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A Measure of Bindingness in the Irish Mortgage Market

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Abstract

Macro-prudential policies such as the 2015 Irish mortgage measures have become increasingly utilised by central banks. These measures have implications for both lenders and borrowers given the prominence of mortgage debt on bank and household balance sheets. They transmit through the direct lending channel, whereby the level of bindingness alters the size and number of loans relative to a counterfactual with no measures. This *Note* provides a measure of bindingness by combining estimates of credit available and take-up for individual Irish borrowers. The proportion of borrowers drawing down more than 90 per cent of credit available to them rose from 29 to 46 per cent since the introduction of the measures. This suggests that the measures have become increasingly binding over time, consistent with the observed imbalance between demand and supply in the housing market, driving house prices to grow faster than incomes. In terms of distributional effects, the measures appear to be most binding for first time buyers in Dublin, given the high level of Dublin house prices relative to incomes compared to other parts of the country.

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1 Introduction

As a post crisis response, central banks have increasingly deployed macro-prudential instruments. Their toolkits now include both capital and borrower-based measures. The former impacts bank leverage requiring a larger portion of liabilities to be held in the form of equity. The latter limits individual borrower leverage through constrained credit conditions, for example the Loan-to-Value (LTV) and Loan-to-Income (LTI) limits (hereinafter Measures) announced in 2015 on Irish mortgages. They operate through building borrower resilience on the flow of new lending, indirectly strengthening bank resilience by improving credit quality in loan portfolios over time. In addition, by linking credit developments to income growth, they limit the potential emergence of a house price and credit spiral. Their cyclical effectiveness depends on their level of bindingness; both at individual borrower's level through unfulfilled demand and in aggregate by the proportion of borrowers bound. Bindingness will evolve with the cycle and heighten in periods of relatively higher growth in house prices compared to income. This is required to maintain the objective of mitigating potential pro-cyclical credit conditions that hamper borrower resilience from the price pressures of undersupply in the housing market.

While bindingness is core to policymakers evaluation of the Measures, its measurment is complex as outcomes are partially observed. Bar those demanding their maximum available, the observed mortgage reflects their demand relative to this maximum. This *Note* builds on Kelly and Mazza (forthcoming), whereby individual mortgages are decomposed into credit available and take-up. A frontier methodology allows for estimation of the partially observed credit available and the demand relative to this level or take-up. These estimates depend on the cycle and individual borrower characteristics such as income, deposit and borrower age. Borrower income is the largest determinant of credit available, while borrower age and deposit size are the main drivers of reduced take-up. We derive a threshold measure of bindingness, defined as the proportion of borrowers with take-up greater than 90 per cent. This allows for a consistent measure of bindingness across subgroups and time, which equates to the group of borrowers who likely took on less debt than they would have had in the absence of the Measures[1].

The bindingness measure provides an estimate of the impact of the LTI and LTV restrictions over the cycle. Results show the proportion of bound borrowers rose from 29 to 46 per cent since the introduction of the Measures. Recently, there has been a stabilisation of bindingness for borrowers within the limits, reflective of the recent supply increase after a

[1] This estimate of bindingness is based on realised outcomes in the mortgage market. Therefore, this approach cannot provide an estimate of the impact of the Measures on the level of discouraged or unsuccessful applicants.

prolonged period of supply shortage in the housing market. For the Measures to address these cyclical pressures, bindingness will evolve over the cycle to mitigate the potential negative impact on borrower affordability and resilience. The rich set of borrower characteristics also allows for the estimation of some of the distributional impacts of the Measures. In the first half of 2019, first time and Dublin buyers have significantly higher levels of bindingness reflecting the high level of Dublin house prices relative to incomes compared to other parts of the country.

Given the relative infancy of these instruments, there is a burgeoning literature measuring outcomes with a view to informing effective calibration. The Measures are shown to be consistent with the goals of increased household (Gabarro et al., 2019) and bank (Altunbas et al., 2018) resilience but outcomes differ by the level of economic openness (Cerutti et al., 2017) and the point of introduction in the cycle (Kelly et al., 2018). The level of bindingness and the interaction between instruments can at least partially explain the cyclical differential in outcomes (Grodecka, 2019). For capital based instruments, the level of bindingness has direct and significant implications for lending to the real economy (Labonne and Lame, 2014). While there is less evidence relating the bindingness of borrower based measures to real economy outcomes, Anenberg et al. (2019) shows the significant role of maximum credit available, the main transmission channel of the Measures, on house price developments in the US.

2 Background and Data

The Irish mortgage market provides a unique case study to analyse income and deposit leverage. Between 2003 and 2012, the Irish housing market was among the most extreme in terms of collapse following a decade of robust growth. In the build-up phase, loose credit conditions yielded house price growth well in excess of income growth. At the peak in 2007, 20 per cent of loans had an LTI ratio greater than 5, while more than 10 per cent of loans had a zero or negative downpayment. Ireland then suffered a banking and sovereign debt crisis following the global financial difficulties in 2008. Unemployment quadrupled to 16 per cent and house prices fell for 20 consecutive quarters, halving in value. A demand led recovery in house prices followed as economic conditions improved. By 2015, with house prices on a sustained upward trajectory, the Central Bank of Ireland introduced macroprudential measures to limit LTI and LTV ratios for new mortgage lending. These Measures have two objectives; increasing bank and borrower resilience to economic shocks and dampening the feedback between credit and house prices. At their core (see Table 1), they limit LTV to 80 per cent (90 for first-time buyers) and LTI to 3.5 (hereinafter the Within group), with a proportion of lending allowed above these limits (hereinafter the Allowance group).

Table 1 | Overview of Irish Macroprudential Mortgage Market Regulations

	Loan-to-Value		Loan-to-Income	
	Limit(%)	Allowance(%)	Limit	Allowance (%)
First Time Home-buyer	90	5	3.5	20
Second & Subsequent Buyers	80	20		10
Investors	70	10	N/A	

Notes: Exemptions are granted for negative equity mortgages, switchers with no increase in balance and modifications of distressed mortgages.

Our analysis is based on a rich loan-level dataset introduced to ensure compliance with the Measures. Any lender issuing more than 50 million euro of mortgage debt is required to submit loan origination information including LTI, LTV, loan interest rate and type, collateral and borrower characteristics. Data are collected semi-annually and cover lending between 2015 and 2019h1. We limit the sample to primary dwelling households with a property transaction (i.e. exclude refinance and equity release mortgages). Table 2 provides summary statistics for borrowers within the limits and by allowance type. Across all loans, two thirds of mortgages are to first time buyers and 40 per cent of lending is in Dublin. Average income and deposit are 82,000 and 87,000 euro respectively. There is much greater variability in deposit levels, likely reflecting the lack of an equity channel for first time buyers. Consistent with Kinghan and McCann (2019), allowances are more likely for first-time buyers, lower income borrowers and those buying in Dublin.

3 Empirical Analysis

A measure of bindingness in the mortgage market requires identification of the borrowers at, or close to, the limit of credit available to them. The Measures act to limit any procyclical deterioration in lending standards, complimenting rather than substituting individual bank credit policies, which at points in the cycle maybe tighter than those of the Measures. As a result, borrowers can be limited on the income channel (LTI limit), downpayment channel (LTV limit) or by the maximum a bank is willing to lend due to affordability considerations such as borrower age and interest rates. There is an additional difficulty in measuring bindingness as outcomes are partially observed. For all but those demanding their maximum available, the observed mortgage reflects their demand or level of take-up relative to this maximum. We draw on frontier analysis from the industrial organisation field of economics as a solution to partially unobserved maximum credit available. These models focus on firm efficiency, estimating a firm-specific output frontier, or maximum possible, for

a given set of inputs. In addition, they estimate an inefficiency value to capture the distance between a given firm and their most efficient peers. In our set-up, the output frontier corresponds to the maximum attainable level of credit or credit available. Take-up corresponds to the inefficiency value or the difference between the drawn and maximum attainable credit and varies according to the individuals' need or willingness to borrow. Constrained borrowers will, for instance, fully leverage deposit or income while less constrained borrowers could instead rationally choose to reduce their LTV and LTI ratios for the same property value.

Studying mortgage availability and credit take-up using the frontier approach follows the work of Anenberg et al. (2019). Kelly and Mazza (forthcoming) provide a detailed description of the technical approach and application to the Irish mortgage market. The individual borrower credit available and take-up depends on borrower income, deposit, age, interest rate and first time buyer status. Income and deposit are inputs rather than LTI and LTV as the latter are endogenous, and hence, depends on loan size. Further, using income allows for wider application and comparison to jurisdictions where alternative policy measures set limits on debt service ratios (e.g. Portugal) or amortisation schedule (e.g. Sweden).

The Measures are designed to mitigate the potential for pro-cyclical underwriting standards by linking increases in credit available to income developments. However, take-up will almost certainly evolve with the cycle, reflecting, among others, housing market demand and supply imbalances. To capture these time dynamics, we extend the estimation to include quarterly time fixed effects. These time measures are further interacted with first-time buyer status and allowance type, allowing each of these groups to evolve heterogeneously.

Kelly and Mazza (forthcoming) provide a full discussion of the coefficients and the evolution of credit available and take-up over the longer 2003-2018 period. They show both income and deposit increase the maximum attainable amount of credit, with income having the greatest effect. Take-up falls significantly with increasing borrower age and deposit size. This is consistent with less constrained borrowers choosing to reduce their LTV ratio, although it could also reflect the increased likelihood of income channel constraint. Separating the Within and Allowance groups, Figure 1 visualises the frontier of credit available and the take-up level by income. The Allowance group have a higher frontier reflecting their looser LTV and LTI constraints. In addition, there is clear evidence of lower constraints for higher income borrowers with reduced take-up and a significantly lower proportion of them in the Allowance group.

3.1 A Measure of Binding

Due in part to urbanisation, there has been increased variation in housing affordability within countries. Figure 2 shows a scatter plot of house price and income variation in Ireland, with two distinct groups, driven by proximity to Dublin. For counties above the 45-degree line, property is less affordable relative to those below the line. The additional credit available from higher income is more than offset by higher house prices yielding different levels of affordability, and hence take-up, by geographical region. In addition, one expects first time buyers to have greater take-up due to lower incomes (tend to be younger with greater likelihood of future income growth) and the lack of an equity channel to fund a deposit. Figure 3 highlights the cross sectional difference in take-up by comparing regional and Dublin borrowers by first time buyer status. There is a wider variation in take-up levels among second and subsequent buyers, reflecting the importance of borrowers' demand-side choices and their less tightly-binding credit constraints. In comparison, first time buyers in Dublin have a narrow distribution with a peak above 90 per cent take-up consistent with a higher level of constrained borrowers.

A key consideration for policymakers is a measure of the constrained group of borrowers given the large cross sectional variation and cyclical dimension to take-up levels. Considering simple measures, for example the change in average take-up, is not appropriate. They are sensitive to changes in low values of take-up, which are meaningless in the measurement of bindingness. Instead, we derive a threshold measure, defined as the proportion of loans with greater than 90 per cent take-up (shown as the red shaded area in Figure 3). This provides an easily calculable measure with an easy understanding but it is sensitive to the selection of the 90 per cent threshold. Alternative methods, such as exponentially weighting the high take-up levels or a Gini style coefficient would reduce this sensitivity but at a cost of adding complexity to interpreting changes in the measure.

This measure of bindingness allows the constrained nature of the take-up distribution to be summarised in a single value. Figure 4 shows a heat-map of this value over time and across sub-groups of borrowers. At the aggregate level, bindingness has increased from 29 to 46 per cent since the introduction of the Measures. Decomposing the aggregate level shows loans for all buyers within the limits have stabilised over the last four quarters. In comparison, there is greater volatility and seasonality (quarter one tends to be lower) for the Allowance group. This reflects the seasonality in banks own underwriting standards as the Measures do not specify LTI or LTV limits for the Allowance group. First time and Dublin buyers have significantly higher levels of bindingness, with more than two thirds buying in Dublin bound in the first six months of 2019. This is consistent with the more than half of bound borrowers buying in Dublin and a rising share in its commuter counties.

The above results outline the levels of bindingness across the mortgage market. The impact of wider housing policies which interact with the Measures, for example Help to Buy Initiative[2]) requires understanding the composition of the bound group. Figure 5 shows the evolution in the composition of bound borrowers since 2015, with a relatively stable three quarters buying their first property. There is a falling share of single applicant borrowers, driven by a relatively larger increase in bound joint borrowers rather than falling numbers of bound single applicants. Figure 6 shows the rightward shift in the income composition in the bound group, from a 2015 peak of 45,000-55,000 to 65,000-75,000 euro in the first six months of 2019. This reflects the comparably slower growth in incomes relative to house prices, especially in Dublin. As a result, more than half of the bound borrowers are in Dublin and a rising share in its commuter counties.

The value of the methodology depends on its ability to capture the LTI and LTV limits imposed by the Measures. Therefore, a well-specified model should predict high levels of bindingness close to the limits regardless of income and deposit levels. Figure 7 plots the level of bindingness for first time buyers by LTI. There is little binding at low LTI, with a sharp increase towards 100 per cent for values between 3 and 3.5. The level then falls dramatically to below 10 per cent and gradually increases to 100 for LTI above 4.2. This reflects the existence of a credit maximum for borrowers not receiving an allowance, along with a separate maximum level for those receiving an allowance. Therefore, this methodology captures the limit dynamics while also providing a richer measure of bindingness compared to simple summary statistics, such as the number of borrowers close to the LTI limit. Less than half of the 42 per cent of borrowers bound in 2018 (Figure 8) are close to the LTI limit (between 3.4 and 3.5). The differential can be explained by deposit constraints, the banks' imposed maximum for allowance loans and other factors such as borrower age.

4 Conclusion

A lesson from the financial crisis is the need for a specific framework and a broad range of policy instruments to address the build-up of systemic risk. This has led to the widespread growth and use of macro-prudential policies, including the Irish LTV and LTI limits announced in 2015. These Measures seek to build borrower resilience and dampen the feedback loop between mortgage credit and house prices. Given Irish banks' concentration in property lending and the prominent role of home ownership in Irish society, continual monitoring of the Measures is required to insure their most effective calibration. Altering the calibration

[2]The Help to Buy incentive is a scheme for first-time property buyers of new property. The incentive refunds Income Tax and Deposit Interest Retention Tax up to a maximum of 20,000 euro, based on 5 per cent of the house value.

of the limits is akin to changing the maximum level of credit available to individual borrowers. Understanding the overall impact and those most affected requires identifying borrowers close to their current maximum. These are bound borrowers and the overall proportion of such borrowers provides an estimate of the level of bindingness in the market.

There are a number of technical challenges to providing a measure of bindingness. Firstly, borrowers can be limited by one of multiple channels and the Allowance group faces a different borrowing constraint. Secondly, the direct impact of the Measures is unobserved for borrowers demanding less credit than the maximum available to them. This *Note* provides a measure of bindingness by combining estimates of credit available and take-up for individual Irish borrowers. This measure shows an increase in the level of bindingness since 2015 with strong distributional differences showing more than half of first time buyers borrowing almost their maximum available amount. Further examination of the bound group shows rightward shift in the income composition, from a 2015 peak of 45,000-55,000 to 65,000-75,000 euro in the first six months of 2019. This reflects the comparably slower growth in incomes relative to house prices, especially in Dublin. This geographical difference in housing affordability is evidenced with three quarters of bound borrowers buying in the Greater Dublin Area.

A measure of bindingness is critical to policymakers' evaluation of the Measures over the cycle. With low levels of bindingness, the Measures have little impact on credit outcomes. This might be desirable at their point of introduction to minimise market disruption. However, it would undermine the goal of building resilience if the upward price pressure from a housing supply shortage resulted in pro-cyclical credit conditions and reduced borrower resilience. In contrast, for high levels of bindingness careful consideration is needed to understand the impact on housing supply. Higher bindingness affects owner-occupier demand but less so the demand for housing services overall which is mainly determined by demographics and migration flows. Therefore, this may have implications for the mix rather than quantity of new builds, especially if the type and location of property demanded differs by tenor.

In conclusion, this *Note* illustrates the level of bindingness within the Irish mortgage market after the introduction of the borrower-based measures in 2015. This is a key consideration for policymakers when reviewing such policies given their impact and effectiveness depends on not only the current level but also the wide cross sectional and cyclical variation in bindingness.

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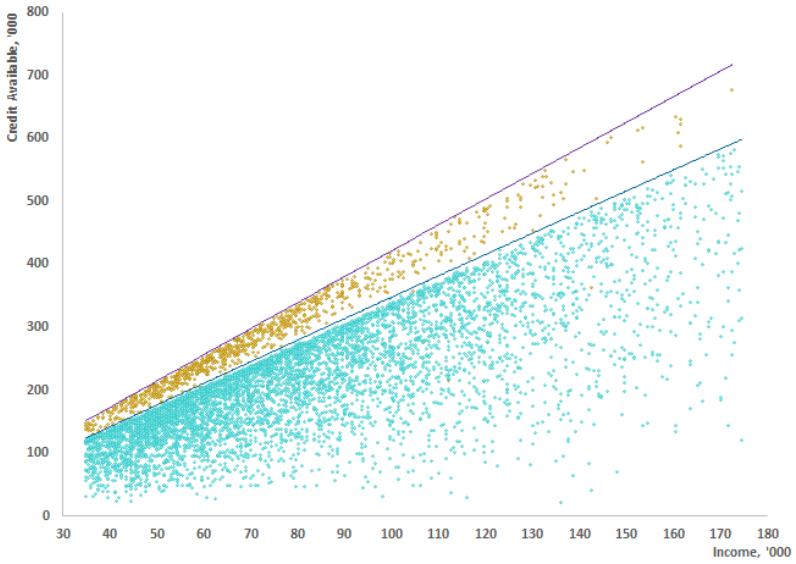
Figures and Tables

Table 2 | Summary Statistics

	Full Sample	Within	Allowance (LTI)	Allowance (LTV)
Loan Size	227,734	209,954	290,222	335,721
	(139,230)	(131,537)	(125,487)	(173,755)
Income	81,992	80,639	73,355	115,901
	(41,380)	(41,176)	(30,490)	(45,961)
Deposit	87,557	91,224	85,156	44,226
	(119,328)	(126,025)	(95,880)	(28,370)
LTI	2.79	2.62	3.97	2.81
	(0.81)	(0.72)	(0.34)	(0.64)
LTV	75.3	73.6	79.42	88.64
	(17.3)	(18.0)	(11.64)	(4.96)
Interest Rate	3.29	3.28	3.32	3.43
	(0.41)	(0.41)	(0.36)	(0.47)
FTB	63.6	64.2	81.4	21.8
Dublin	39.2	34.2	68.4	48.5

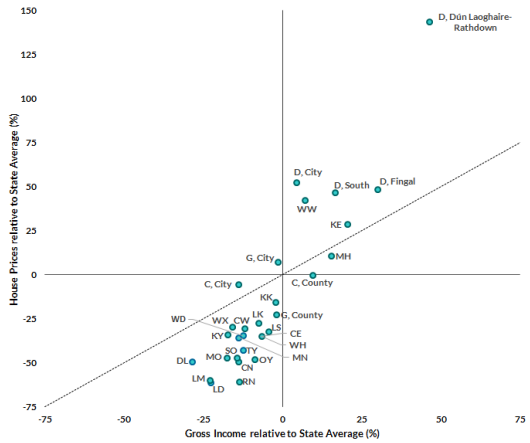
Notes: Summary statistics (mean values and standard deviation in parentheses) covering Irish mortgage lending between 2015 and 2019H1, limitied to primary dwelling households with a property transaction (i.e. exclude refinance and equity release mortgages).

Figure 1 | Frontier of Credit Available and Take-up by Income



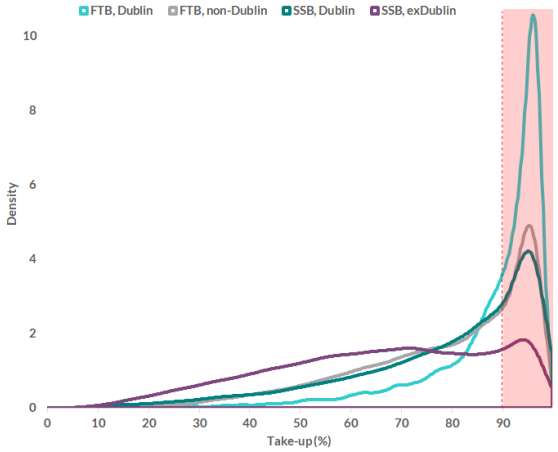
Notes: Credit available and take-up are estimated at the borrower level using a stochastic frontier methodology. The lines represent the frontier or maximum credit available for the Within and Allowance group by income level. The dots represent individual borrowers take-up or demand relative to this maximum.

Figure 2 | Regional Income and House Price Dispersion 2016



Notes: Scatter plot of differential (per cent) from national average in income (CSO household median gross income by county) and house prices (CSO county level Residential Property Price Index) in 2016.

Figure 3 | Take-up by Borrower Type and Location



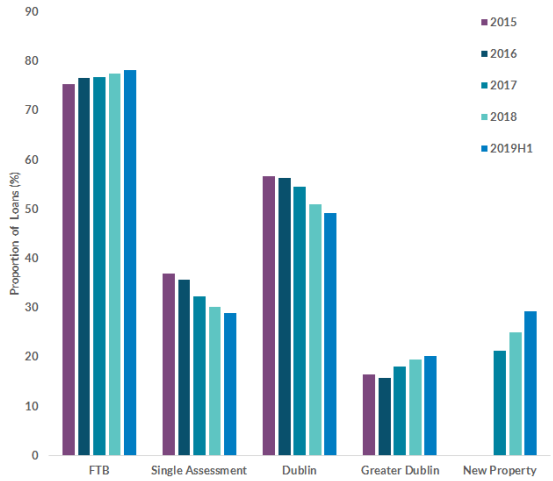
Notes: Cross section of distribution of take-up (inefficiency term from a stochastic frontier model) over the 2015-2018 period. First-time buyers in Dublin are compared to second and subsequent buyers outside Dublin.

Figure 4 | Heatmap of Bound Borrowers by Quarter (2015 - 2019 H1)

		2015-q2	2015-q3	2015-q4	2016-q1	2016-q2	2016-q3	2016-q4	2017-q1	2017-q2	2017-q3	2017-q4	2018-q1	2018-q2	2018-q3	2018-q4	2019-q1	2019-q2
	All Loans	29	30	29	30	34	35	35	35	36	39	40	39	44	42	43	43	46
	Within	17	21	24	26	28	28	27	30	30	33	33	35	36	39	40	41	41
	Allowance	57	55	53	53	62	65	65	57	56	59	61	63	66	67	66	59	69
FTB	Overall	37	36	36	38	41	42	42	41	43	46	46	48	49	51	52	51	53
	Within	23	25	29	32	34	35	33	36	37	39	40	42	44	47	49	48	48
	Allowance	65	64	64	65	74	77	73	69	64	69	71	73	71	75	81	75	82
Location	Dublin	53	53	53	52	58	58	59	58	57	62	62	65	64	67	67	67	68
	GDA	47	43	43	41	52	48	53	45	52	52	55	58	60	61	65	62	67
Income	< 40k	39	41	35	39	42	42	40	41	43	50	48	44	50	52	53	51	46
	40k-50k	39	36	38	37	42	46	43	39	43	46	43	46	44	47	50	45	53
	50k-60k	38	39	40	43	47	45	46	46	49	46	47	49	53	52	51	52	55
	60k-70k	40	38	40	43	45	47	51	46	46	51	56	54	59	57	61	57	58
	70k-80k	30	35	37	41	44	42	42	44	50	52	51	53	51	59	61	56	62
	80k-90k	37	34	30	29	35	37	37	39	41	48	45	48	49	57	57	53	55
	90k-100k	43	25	21	31	33	31	32	38	32	40	44	41	43	44	49	52	57
	100k+	26	25	28	27	34	33	33	33	33	31	35	42	39	37	32	42	39

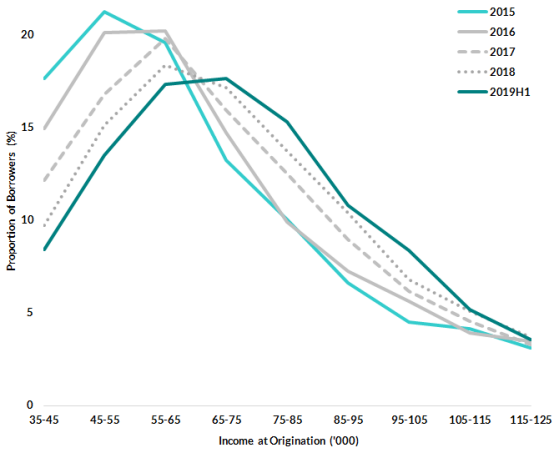
Notes: Bound loans are defined as the proportion (number) of loans with take-up greater than 90 per cent of credit available. Within are loans classified within scope of the measures and below both LTV and LTI limits. Allowance is the group of loans above one or both limits as part of the proportionate cap. GDA is the Greater Dublin Area and is defined as properties in counties Kildare, Louth, Meath, and Wicklow.

Figure 5 | Composition of Bound Loans (2015 - 2019 H1)



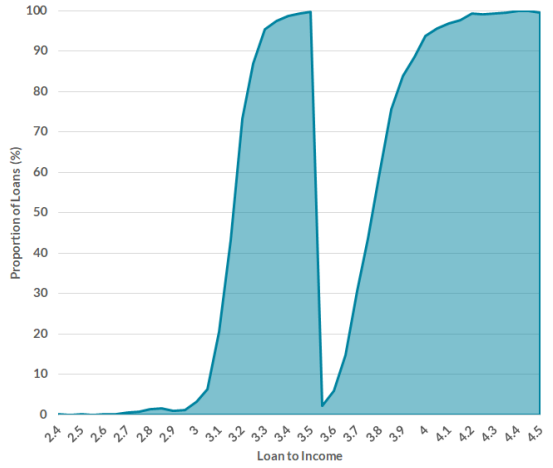
Notes: Bound loans is defined as the group of loans with take-up greater than 90 per cent of credit available. Greater Dublin is defined as properties in counties Kildare, Louth, Meath, and Wicklow. New property refers to purchase of new build, data collection begins in 2017.

Figure 6 | Composition of Bound Loans by Income



Notes: Bound loans is defined as the group of loans with take-up greater than 90 per cent of credit available.

Figure 7 | Proportion of Bound Loans by LTI



Notes: Bound loans is defined as the group of loans with take-up greater than 90 per cent of credit available.

Figure 8 | Comparsion of bound loans to LTI and LTV binding

Notes: Bound loans is defined as the group of loans with take-up greater than 90 per cent of credit available. The breakdown follows a waterfall methodology from LTI bound (between 3.4 and 3.5), LTV bound (90 per cent), banks imposed maximum for allowance loans and other captures factors such as borrower age.

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