



## The Effects of Macroprudential Policy on Borrower Leverage

Christina Kinghan, Yvonne McCarthy, and Conor O'Toole <sup>1</sup>

Vol 2016, No. 8

### Abstract

This *Economic Letter* explores the effects of the recent macroprudential measures in the mortgage market on the leverage of Irish borrowers. Using loan-by-loan data from before and after the measures, we test how loan-to-income (LTI) and loan-to-value (LTV) ratios have changed for First Time Buyers (FTBs) and Second and Subsequent Buyers (SSBs). A number of findings emerge. The average (mean) LTV and LTI ratios increased slightly after the introduction of the regulations for both FTBs and SSBs. However, the opposite pattern is observed for high leverage borrowers. For FTBs with an LTV of 80 per cent or above, the average borrower registered a small reduction in their LTV after the regulations. This result was only present for higher income borrowers, i.e. FTBs at the lower end of the income distribution had the same average LTV pre- and post-regulations. SSBs with an LTV of 80 per cent and above also had a lower LTV after the regulations, but the effect was more pronounced than for FTBs. Few borrowers experienced a tightening of LTIs following the measures; we find only a limited effect among high leverage SSB borrowers.

## 1 Introduction

Macroprudential rules in residential mortgage markets, such as limits on loan-to-value (LTV) or loan-to-income (LTI) ratios, have become an increasingly popular tool for managing financial stability risks. In the European Union, for example, sixteen Member States now have some form of LTV and / or debt-service-to-income or LTI measures in place. The Central Bank of Ireland introduced macroprudential measures in the Irish mortgage market in 2015, placing regulatory limits on the LTV and LTI

ratios of newly issued mortgages from 9 February 2015.<sup>2</sup> The measures aim to enhance the resilience of borrowers and banks to financial shocks and limit the dynamics between house prices and mortgage credit.

Accompanying the increased usage of these measures, a nascent literature has developed assessing their impact and efficacy. Much of the literature has focused on the macro-impact of these measures on aggregate credit and house price developments ([Vandenbussche et al., 2015](#); [Jacome and Mitra, 2015](#); [Cerutti et al., 2015](#); [Kelly et al.,](#)

<sup>1</sup>Corresponding authors: [yvonne.mccarthy@centralbank.ie](mailto:yvonne.mccarthy@centralbank.ie); [conor.otoole@centralbank.ie](mailto:conor.otoole@centralbank.ie). We would like to thank Paul Lyons, Fergal McCann and Gabriel Fagan for comments and suggestions. The views expressed in this paper are those of the authors alone and do not represent the official views of the Central Bank of Ireland or the European System of Central Banks. Any remaining errors are our own.

<sup>2</sup>Please see [Cassidy and Hallissey \(2016\)](#) for details of the measures.

2015; Igan and Kang, 2011; Gerlach and Peng, 2005). Relatively few studies, however, have assessed the impact on borrowers.<sup>3</sup> This *Economic Letter* provides a summary of the research in Kinghan et al. (forthcoming), where the authors test the impact on borrowers of the LTV and LTI limits in the Irish market. The research is based on a unique loan-by-loan dataset that covers lending from the period before and after the introduction of the regulations, and allows for analysis across different borrower groups (first-time buyers (FTBs), second and subsequent buyers (SSBs) and buy-to-let (BTL) borrowers). The latter feature is particularly pertinent given the extant literature that highlights how changing credit conditions impact differently across buyer types (McCarthy and McQuinn, 2016; Bover et al., 2016; Ortalo-Magne and Rady, 2006).

The *Letter* proceeds as follows: Section 2 summarises the LTV and LTI measures, as they applied to the Irish market over the period of analysis. Section 3 provides an overview of the data employed and key summary statistics. The evolution of LTV and LTI ratios among FTBs, SSBs and BTLs over time is discussed, and developments since the introduction of the macroprudential measures are highlighted. Section 4 contains a formal analysis of the effect of the regulations on the leverage of different borrower groups. Finally, Section 5 concludes.

## 2 The measures

The mortgage measures, which specify limits on the LTV and LTI ratios applying to new residential mortgage lending, were introduced from 9 February 2015. The analysis in Kinghan et al. (forthcoming) covers the period prior to the first review of the measures and the original calibration of the measures, as outlined in CBI (2015), applied.<sup>4</sup> The limits set from 9 February 2015 differentiated between buyer types. FTBs were subject to a sliding LTV limit, where the first €220,000 of their purchase required a 10 per cent deposit and the balance above €220,000 required a 20 per cent deposit. SSBs were subject to a maximum LTV of 80 per cent on their property purchase under the regulations, while BTLs were subject to a 70 per

cent maximum LTV. The LTI limit was set at 3.5 times gross income, and applied only to borrowers purchasing their primary residence (FTBs and SSBs).

The regulations allowed for a certain value of new lending to exceed the limits. Financial institutions were each permitted to lend up to 15 per cent of the value of new lending for principal dwelling houses (PDH) in excess of the LTV limit for PDH borrowers while 10 per cent of the value of new BTL lending was allowed exceed the LTV limit for this group. Regarding the LTI limit, financial institutions could provide up to 20 per cent of the value of their new PDH lending in excess of the LTI limit. There were also a number of exemptions to the regulations. Specifically, mortgages to borrowers in negative equity or to borrowers switching or re-financing their loan with no increase in principal were exempt, as were mortgage modification arrangements and loans that were approved prior to the regulations.

## 3 Data and summary statistics

### 3.1 Data description

Our analysis draws on two interlinked sources of data collected by the Central Bank of Ireland. First, we use a loan-level dataset (LLD) to capture information on loans originated prior to the introduction of the regulations. This dataset is submitted on a six-monthly basis by the five main banking institutions currently active in the Irish mortgage market. These are Allied Irish Bank (AIB, including the Educational Building Society (EBS)), Bank of Ireland (BoI), Permanent TSB (PTSB), Ulster Bank Ireland (UBIL) and KBC Bank Ireland (KBC). We use the LLD from December 2015, which provides originating and current information on all outstanding mortgages across the five institutions at this date. We focus on loans issued between 1 January 2006 and 8 February 2015. Second, we use loan-by-loan information submitted to the Central Bank of Ireland to monitor compliance with the new macroprudential measures. These data are captured in a return known as “SI 47 Monitoring Templates” (MT). The MT data are submitted by institutions that advance at least €50

<sup>3</sup>Notable exceptions come from Allen et al. (2016) and Allen et al. (2015), who use micro-data to examine the impact of changes to macroprudential housing rules on borrowers in Canada.

<sup>4</sup>See CBI (2016) for details of the regulations that will apply from 1 January 2017.

million of new mortgage lending in a six month period. Since the introduction of the measures on 9 February 2015, the same five lenders detailed above met this criteria. The latest available MT dataset covers the six-month period 1 January 2016 to 30 June 2016. From the MT datasets, we extract information only on those loans that were in-scope of the Regulations. These combined sources provide us with a dataset containing approximately 500,000 loans with an origination date between 1 January 2006 and 30 June 2016.

While we examine patterns in lending throughout this time period, for the impact assessment in Section 4, we focus on a comparative period before and after the introduction of the measures, to assess whether there was a change in LTV and LTI ratios for different borrower groups. Specifically, we focus on: 1) A pre-regulations period (Pre), from the 1 January 2013 to 30 September 2014 (Q1 2013 to Q3 2014). Our sample contains 27,940 loans that were originated over this time-frame.<sup>5</sup> 2) A post-regulations period (Post), from the 9th February 2015 to the 30th June 2016 (Q1 2015 to Q2 2016). Our sample contains 25,969 loans with an origination date during this time that were in-scope of the regulations. We exclude loans in 2015 that were out-of-scope of the measures.<sup>6</sup> Regarding borrower types, FTBs accounted for the largest share of loans in each period at over 50 per cent, followed by SSBs at approximately 42-45 per cent and the remainder was extended to BTLs. In what follows, we focus predominantly on FTB and SSB borrower types in assessing the impact of the mortgage market measures.<sup>7</sup>

## 3.2 Univariate and distributional analysis

### 3.2.1 LTV and LTI trends over time

Before assessing the impact of the regulations on borrower leverage, we first explore developments in the LTV and LTI ratios since 2006. The trends are displayed in Figure 1, which presents the mean, median and distributions of these series for differ-

ent borrower groups over the period.<sup>8</sup>

From the peak in 2006, average LTVs tightened slightly for FTBs, particularly during the peak-crisis years of 2008-2010 (panel 1:A). Thereafter, the mean and median LTVs increased marginally, though small fluctuations are clear in different years.

More notable changes can be observed, however, at the upper end of the LTV distribution for FTBs (marked by the top of the grey and orange shaded areas). Since 2007, the upper end of the LTV distribution moved downwards, signalling less lending at high LTV ratios. Specifically, it is clear that at least 10 per cent of FTBs had an LTV ratio of 100 per cent in 2006 and 2007 (marked by the top of the grey shading, which captures borrowers in the 90th percentile of the LTV distribution). From 2009 onwards the highest LTV among this group was closer to 92 per cent. The chart indicates that the introduction of the measures in 2015 was also associated with a reduction in high LTV loans as the 90th percentile fell from an LTV ratio of 92 to 90.

The LTV distribution for SSBs is shown in panel 1:B. Consistent with FTBs, average LTVs among SSBs contracted between 2006 and 2009. Thereafter, the average LTV of an SSB increased, rising from approximately 45 per cent in 2009 to over 60 per cent in 2014. For the median borrower, the LTV increased from just over 40 per cent in 2009 to 70 per cent in 2014. This increase may be related to the sharp fall in house prices over the period, which would have reduced the equity available to SSBs from the sale of their previous homes. Since the introduction of the mortgage regulations in 2015, lending at the higher end of the LTV distribution for SSBs has been reduced. Specifically, in 2014, a 90 per cent LTV marked the 90th percentile of the LTV distribution for SSBs; in H1 2016 this was reduced to 80 per cent. Furthermore, a slight decrease in mean and median LTVs for SSBs is evident between 2014 and 2015 / H1 2016.

The LTI distributions for FTBs and SSBs are presented in panels 1:C and 1:D respectively. Fo-

<sup>5</sup>We exclude loans in the final quarter of 2014 from the pre-regulations sample. The Central Bank of Ireland formally announced the introduction of such limits in the first week of October 2014. The behaviour of banks and borrowers could have altered after this point, in anticipation of the limits that would be introduced from February 2015.

<sup>6</sup>Please see Keenan et al. (2016) for details.

<sup>7</sup>In this analysis (both Pre and Post), we include all loan types including loans for new property purchase, equity release and refinancing. It was not possible to create a sample for only new property purchase before and after the measures.

<sup>8</sup>The samples underlying the LTV and LTI charts differ due to missing observations on house prices and income over the period.

cusing on panel 1:C, we observe a decrease in the LTI ratio of FTBs from 2008 onwards, with a reduction in the mean/median LTI ratio from almost 4.5 in 2008 to approximately 2.7 in 2014. The LTI increased slightly since 2014; in 2016, the average (mean or median) LTI among FTBs was approximately 3. The chart also shows a reduction in high LTI lending over time.

Panel 1:D shows a reduction in the LTI ratio for SSBs between 2007 and 2009, which fell from a mean/median value of close to 3.2 in 2007 to 2 in 2009. The average LTI of SSBs remained relatively constant between 2009 and 2014 but increased slightly thereafter. In H1 2016, the average LTI ratio among SSBs was just under 2.5. Lending at the upper end of the LTI distribution has also declined over time. While as many as 10 per cent of SSBs received loans with an LTI ratio of 5 or over between 2006 and 2008, the maximum LTI ratio extended among this group since 2011 has been between 3 and 3.5.

Finally, Figure 2 illustrates the distribution of the LTV ratio for BTL loans from 2006 to H1 2016. The average LTV ratio for BTLs declined from 2006 to 2011, from a mean of 70 per cent to approximately 50 per cent. Since 2012, the LTV increased marginally, up until the introduction of the mortgage regulations. Since then, a small reduction in LTV has been observed at both the mean and the median for BTL borrowers. Lending at the upper end of the LTV distribution fell steadily from 2006 to 2011, with relatively little lending taking place at an LTV above 70 per cent from 2012 onwards. The introduction of the measures coincided with further tightening at the upper end of the distribution.

### 3.2.2 Borrower and loan characteristics

Next, we explore lending in the period immediately prior to and since the introduction of the measures in detail, by examining average loan and borrower characteristics in both periods. A t-test is used to identify statistically significant differences across time. Table 1 presents the results for FTBs and Table 2 presents the results for SSBs.

In the period since the regulations, we note a number of statistically significant changes in loan characteristics. Specifically, the average loan size, property price and LTV were all higher for both

FTBs and SSBs after the regulations. Turning to borrower characteristics, we observe no changes in the average age or region of residence in either group of borrowers. However, we find an increase in the share of couples among both FTBs and SSBs in the period since the regulations. We also note a statistically significant increase in the average income of FTBs (which was €3,704 higher in real terms, on average, in the post-regulations period) and a small increase in the percentage of SSBs who are employed.<sup>9</sup>

For completeness, we provide information on the average loan size, property value and LTV for BTL loans. We omit borrower characteristics due to the small sample size. Consistent with both FTBs and SSBs we observe a higher property value and LTV in the post-measures period and these differences are statistically significant.

### 3.2.3 Insights across the distribution

In Figure 3, we provide further insight into changes in the LTV and LTI ratios after the regulations, by presenting a distributional comparison of these variables, by borrower type. Focusing first on panel 3:A, we observe a reduction in the number of FTB loans with an LTV greater than 90 per cent after the regulations and a corresponding increase in the number of loans between 80 and 90 per cent LTV. Lending at the lower end of the LTV distribution is consistent across both time periods.

Panel 3:B displays the LTV distributions for SSBs. A sizeable increase in lending at 80 per cent LTV is observed after the introduction of the regulations, with lower quantities of lending taking place in excess of 80 per cent LTVs, in line with the regulations. A small amount of lending is observed above an 80 per cent LTV after the regulations, reflecting the allowance for some lending in excess of the limits.

Focusing on the distribution of LTI for FTBs, there is an evident clustering of loans at the 3.5 LTI limit after the regulations, when compared to the cohort of loans originated over Q1 2013 to Q3 2014. There is a slight shift rightwards in the SSB LTI distribution after the regulations, indicating more lending at relatively higher LTIs in that period. A clustering of loans at the 3.5 LTI limit is also evident.

Figure 4 explores the LTV distribution of FTBs

<sup>9</sup>We also observe that FTBs are less likely to be employed, however this difference is less than one per cent and is only marginally statistically significant.

in further detail, showing a split of the distribution for FTBs by whether the property purchased was above or below €220,000.<sup>10</sup> Focusing first on loans with a property value of less than €220,000, the LTV distributions look similar for both periods, though a small reduction in the number of loans with an LTV of 92 per cent is observed under the regulations, while a corresponding increase in 90 per cent LTV loans is also clear. This suggests that borrowers purchasing properties valued at or less than €220,000 faced broadly similar LTVs after the regulations. For borrowers with a property price greater than €220,000, the distribution of LTVs has shifted inwards from the right. We observe more lending between an LTV of 80 and 90 per cent reflecting the sliding scale requirement for a larger deposit for FTBs of more expensive properties.

## 4 Testing for the effects on leverage

### 4.1 Model set-up and testing procedure

The univariate and distributional analysis presented above points to some changes in the LTV and LTI distributions among FTBs and SSBs after the regulations were introduced. However, the developments observed could be linked to changes in the underlying composition of borrowers or the types of properties purchased over the period. Therefore, as a next step, we formally test for changes in LTV and LTI ratios in the post-regulations period while controlling for borrower, loan and property characteristics. In this way, we can observe how average LTV and LTI ratios changed for a similar borrower purchasing a similar property after the regulations were introduced. Our analysis is based on lending that took place in the pre- and post-regulations periods defined pre-

viously (Pre and Post). We specify the following model:

$$LI_i = \beta_0 + \beta_1 Post + \beta X_i + \omega Z + \epsilon_i \quad (1)$$

Where  $LI_i$  is the dependent variable (LTV or LTI) for household  $i$ ,  $X_i$  is a set of controls for borrower and property characteristics for household  $i$ ,  $Z$  is a set of loan controls for the bank and the month of origination and  $\epsilon_i$  is the error term for household  $i$ .<sup>11</sup> Importantly, the model also includes a dummy variable, *Post*, which equals one for loans originated under the regulations and zero for those issued before. The coefficient on this variable signals how the leverage indicator (LTV or LTI) changed in the post-regulations environment, after controlling for the borrower, loan and property characteristics.<sup>12</sup> Since the rules differentiate between FTBs and SSBs, we estimate separate models for both of these groups.

As a second step in the empirical analysis, we interact the *Post* variable with borrower characteristics to check if the relationship between borrower characteristics and the LTV or LTI ratio is altered after the measures were introduced. We do not interact the property variables in equation 1 with the *Post* indicator because we want to assess if the coefficients on borrower characteristics change for borrowers purchasing the same type of property before and after the regulations.<sup>13</sup> The results are discussed in the next section.

### 4.2 Empirical results

Table 3 presents the coefficients on the *Post* variable from the baseline regression specified in equation 1.<sup>14</sup> The top panel shows the results for FTBs and SSBs when the model is estimated at the mean. We find that the average LTV for both FTBs and SSBs is marginally higher following the measures. Specifically, in the case of FTBs the coefficient on the *Post* variable is 1.3, indicating

<sup>10</sup>We focus on €220,000 given its role in defining the regulatory LTV of an FTB in the period since the regulations.

<sup>11</sup>The model is estimated with ordinary least squares. The borrower characteristics include age, marital status, employment type and gross income. The property characteristics include region, dwelling type (apartment, detached house, semi-detached house, terraced house and other.) and the price of the house. The income and house price variables enter as indicator variables capturing the within-year quintile on the house price or income distributions.

<sup>12</sup>The samples underlying the econometric model specified here will differ from the charts presented in section 3.2 since loans with missing information for any of the variables in the model will be excluded.

<sup>13</sup>It could also be the case that the measures changed the type of properties purchased. This issue is examined in Kinghan et al. (forthcoming) who run a model which allows the type of property, region and house price to differ Pre and Post the regulations. In this model, they find similar changes to LTI and LTV as those presented in table 3 in this *Economic Letter*.

<sup>14</sup>The full table of coefficients is available in Kinghan et al. (forthcoming) or is available from the authors on request.

that the average LTV for an FTB of the same average age, income and with the same marital and employment status after the measures as before, was approximately 1.3 percentage points higher after the regulations. The corresponding increase for an SSB of the same average age, income and with the same marital and employment status after the measures as before was 1.1 percentage points. These findings are in keeping with the univariate statistics presented earlier in Figure 1. The results are statistically significant but small in magnitude.

Regarding LTI ratios, there has been an increase in the average LTI ratio for both FTBs and SSBs since the measures of approximately 0.2 and 0.3 units respectively. Again, these results are statistically significant and in keeping with the univariate statistics in Figure 1.

Given that the regulations aim to reduce lending at high LTV and LTI ratios, it is also interesting to assess how average LTV and LTI ratios adjusted for borrowers in the upper end of the LTV and LTI distributions in the post-regulations period. We therefore re-estimate the baseline models, but this time we restrict the sample to only those borrowers with high leverage in both the pre- and post-periods. For LTV, we define the high leverage group to include borrowers with an LTV of greater than or equal to 80 per cent and, for LTI, the group includes borrowers with an LTI of 3 or more.<sup>15</sup> The results are presented in the bottom panel of Table 3. For high leverage FTBs, a small reduction in LTVs, of approximately 0.5 percentage points, is observed in the post-regulations period. Given that all borrowers in this group had an LTV of at least 80 per cent, a 0.5 per cent change is small in magnitude. For SSBs, however, LTVs fell by an average of 4 percentage points after the regulations were introduced. There is no evidence, on the other hand, of a change in the LTI ratio for high leverage FTBs after the regulations, and only a small decline for high leverage SSBs (of 0.03 units).

As noted in Section 4.1, we also run a model which incorporates interactions between the post-regulations dummy variable and borrower characteristics, i.e. we allow the relationship between

borrower characteristics and the LTV and LTI ratios to change after the introduction of the measures. The results of this model are consistent with those shown in Table 3 - i.e. average LTV and LTI ratios increased for average FTB and SSB borrowers in the period after the introduction of the measures.<sup>16</sup> In addition, however, we find some changes in the estimated relationships between borrower characteristics and LTV and LTI ratios in the post-Regulations period. Figures 5 and 6 highlight an important result in this regard.

Figure 5 presents the predicted LTV and LTI ratios for FTBs in the pre- and post-regulations periods at different points on the income distribution. The predictions are calculated for quintiles of the income distribution; the first income quintile captures borrowers in the bottom twenty per cent of the income distribution while the fifth quintile captures borrowers in the top 20 per cent of the income distribution. In panel 5.1 we see that the predicted LTV ratio increases with borrower income for FTBs, and there is no notable difference in the effect of income between the pre- and post-regulations periods. In panel 5.2, however, we plot the impact among the high-leverage group only. Here we find that, while income retains a positive association with the LTV ratio both before and after the regulations, the size of the relationship is reduced in the post-measures period, but only for higher income borrowers. Specifically, FTBs in the bottom 20 per cent of the income distribution with high LTV loans have the same predicted LTV pre- and post-the regulations. For high leverage FTB borrowers in the top 20 per cent of the income distribution, however, the predicted LTV is about 2 percentage points lower after the regulations.<sup>17</sup>

Turning to LTI, the Figure in panel 5.3 shows that predicted LTIs are marginally higher across the income distribution after the measures, indicating that on average, FTBs registered a slightly higher LTI in the post-regulations period, regardless of income level. In contrast, Figure 5.4 shows no difference in the effect of income on predicted LTI ratios among the high-LTI group of FTBs in the pre- and post-regulations period.

The corresponding results for SSBs are de-

<sup>15</sup>The definition of “high leverage” borrowers is somewhat arbitrary; in the case of LTV we choose the limit set in the regulations for SSBs. For LTI, we perform a number of robustness checks setting the threshold, for example, at 3.25 or 3.5. The results are similar in all cases to those presented here. Kinghan et al. (forthcoming) explore this issue in further detail.

<sup>16</sup>The results are not shown, but are available in Kinghan et al. (forthcoming) and from the authors on request.

<sup>17</sup>This finding is related to the sliding scale LTV limit for FTBs, as higher income borrowers tend to purchase more expensive properties.

picted in Figure 6. The Figures show that, in the post-regulations period, there is no difference in the relationship between income and predicted LTV ratios relative to the pre-measures period, at the average LTV ratio (panel 1). However, panel 2 shows that the predicted LTV for high leverage SSBs is lower at all points along the income distribution after the regulations. In terms of LTI, the results are similar to those for FTBs; on average, LTI ratios are higher for SSBs after the regulations, and this holds across the entire income distribution. For SSBs in the high leverage group only, however, there is no difference in predicted LTI ratios pre- and post-the regulations.

## 5 Conclusions

In this *Economic Letter*, we test whether similar borrowers faced higher or lower LTV and LTI ratios after macroprudential measures were introduced in the Irish mortgage market. We compare lending to FTBs and SSBs in two periods - Q1 2013 to Q3 2014 (pre-measures) and Q1 2015 to Q2 2016 (post-measures) - using a model that relates the LTV and LTI ratios to borrower and property characteristics in both periods.

A number of findings emerge. First, FTBs of the same average age, income, marital status and

employment type, who purchased an equivalent property before and after the regulations, had a marginally higher average LTV post-measures. A similar result is evident for SSBs. Second, focusing only on FTBs with an LTV over 80 per cent, borrowers in this group registered a small reduction in their LTV after the regulations, though this result was only present for higher income borrowers, i.e. borrowers at the lowest end of the income distribution in this group had the same average LTV pre- and post-regulations. The size of this effect is small in magnitude. Among the group of SSBs with an LTV over 80 per cent, a reduction in the average LTV was observed after the measures, and this result holds for all income levels. Third, in relation to LTI impacts, on average, LTIs were marginally higher for FTBs and SSBs following the measures. Among the high-LTI group of FTBs (defined as an LTI ratio of greater than 3), however, we find no difference in the pre- and post-measures LTI ratio. In contrast, for an equivalent SSB with an LTI over 3, there was a marginal reduction in the average LTI after the regulations.

In summary, the results suggest that the impact of the measures on borrowers has been limited to those with the highest LTVs and, for FTBs, borrowers at the higher end of the income distribution. Many borrowers were unaffected by the measures.

## References

- Allen, Jason, Robert Clark, and Jean Francois Houde, "Macroprudential Housing Policies and Borrowing Constraints," *working paper*, 2015.
- , Timothy Grieder, Brian Peterson, and Tom Roberts, "The Impact of Macroprudential Housing Finance Tools in Canada: 200510," *Staff Working Papers*, Bank of Canada 2016.
- Bover, Olympia, Jose Casado, Sonia Costa, Philip Du Caju, Yvonne McCarthy, Eva Sierminska, Panagiota Tzamourani, Ernesto Villanueva, and Tibor Zavadil, "The Distribution of Debt across Euro-Area Countries: The Role of Individual Characteristics, Institutions, and Credit Conditions," *International Journal of Central Banking*, 2016, 12 (2), 71–128.
- Cassidy, Mark and Niamh Hallissey, "The Introduction of Macroprudential Measures for the Irish Mortgage Market," *Economic and Social Review*, 2016, 47 (2), 271–197.
- CBI, "Information Note: Restrictions on residential mortgage lending," *Technical Report*, Central Bank of Ireland 2015.
- , "Review of residential mortgage measures," *Technical Report*, Central Bank of Ireland 2016.
- Cerutti, Eugenio, Stijn Claessens, and Luc Laeven, "The Use and Effectiveness of Macroprudential Policies: New Evidence," *IMF Working Papers 15/61*, International Monetary Fund 2015.

- Gerlach, Stefan and Wensheng Peng**, "Bank lending and property prices in Hong Kong," *Journal of Banking and Finance*, 2005, 29 (2), 461–481.
- Igan, Deniz and Heedon Kang**, "Do Loan-To-Value and Debt-To-Income Limits Work? Evidence From Korea," IMF Working Papers 11/297, International Monetary Fund 2011.
- Jacome, Luis and Srobona Mitra**, "LTV and DTI Limits - Going Granular," Working Paper WP/15/154, International Monetary Fund 2015.
- Keenan, Enda, Christina Kinghan, Yvonne McCarthy, and Conor O'Toole**, "Macroprudential Measures and Irish Mortgage Lending: A Review of Recent Data," Economic Letters 03/EL/16, Central Bank of Ireland 2016.
- Kelly, Robert, Fergal McCann, and Conor O'Toole**, "Credit conditions, macroprudential policy and house prices," Research Technical Papers 06/RT/15, Central Bank of Ireland 2015.
- Kinghan, Christina, Yvonne McCarthy, and Conor O'Toole**, "Leverage, Macroprudential Policy and Borrower Heterogeneity," Technical research paper, Central Bank of Ireland forthcoming.
- McCarthy, Yvonne and Kieran McQuinn**, "Credit conditions in a boom and bust property market: Insights for macro-prudential policy," *The Quarterly Review of Economics and Finance*, 2016, pp. –.
- Ortalo-Magne, Francois and Sven Rady**, "Housing Market Dynamics: On the Contribution of Income Shocks and Credit Constraints \*," *Review of Economic Studies*, 2006, 73 (2), 459–485.
- Vandenbussche, Jerome, Ursula Vogel, and Enrica Detragiache**, "Macroprudential Policies and Housing Prices: A New Database and Empirical Evidence for Central, Eastern, and Southeastern Europe," *Journal of Money, Credit and Banking*, 2015.

## Tables

Table 1: FTB Loan and Borrower Characteristics - Pre and Post Measures

	Pre	Post	Diff
<b>Loan Characteristics</b>			
Loan Size (€)	150,512	175,569	25,056***
Property Value (€)	224,146	243,796	19,650***
Loan-to-Value (%)	75.1	78.5	3.4***
Loan-to-Income	2.7	2.9	0.2***
<b>Borrower Characteristics</b>			
Real Income (€)	56,162	59,865	3,704***
<i>Real Income - Couples (€)</i>	67,403	70,533	3,130***
<i>Real Income - Single (€)</i>	50,049	52,320	2,271***
Borrower Age (Years)	34	34	0
Marital Status, of which:			
<i>Couples (%)</i>	36.3	41.6	5.3***
<i>Single (%)</i>	61.8	57.3	-4.5***
<i>Other (%)</i>	2.0	1.1	-0.8***
Occupation			
<i>Employed (%)</i>	90.8	90.1	-0.7*
Region			
<i>Dublin (%)</i>	35.4	34.7	-0.7
% of loans	53.3	50.0	

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Note: 1) Incomes deflated by annual CPI to obtain real values.

2) Sample sizes may differ per variable due to missing observations.

Table 2: SSB and BTL Loan and Borrower Characteristics - Pre and Post Measures

	Pre	Post	Diff
<b>Second and Subsequent Buyers</b>			
<b>Loan Characteristics</b>			
Loan Size (€)	182,602	182,259	-342
Property Value (€)	333,661	380,762	47,102***
Loan-to-Value (%)	61.6	62.8	1.3***
Loan-to-Income	2.0	2.3	0.3***
<b>Borrower Characteristics</b>			
Real Income (€)	95,343	94,714	-630
Real Income - Couples (€)	106,612	103,671	-2,941***
Real Income - Single (€)	75,255	71,109	-4,146**
Borrower Age (Years)	41	41	0
<b>Marital Status</b>			
<i>Couples (%)</i>	70.0	73.3	3.4***
<i>Single (%)</i>	20.9	19.8	-1.1*
<i>Other (%)</i>	9.1	6.9	-2.2***
<b>Occupation</b>			
<i>Employed (%)</i>	87.9	89.2	1.4**
<b>Region</b>			
<i>Dublin (%)</i>	40.1	40.6	0.4
% of loans	42.7	44.3	
<b>Buy-To-Let</b>			
<b>Loan Characteristics</b>			
Loan Size (€)	114,598	117,774	3,176
Property Value (€)	229,331	254,875	25,545***
Loan-to-Value (%)	56.4	54.4	-2.0**
% of loans	4.1	5.6	

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Note: 1) Incomes deflated by annual CPI to obtain real values.

2) Sample sizes may differ per variable due to missing observations.

Table 3: Impact on LTV and LTI ratios, post-measures

	FTBs	SSBs
Impact at Mean		
LTV	1.3185*** (0.228)	1.1428*** (0.325)
LTI	0.2006*** (0.010)	0.2867*** (0.012)
Impact - Higher Leverage Group		
LTV	-0.4953*** (0.073)	-4.0476*** (0.178)
LTI	-0.0051 (0.009)	-0.0340* (0.017)

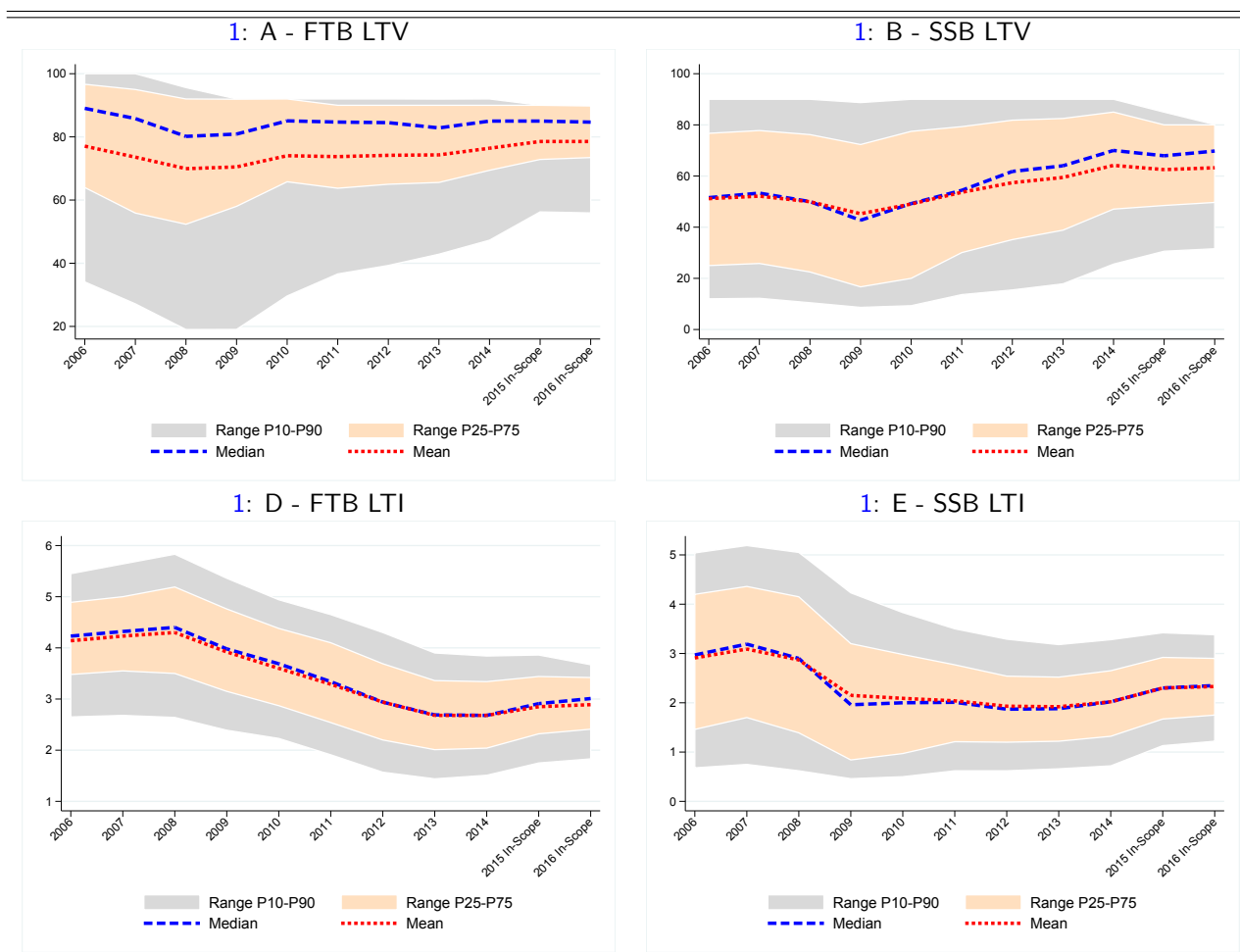
Standard errors in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Model includes controls for borrower and property characteristics, loan origination month and bank.

The table reports the coefficient on the *Post* variable from the models specified in Section 4.1.

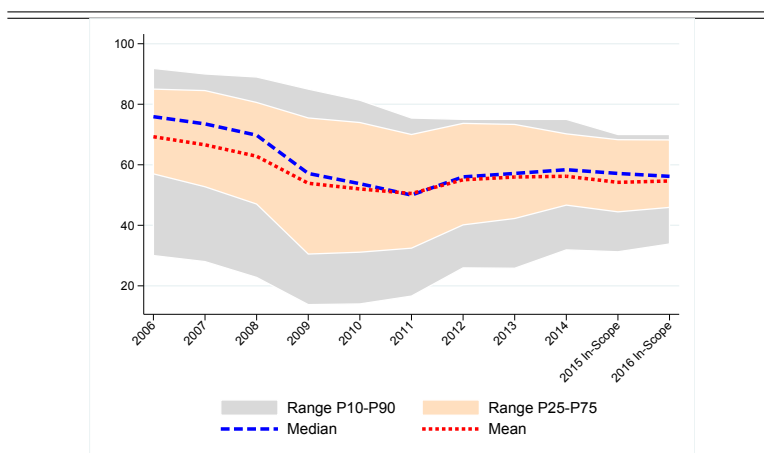
## Figures

Figure 1: Trend Over Time in LTV and LTI by Buyer Type



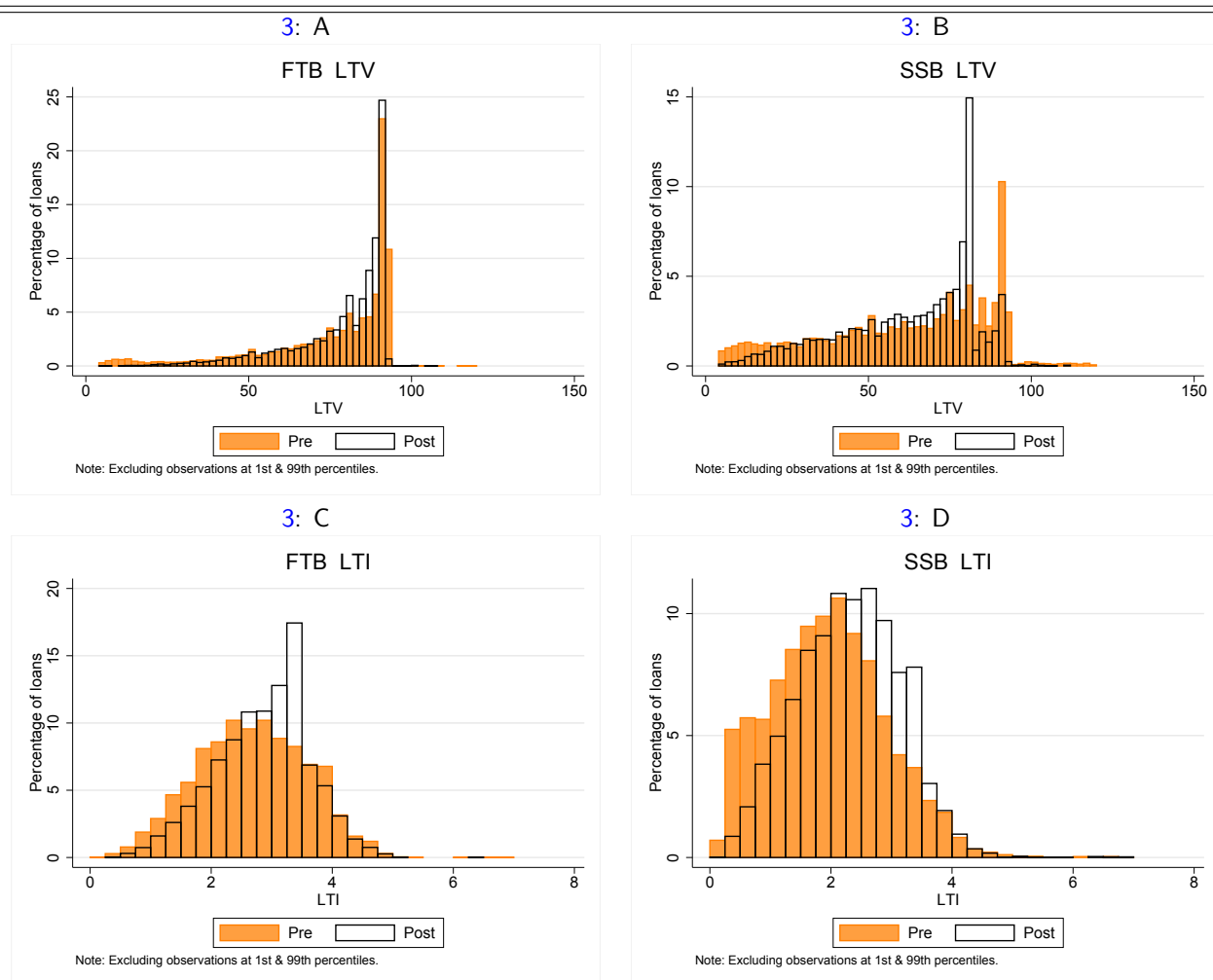
Source: Authors' calculations using Central Bank of Ireland data.

Figure 2: Trend Over Time in LTV - BTL



Source: Authors' calculations using Central Bank of Ireland data.

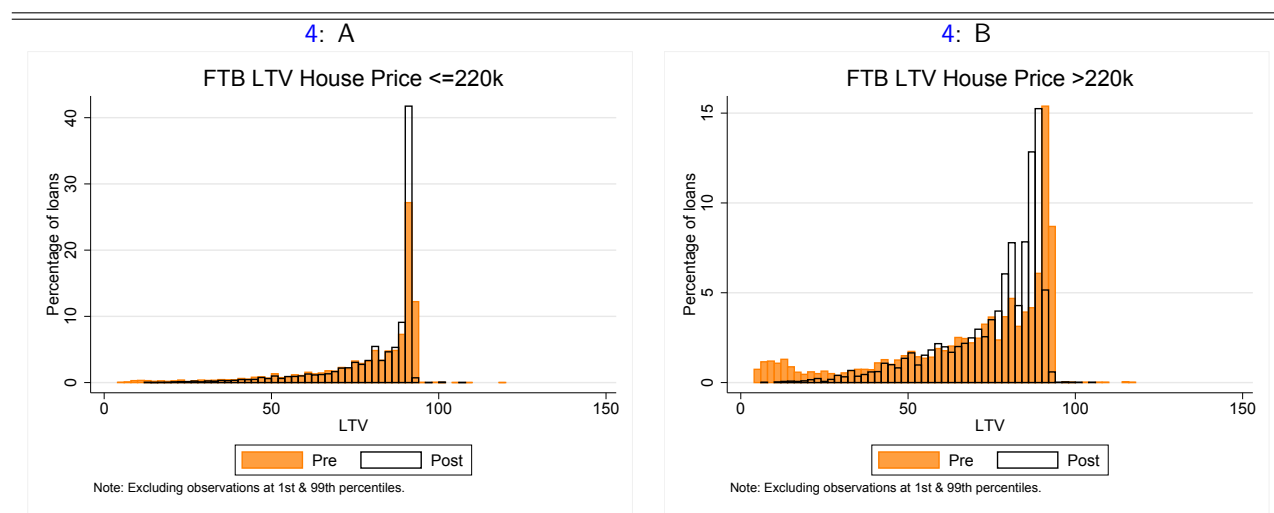
Figure 3: Distributional Comparison of LTV and LTI by Buyer Type, Q1 2013-Q3 2014 Vs Q1 2015-Q2 2016



Source: Authors' calculations using Central Bank of Ireland data.

Note: Pre - Q1 2013-Q3 2014, Post - Q1 2015-Q2 2016 (In-scope loans only).

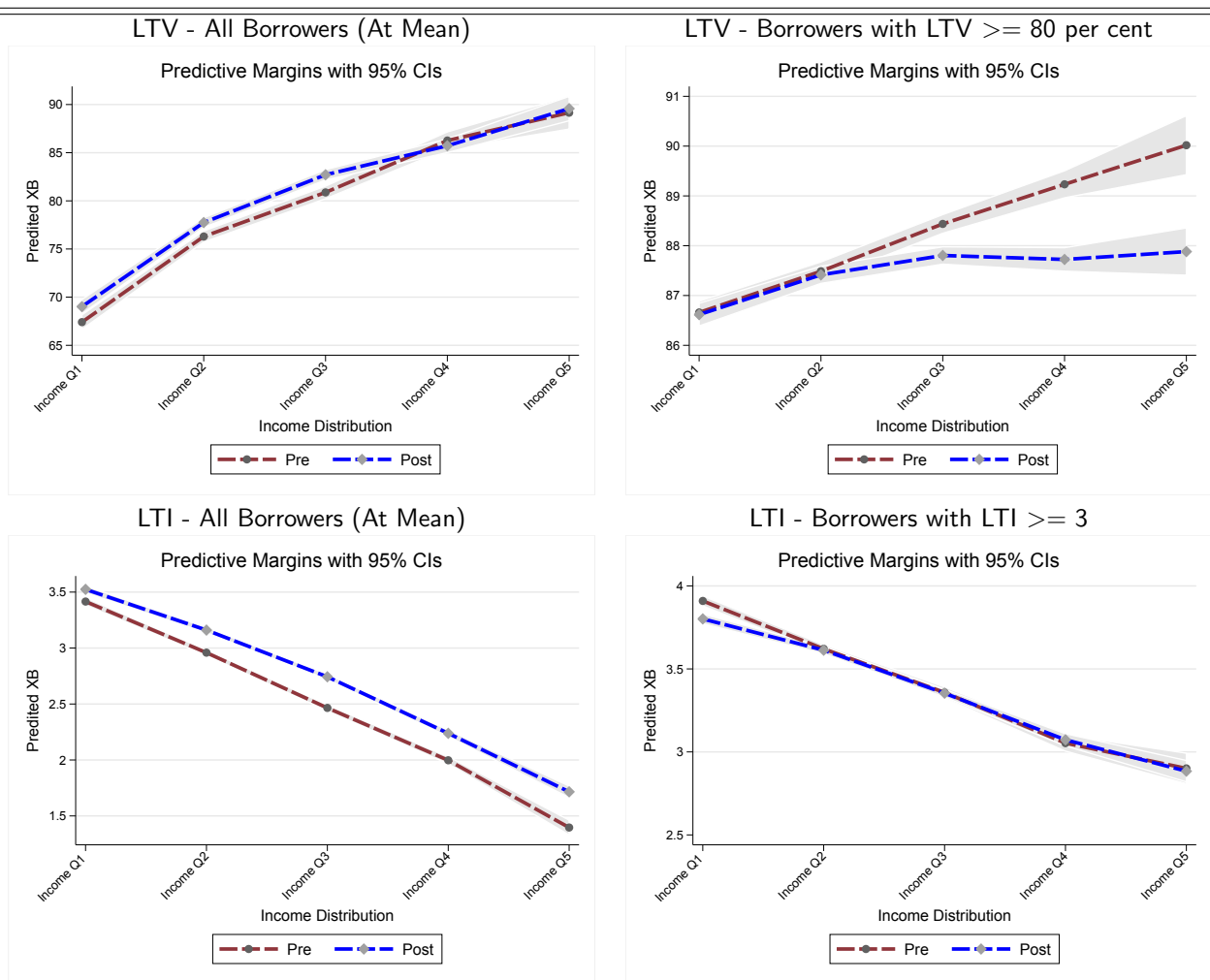
Figure 4: Distributional Comparison of LTV for FTBs above or below 220k, Q1 2013-Q3 2014 Vs Q1 2015-Q2 2016



Source: Authors' calculations using Central Bank of Ireland data.

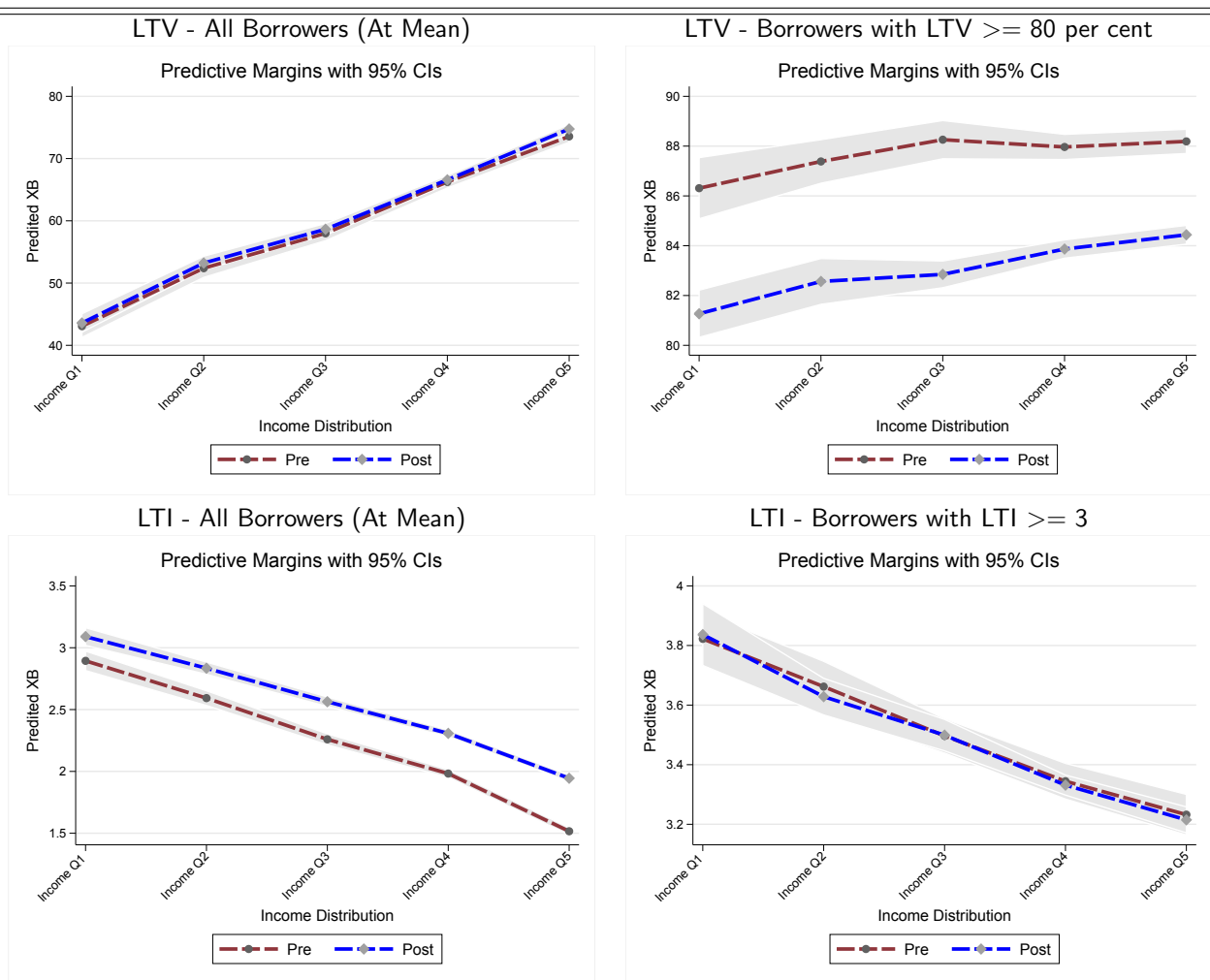
Note: Pre - Q1 2013-Q3 2014, Post - Q1 2015-Q2 2016 (In-scope loans only).

Figure 5: Borrower Impacts Across the Income Distribution - FTBs



Source: Authors' calculations using Central Bank of Ireland data.

Figure 6: Borrower Impacts Across the Income Distribution - SSBs



Source: Authors' calculations using Central Bank of Ireland data.