that average responses calculated with covariates depend on the distribution of the data and if treatment variables differ on observables but are not equally balanced across the data, covariates will not address the issue fully.

To address this issue, we follow McCann and O'Toole (2019) and Kinghan et al. (2019) by applying the Stuart et al. (2014) inverse probability weighting approach to match the borrowers on observables across our treatment and control groups before and after the policy. Our data are split into four groups: pre-policy treated, pre-policy control, post-policy treated and post-policy control. In our case, treatment is either being a private renter or being a borrower aged less than 43. A multinomial model is then estimated on the four groups with a range of covariates included which should control for the sample selection differences. The predicted probabilities of being in each group given the multinomial estimates are then used as the weights:

$$\text{where1} = \left(\sum_{g=1}^{4} Pr_g \left(X_i \right) \right) \forall i, \tag{3}$$

where X is the group of covariates selected and g is the four groups noted above across each household i. These weights can then be applied as probability weights in the second-stage logit model. The covariates included in the X vector in this regression are gender, region, marital status, education, children, work and employment status, occupation, economic sentiment expectations, views on purchasing activity, financial stress and expected changes to financial circumstances.

5.3.1 | Multinomial weighted results

The results of the multinomial weighted logit regressions are presented in Tables 14 and 15. The former presents the estimates for young households, and the latter presents the estimates for private renters. The tables contain the marginal effects of the policy for young households (renters) for each of the three constraint indicators from a model including the interaction of age and policy and weighted using the multinomial probability weights.

The findings indicate that savings constraints increased for younger households and renters following the introduction of MPP, which is in line with our main baseline estimates. The results continue to have statistical significance at conventional levels (10%), and the magnitudes are in line with the baseline findings. Given these results, the issue of sample selection biases from differences in the observable samples, in the cross section or over time, is highly unlikely, and as a consequence, our findings appear robust.

TABLE 14 Multinomial inverse weight for young households: average effect

	(1)	(2)	(3)
	House saver (Con)	Potential buyer (Con)	Constrained
Post	−0.0151 (0.039)	0.1031 (0.061)*	0.0064 (0.040)
Observations	662	1,013	1,675

Standard errors in parentheses, *p < .1; ** p < .05; ***p < .01.

TABLE 15 Multinomial inverse weight for renters: average effect

	House saver (Con)	Potential buyer (Con)	Constrained
Post	−0.0767 (0.080)	0.1425 (0.082)*	0.0319 (0.062)
Observations	662	1,013	1,675

Standard errors in parentheses, *p < .1; **p < .05; ***p < .01.

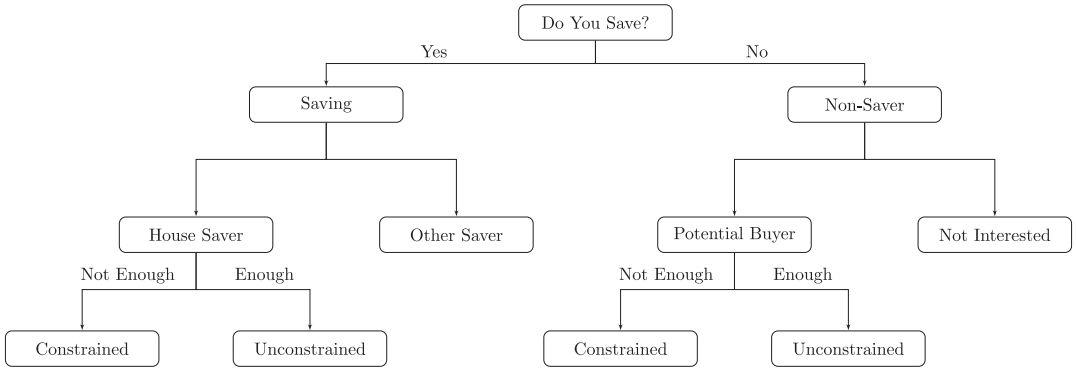

FIGURE 1 Flow chart of respondent choices

6 | CONCLUSIONS AND POLICY IMPLICATIONS

In this study, we use novel, nationally representative survey data on households in Ireland before and after the unanticipated introduction of macroprudential mortgage rules to explore the impact of loan-to-value and loan-to-income limits on household savings. We exploit quasi-natural experimental variation across groups of households who are a priori expected to suffer from household downpayment and income constraints to test the impact of the regulations. Therefore, our study uniquely traces the impact of changes in MPP on standard household finance issues. We also build on existing studies by splitting households into those facing savings constraints (feel they are not saving sufficiently) and those saving to purchase a house to better identify the effects of macroprudential regulations.

We find that households intending to purchase a home were more likely to experience savings constraints in response to the introduction of MPP. The overall share of savers in all households (including those households saving for unanticipated events or other non-housing purchases) does not adjust, nor does the intention to purchase a home. Instead, this study reveals a greater difficulty among certain groups of households in generating sufficient savings necessary to pursue homeownership. From our quasi-experimental testing, we find that the effects are largest for younger households and those in the private rental market; both groups of households are more likely to face downpayment constraints when entering the housing market.

Supportive of the precautionary savings behaviour, we find that households who are part of the private sector or indicate they see income shocks as the main risk they face are particularly exposed to this form of savings constraint pressure.

The MPP limits in the mortgage market are vital in ensuring financial stability and limiting systemic risk. The policy naturally excludes the least eligible households from a market that would otherwise have been offered a mortgage contract. As is evident from our findings, MPP featured these important heterogeneous effects across households, in particular on savings activity. A number of implications arise for policy. This paper shows the incidence of these policies is focused on specific subgroups of the population (young borrowers, renters) and those likely to experience income uncertainty. As these policies have clear distributional impacts, their calibration across groups is important. Indeed, frameworks that disaggregate across potential buyer types, such as is the case with the Irish rules, can limit some of the distributional consequences. Given these findings, the interaction between MPP rules and broader housing market policies is also important to broad housing affordability goals.

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APPENDIX

Overview of control variables

Control variable	Description
$Female_i^t$	Dichotomised as female (1) or male (0)
$Month_i^t$	Every even month between 2013M08 and 2016M06
Age_i^t	Continuous variable, ranging from 16 to 99
$AgeG_i^t$	Dichotomised as below 42 (1) or 42 and above (0) years of age
$NUTS3_i^t$	Categorical variable indicating household location across seven distinct regions: Border, Dublin, Mid-East, Midland, Mid-West, Southeast, Southwest and West
$Education_i^t$	Dichotomised as third level (1) or lower (0)
$MaritalStatus_i^t$	Categorical variable indicating marital status of respondent: married/partner, single and widowed/divorced/separated
$Tenure_i^t$	Dichotomised as homeowner (1) or private renter (2),
$Children_i^t$	Dichotomised as no children (0) or children (1)
$WorkingStatus_i^t$	Categorical variable indicating number of adults at work (over 18) in household; no working adults (0), one working adult (1) and multiple working adults (2)
$Occupation_i^t$	Dichotomised as professional/technical (1) or manual (2)
$EmploymentGroup_i^t$	Categorical variable indicating the employment status of respondent; employee (1), self-employed (2) and other (3)
$EconomicOutlook_i^t$	Categorical variable asking how the economic situation will develop in 12 months; better (1), same (2) and worse (3)
$MajorPurchases_i^t$	Categorical variable asking if it is a good time to make large household purchases; good time (1), neither (2) and bad time (3)
$FinancialPosition_i^t$	Categorical variable asking self-perceived financial position of the household; difficult (1), moderate (2) and easy (3)
$FinancialExpectations_i^t$	Categorical variable asking how financial situation will change over next 12 months; better (1), same (2) and worse (3)
$AffordabilityRisk_i^t$	Categorical variable asking main risk of purchasing a home for respondent; dichotomised as affordability (income) risk (1) or other (0)
$RegionalHousePrice_i^{t-1}$	Continuous variable, year-on-year house price growth by Nuts3 region
$RegionalUnemploymentRate_i^{t-1}$	Continuous variable, year-on-year unemployment rate by Nuts3 region