ESRI Working Paper No. 779

May 2024

17 years after the start of the global financial crisis (GFC), where are we now with credit and house prices in the Irish residential market?

Paul Egan[a], Kieran McQuinn[b] and Conor O'Toole[c]

a) Research officer, ESRI. Email: Paul.Egan@esri.ie
b) Research professor, ESRI. Email: Kieran.mcquinn@esri.ie
c) Associate Research Professor, ESRI. Email: Conor.OToole@esri.ie

Abstract

The credit bubble experienced by the Irish residential and financial sector immediately prior to the global financial crisis (GFC) was one of the largest experienced across contemporary western economies. The Irish property market had witnessed a significant increase in activity as the economy was transformed during the "Celtic tiger" era. However, hand in hand with the increase in housing demand came a significant degree of credit market liberalisation which resulted in a substantial increase in the availability of mortgage credit. This in turn additionally fuelled the emerging house price bubble emerging by 2005 resulting in the Irish financial sector being especially vulnerable to the global financial crisis of 2007/08 due to its substantial liabilities in the property market. A period of significant reform in credit availability followed, as evidenced by the adoption of the Central Bank of Ireland of macroprudential rules in early 2016. Now 17 years after the crisis first impacted the Irish market and given the persistent increase observed in Irish house prices since 2012, it is prudent to examine the inter-relationship between credit availability and house price movements to see how the residential and financial market are evolving? We use a recently developed model of the Irish housing and credit sector to assess the contribution of changing credit standards to recent house price developments.

Introduction

The Irish housing and banking crash of 2008 – 2012 was one of the most substantial experienced by any western economy. On foot of the rapidly growing economy from the early 1990's, the Irish housing market experienced a rapid increase in housing demand and subsequently activity levels. By 2005, both price and supply levels were rising sharply and concomitantly mortgage credit levels were also rising in a sizeable manner (McCarthy and McQuinn (2017)). A number of studies indicated the presence of a dangerous house price – mortgage credit link (Fitzpatrick and McQuinn (2007)) and when the global financial crisis (GFC) emerged in 2007/08, the Irish financial system, which was particularly exposed to the bubble in the residential market, was especially vulnerable. The fortunes of the domestic financial sector and the Sovereign were intertwined via the guarantee of the Irish Government of the entire domestic banking sector in October 2008.[1] Subsequently, over the period 2008 – 2012, the Irish economy and financial sector experienced a profound downturn culminating in Ireland entering a programme of support in October 2010 with the European Union (EU), the European Central Bank (ECB) and the International Monetary Fund (IMF) (collectively known as the "Toika"). The costs of the crisis were substantial in terms of lost economic activity and the erosion of wealth; house prices fell by 54 per cent in nominal terms between 2007 and 2012, net household wealth declined by 40 per cent over the same period while unemployment which had been averaging just over 4.5 per cent between 2000 and 2007 quickly jumped to nearly 14 per cent by early 2010.

The post GFC period has been characterised by a significant overhaul of financial regulation at both a national and EU level. The Troika specified particular targets for deleveraging in the financial sector while the adoption by the Central Bank of Ireland of macroprudential measures in early 2016 saw upper limits set for loan to income and loan to value ratios as part of the domestic regulatory framework. However, notwithstanding the contraction in total lending by the Irish financial sector and the adoption of specific macroprudential measures, housing demand, in response to the general economic recovery, has recovered robustly post 2012 in the Irish market. At the same time, housing supply struggled significantly to respond; supply levels which had averaged some 85,000 units between 2005 and 2007 fell away to just over 4,500 units by 2013 and failed to surpass 20,000 units until 2022. This can be compared with estimates of the structural demand for Irish housing (Bergin and Garcia-Rodriguez (2020)) which suggest that approximately 30,000 units a year are required just to meet the increase in demand due to trends in demography and household formation. Consequently, since 2012, house prices in nominal terms have increased by 126 per cent with rent levels increasing by 108 per cent.

This surge in house prices has given rise to some concern that part of the recent increase in prices may be unsustainable in nature or that it may be fuelled once again by a mortgage credit – house price spiral (OECD (2017))[2]. Therefore, given the profound difficulties experienced by the Irish financial

---

[1] For more on the Irish Government guarantee see Honohan, Donovan, Gorecki and Mottiar (2010).
[2] In its economic outlook for Ireland OECD (2017) noted that "the sharp rise in prices and lending raises concerns that another bubble may be forming, and the authorities should stand ready to tighten prudential regulations if needed"

sector and the related implications for the Sovereign, an examination of the inter-relationship between mortgage credit and house prices is warranted. In this paper, we use a recently developed model of the Irish housing and financial sector, Egan, McQuinn and O'Toole (2022), to characterise Irish house price movements over the period 1980 to 2023. We pay particular attention to the recent post global financial crisis (GFC) recovery in house prices and assess whether changes in the credit market, in and of themselves, have been particularly influential in impacting house prices. This new model resides within COSMO, the core structural model of the Irish economy (see Bergin and Egan (2022)). A significant number of studies have examined Irish house prices over the past 25 years. These include Roche (1999, 2001), McQuinn and O'Reilly (2008), Kelly and McQuinn (2014), Cronin and McQuinn (2021) and Egan, McQuinn and O'Toole (2023).

The results of our analysis are somewhat sobering and suggest that the credit channel has once again in recent years become somewhat influential in impacting Irish house prices. The loan to income ratio, on average within the Irish mortgage market, is now back to multiples only previously seen at the peak of the Celtic tiger boom. Results from the econometric application indicate that exogenous movements in credit conditions have become quite notable since 2021 and are consequently now having an impact themselves on house prices. However, one crucial difference between the present period and the Celtic tiger is that of scale. Whereas a significant amount of mortgages were being issued in the 2005 - 2007 period when credit conditions were loosened considerably, relatively fewer mortgages are now available. Nonetheless, this does suggest that there is a growing cohort of mortgage holders in the Irish residential market who are taking out highly leveraged positions. A significant deterioration in economic fundamentals such as reduced income levels or higher mortgage rates could result in these households experiencing some difficulties in repaying their mortgages. At this point, the risk does not appear to be systemic in nature.

The rest of the paper is as follows; the next section reviews developments in the Irish housing and mortgage market over the past 25 years, while a following section outlines the modelling approach taken. The results of the analysis are then presented and some concluding comments are offered.

2.   *The Irish housing and mortgage market*

Figure 1 plots Irish house prices and housing supply levels along with key macroeconomic data such as disposable household income and residential mortgage interest rates from 1995 to 2023. As can be seen, and, as noted by Cronin and McQuinn (2022), house prices over the period can be characterised by three distinct sub-periods; the Celtic tiger period (1995 – 2007), the post global financial crisis (GFC) period (2008 – 2012) and the recovery period (2013 – 2023). Income levels followed a broadly similar trajectory although not quite experiencing the same variability while interest rates, apart from the 2005

– 2007, period followed a clear downward path. Clearly, the improvement in economic circumstances greatly influenced the increase observed in housing demand.

[Insert Figure 1 here]

This combination of macroeconomic factors in influencing housing demand can be neatly summarised via the affordability variable introduced by McQuinn and O'Reilly (2008). This approach assumes that the demand for housing is mainly a function of the amount that prospective house purchasers can borrow from financial institutions and this, in turn, is dependent on current disposable income and the existing mortgage interest rate. The relationship between income levels, interest rates and the typical amount of a mortgage offered by a financial institution is generally based on the present value of an annuity. The annuity is the fraction $\emptyset$ of current disposable income pdr_t, which is determined endogenously within COSMO, that goes toward mortgage repayments and is discounted at the current mortgage interest rate, rmt_t for a horizon equal to the term of the mortgage τ. Thus, the amount that can be borrowed $afford_t$ is given by

$$afford_t = \emptyset(pdr_t)\left(1 - \frac{(1+rmt_t)^{-\tau}}{rmt_t}\right) \qquad (1)$$

This mimics the reality that people seek to maximise the amount they can borrow subject to the lending criteria of mortgage lending institutions. Figure 2 plots the affordability variable in the Irish mortgage market over the period 1995 – 2023. The substantial increase in the variable is evident over time highlighting the role that changes in key fundamental, economic variables played in underpinning the movements in house prices for the period.

[Insert Figure 2 here]

However, it wasn't just key economic variables which registered significant change over time. Credit conditions and the availability of mortgage credit also witnessed substantial variations over the period 1995 to 2023. This sharp rise in credit reflected both deregulation and liberalisation in Ireland (see Kelly and Everett, (2004)) and the Irish retail banks being able to access additional funds from abroad following the adoption of the euro. These developments were a feature of European intermediation more generally with less regulation, financial innovation and cross-border lending occurring at that time (Le Leslé, (2012) and McCarthy and McQuinn, (2017)). These changes allowed European financial institutions with a surplus of funds to lend to those in deficit. Figure 3 plots two commonly used macroprudential credit measures aimed at capturing the sustainability or otherwise of financial sector developments: The domestic credit to domestic deposit ratio and the ratio of the same credit variable to overall economy-wide output.

[Insert Figure 3 here]

A consequence of the reliance on overseas funding in Ireland was a rise in the ratio of private sector credit to the domestic retail deposit base, to close to 189 percent by 2008Q1 (the left-hand side of Figure

3). Using household disposable income as a proxy for overall output (given the well-known issues of using Irish GDP for that purpose – (see Lane (2017), FitzGerald (2018, 2020) and Honohan (2021) for more on this), the right-hand-side panel of Figure 3 shows the credit-to-output ratio experiencing a sharp increase through the mid-2000s, reaching a value of 153 per cent in 2007Q3. Both the increase in this ratio and the gap that emerged between retail loans and retail deposits left the Irish economy vulnerable to a change in international financial conditions. When such a change occurred in 2007/8, the vulnerabilities in the Irish financial system led to a steep downturn in economic and housing market performance.[3] In the post global financial crisis (GFC) period, what is noticeable is that the recovery in the Irish economy occurred alongside little change in the value of mortgages outstanding and an ongoing reduction in the Irish retail banks' loans-to-deposits ratio. The ratio of private sector credit to total household disposable income also continued to decline through to end-2023.

The specific manner in which increased credit levels impacted the Irish residential mortgage market can be gleaned from Figure 4 which plots the average loan to income ratio and the average loan to value ratio. McCarthy and McQuinn (2017), availing of detailed bank level loan data, noted the importance of changes in the loan to income ratio in the greater provision of mortgage credit in the Irish market. From the Figure, it can be seen that the ratio of the average loan amount to household disposable income increased to a height of 4.7 in 2006Q4 before falling considerably in the post GFC era. In addition to regulatory reforms introduced at an EU level, the Central Bank of Ireland introduced its own macroprudential mortgage measures in 2016. These placed specific limits on loan to income and loan to value ratios in the Irish market. However, notwithstanding the presence of these limits, it is evident that since 2020 the loan to income ratio has been increasing somewhat and by the end of 2023 the average loan size is now back to a rate of 4.6 times disposable income.

[Insert Figure 4 here]

Given the apparent increase in this ratio in recent times, in the next section we outline our modelling strategy for investigating the impact of changes in this channel on Irish house prices.

3.   *A model of house prices and mortgage credit*

In terms of specifying a house price model, we adopt the model outlined in Egan, McQuinn and O'Toole (2022). This is rooted in the standard approach in the literature, where housing demand function is inverted and rearranged such that the dependent variable is the house price, as opposed to the quantity of houses. Similar applications are found in Peek and Wilcox (1991), Muellbauer and Murphy (1997), Meen (1996), Meen (2000), Cameron, Muellbauer, and Murphy (2006), Kelly and

---

[3] Honohan (2010) takes the view that the scale of the Irish banking crisis that took hold in 2008 was principally owing to domestic determinants with policy failures on the part of the Irish retail banks and government contributing strongly.

McQuinn (2014) and Cronin and Quinn (2021). The model, which assumes that the demand for housing services is proportional to the housing stock, is usually derived in log-linear fashion. According to this equation, house prices are positively related to real income per capita and are negatively related to the per capita housing stock and the user cost of capital.

Following Egan, McQuinn and O'Toole (2022), we also use the affordability variable outlined in (1) above. This is because, as noted in McQuinn and O'Reilly (2008), estimates of the standard inverted demand functions for housing often have a relatively small effect for either the nominal or real interest rate or the user cost of capital. This is a particularly important consideration if the model is to be used for assessing monetary policy simulations. Therefore, the affordability variable is used to capture both the income and interest rate effect together.

The link between house prices and credit has been noted in a wide variety of studies such as Tsatsaronis and Zhu (2004), Goodhart and Hofmann (2008) (Cerutti *et al.*, 2017) Duca, Muellbauer and Murphy (2021) and in Irish based approaches such as Kelly, McQuinn, and Stuart (2011), McCarthy and McQuinn (2017) and Cronin and Quinn (2021). To allow for the impact of changing credit conditions in the model, we employ the approach in Duca, Muellbauer, and Murphy (2011) who address the issue in the US housing market. Namely, we, first, construct an *adjusted* loan-to income, *lti,* series for the Irish housing market over the period. This is achieved in the same way as Duca et al. (2011) by estimating the following regression:

$$lti_t = \beta_0 + \beta_1 \left(\frac{afford_t}{pcd_t}\right) + ltires_t \qquad (2)$$

The residuals from the regression, ($ltires_t$), can be considered as the exogenous shift in credit conditions in the Irish market i.e. those changes in credit conditions which are not captured by the endogenous factors contained in $afford_t$. These residuals are then included in the house price equation to allow for the presence of changing credit conditions. The house price model also includes the stock of housing, (cap_t), which evolves according to the standard perpetual inventory method:

$$cap_t = cap_{t-1} \times (1 - \psi) + hs_{t-1} \qquad (3)$$

where ψ is the rate of obsolescence in the Irish housing market and hs_t is the level of new dwelling completions. The stock of housing is included to allow for supply-side effects in the house price model and provides a link with the housing supply equation in the broader COSMO framework. The house price equation also includes a demographic variable. The long run specification can therefore be written as:

$${hp_t}/{pcd_t} = \beta_0 + \beta_1 \, {afford_t}/{pcd_t} + \beta_2 \, ltires_t + \beta_3 \, (pop2544_t/tpop_t) + \beta_4 \, cap_t + \epsilon_t \ (4)$$

where $afford$ is the affordability measure outlined in (1), $pop2544/tpop$ is the proportion of the population between the ages of 25 to 44, capturing the main house purchasing cohort and cap is the measure of supply. All monetary variables are deflated by the personal consumption deflator (pcd_t). We would expect all variables to exhibit a positive sign with the exception of the supply of housing variable.

4. Results

Table 1 presents summary statistics on all the relevant variables used in the analysis. It's evident that a number of the variables have witnessed significant variation over the period 1980 – 2023, particularly given the period of elevated growth generally in the Irish economy from the early 1990's onwards.

Long-run estimates of the LTI (2) and house price (4) models are presented in Table 2. All variables are in logs so the coefficients may be interpreted as elasticities. The results from (2) are of particular interest given the importance of changing credit conditions. As is evident from the estimates, changes in key macroeconomic variables such as disposable income and mortgage interest rates, as captured by the affordability variable, have a significant impact on credit conditions. However, what is of particular interest is the role played by the residuals from (2), the unexplained change in credit conditions, or the exogenous shift in lending standards.

The results for the residuals are displayed in Figure 5. From Figure 5, the substantial shift in credit conditions in the pre GFC period is evident with the residuals exceeding 20 per cent from mid-2006 to early-2008. From 2009 onwards, the residuals displayed a significant downward trend and remained practically static between 2011 and 2021. Thereafter, they have increased somewhat through 2022 and 2023, suggesting that there is an exogenous shift in credit conditions over this period. Consequently, a growing portion of the increase in the actual loan to income ratio illustrated in Figure 4 from 2021 onwards is not explained by movements in macroeconomic variables such as income levels and interest rates.

The subsequent effect of the change in credit conditions can be observed from the house price model in Table 2; the coefficient on the residuals from the LTI model is a sizeable 1.4. Therefore, a significant increase in exogenously determined credit conditions has a non-trivial effect on house prices. The results for the house price model can be gleaned from Figure 6 which plots both the actual and fitted price from the model (on the left-hand side) as well as the resulting residuals (right-hand side). From the residuals it is evident that the recent increase in house prices is somewhat unexplained even

6

when the exogenous shift in credit conditions is allowed for. The scale of the residuals at around 10 per cent is still somewhat less than the 30 per cent which existed at the peak of the Celtic tiger.

Overall, therefore, the results suggest that some of the recent increase in house prices may be due to an exogenous shift in credit conditions along the lines of what happened in the mid-2000s. This is despite the presence of the Central Bank's macroprudential framework which was introduced in 2016 and has placed specific limits on metrics such as loan to income and loan to value ratios.

It is important to place the scale of such a development in context. Figure 7, for example, plots both the total stock of mortgage credit issued to Irish households (LHS) and the number of new mortgages issued (RHS). It is clear that the number of mortgages and general level of credit is substantially lower now than what it was at the peak of the Celtic tiger. However, it is evident that there are a certain number of households in the Irish residential market who have particularly elevated leveraged positions, thereby rendering them especially vulnerable to a sudden sharp economic shock in terms of either income loss or interest rate increases.

In Table 3, in the interests of robustness, the results from an alternative long-run estimator (FM-OLS) used to estimate the house price regression are presented. As can be seen in comparison with the house price results in Table 2, the estimated coefficients are broadly the same. Table 4 presents the results of the corresponding short-run regression for the long-run house price model in Table 2. A general-to-specific Hendry (2000) approach is adopted. As can be seen there is clear evidence of error-correction with the ECM_{t-1} variable having a coefficient value of -0.08. The residuals for the short-run model are presented in Figure 8 and are, in general, well behaved.

5. *Concluding thoughts*

The exceptional cost of the intertwined nature of credit conditions and house prices in an Irish context means that the relationship must be consistently evaluated particularly from a financial stability perspective.[4] Quite apart from the fiscal cost to the Sovereign of the financial crash, the associated impact on households in terms of mortgage arrears and negative equity as well as the knock-on implications for the domestic economy were substantial in nature.

It is evident that much of the increase observed in Irish house prices post the global financial crisis (GFC) can be attributable to economic factors such as the recovery in the economy or the absence of a significant response from the supply-side of the housing market. However, over the past few years, it would appear that changes in credit standards are once again beginning to have an impact on

---

[4] The latest estimated net cost to the Irish state of the bank stabilisation measures is in the region of €41.7 billion (Office of the Comptroller and Auditor General (2019)).

residential prices. This is particularly evident via an exogenous change in lending standards since 2021. These results do suggest that it may have been premature for the Central Bank of Ireland to ease its mortgage based macroprudential measures in 2022 when the upper limit on the loan to income ratio was raised from 3.5 to 4 for first time buyers. Enabling prospective house buyers to borrow more at a time when there was considerable savings already built up in the Irish economy due to Covid-19 has almost certainly put upward pressure on house prices.[5]

While there is not a systemic risk yet to the domestic financial system, it is important that this trend in changing credit conditions and the resulting impact on house prices be carefully monitored. With actual levels of housing supply in the Irish market somewhat below estimates of the structural demand for housing (Bergin and Garcia-Rodriguez (2020)), it is particularly important that any upward movements in house prices are not additionally fuelled by changes in credit conditions.

---

[5] Fitzgerald, Kenny and Lopez Cermeno (2021) note that when European consumers were similarly rationed during the second world war, excess savings were subsequently converted into physical assets in the housing market.

References

Bergin, A., and Garcia-Rodriguez, A. (2020). Regional demographics and structural housing demand at a county Level, Research Series, Economic and Social Research Institute (ESRI), RS111.

Egan, P. and Bergin, A. (2023). "The impact of government spending on Ireland's housing and residential market – Targeted vs economy-wide stimulus," *Journal of Policy Modeling*, Elsevier, vol. 45(3), pages 552-569.

Egan, P., McQuinn, K. and O' Toole, C. (2022). A Revised Financial Satellite Model for COSMO, ESRI Working Paper.

Cameron, G., Muellbauer, J., and Murphy, A. (2006). *Was there a British house price bubble? Evidence from a regional panel* (ERES). European Real Estate Society (ERES).

Cerutti, E., Claessens, S., and Laeven, L. (2015). The use and effectiveness of macroprudential policies: New evidence." IMF Working Paper 15/61, International Monetary Fund, Washington.

Cronin, D., and Quinn, K. M. (2021). "House prices and the credit driven household demand channel: The case of the Irish economy". *Credit and Capital Markets*, *54*(2), 199-221.

Cronin, D., and Quinn, K. M. (2022). "Household consumption and the housing net worth channel in Ireland". Economic and Social Review, Vol. 54, No. 2 Summer, pp. 125-147.

Duca, J. V., Muellbauer, J., and Murphy, A. (2011). Shifting credit standards and the boom and bust in U.S. house prices. Federal Reserve Bank of Dallas, Working Paper (1104).

Duca, J. V., Muellbauer J., and A. Murphy. (2021). "What Drives House Price Cycles? International Experience and Policy Issues." *Journal of Economic Literature*, 59 (3): 773-864.

FitzGerald, J. (2018). National accounts for a global economy: The case of Ireland. Special Article, *Quarterly Economic Commentary*, Economic and Social Research Institute, Summer.

FitzGerald, J. (2020). Understanding recent trends in the Irish economy. Special Article, *Quarterly Economic Commentary*, Economic and Social Research Institute, Autumn.

Fitzgerald J., Kenny S. and A. Lopez Cermeno (2021). Household behaviour in Ireland, Sweden, the US and the UK under rationing. Trinity Economics Paper tep1221, Trinity College Dublin, Department of Economics.

Fitzpatrick T. and K. McQuinn (2007). "House prices and mortgage credit: Empirical evidence for Ireland", *The Manchester School*, Vol. 75, Number 1, pp.82-103.

Hendry, D. F. (2000) "Epilogue: The Success of General-to-specific Model Selection", Chapter 20 in D. F. Hendry (ed.) Econometrics: Alchemy or Science? Essays in Econometric Methodology, Oxford University Press, Oxford, New Edition, 467— 490.

Hoffman B. and C. Goodhart (2008). "House prices, money, credit and the macroeconomy", *Oxford Review of Economic Policy*, Vol. 24(1): pp. 180-205.

Honohan, P., Donovan, D., Gorecki, P., and Mottiar, R. (2010). *The Irish banking crisis: Regulatory and financial stability policy* (MPRA Paper). University Library of Munich, Germany.

Honohan, P. (2021). Is Ireland really the most prosperous country in Europe? *Economic Letter*, 2021, 1. Central Bank of Ireland.

Kelly, J., and M. Everett (2004). Financial Liberalisation and Economic Growth in Ireland. Central Bank of Ireland *Quarterly Bulletin*, Autumn, 91-112.

Kelly, R., and McQuinn, K. (2014). "On the hook for impaired bank lending: Do sovereign-bank interlinkages affect the net cost of a fiscal stimulus?" *International Journal of Central Banking*, *10*(3), 95-128.

Kelly, R., McQuinn, K., and Stuart, R. (2011). "Exploring the steady-state relationship between credit and GDP for a small open economy: The case of Ireland". *The Economic and Social Review*, *42*(4).

Lane, P. (2017). The treatment of global firms in national accounts. *Economic Letter*, 2017, 1, Central Bank of Ireland.

Le Leslé, V. (2012). Bank debt in Europe: Are funding models broken? Working Paper 12/299, International Monetary Fund.

McCarthy, Y., and McQuinn, K. (2017). "Credit conditions in a boom-and-bust property market: Insights for macro-prudential policy". *The Quarterly Review of Economics and Finance*, *64*, 171-182.

Meen, G. (1996). "Ten propositions in UK housing macroeconomics: An overview of the 1980s and early 1990s". *Urban Studies*, *33*(3), 425-444.

Meen, G. (2000). "Housing cycles and efficiency". *Scottish Journal of Political Economy*, *47*(2), 114-140.

Muellbauer, J., and Murphy, A. (1997). "Booms and busts in the UK housing market". *Economic Journal*, *107*(445), 1701-27.

OECD (2017). Economic outlook, volume 2017, Issue 2. Available online at:

https://www.oecd-ilibrary.org/economics/oecd-economic-outlook-volume-2017-issue-2/ireland_eco_outlook-v2017-2-26-en

O'Reilly G. and K. McQuinn (2008). "Assessing the role of income and interest rates in determining house prices", *Economic Modelling*, Vol. 25 pp.377-390.

Peek, J., and Wilcox, J. A. (1991). "The measurement and determinants of single-family house prices". *Real Estate Economics*, *19*(3), 353 to 382.

Roche M.J. (1999). "Irish house prices – will the roof cave in?" The Economic and Social Review, Economic and Social Studies, vol. 30(4), pp. 343-362.

Roche M.J. (2001). "The rise in house prices in Dublin: Bubble, fad or just fundamentals" Economic Modelling, vol. 18(2), pp. 281-295, April.

Tsatsaronis, K. and Zhu, H. (2004). What drives housing price dynamics: Cross-country evidence." Bank of International Settlements *Quarterly Review*, March.

Figure 1. Housing Market Variables: 1995Q1 – 2023Q4
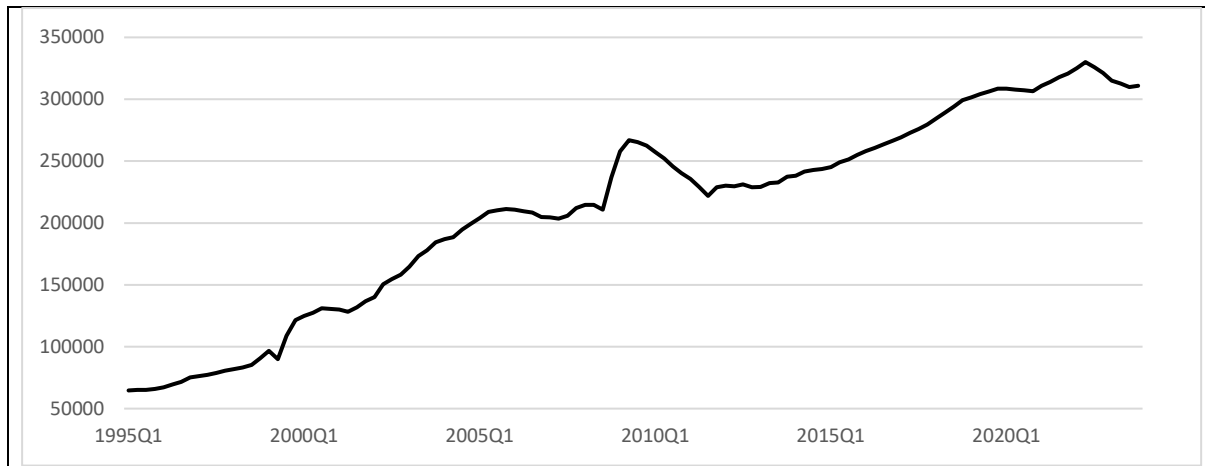
Figure 2. Affordability variable (€): 1995Q1 – 2023Q4

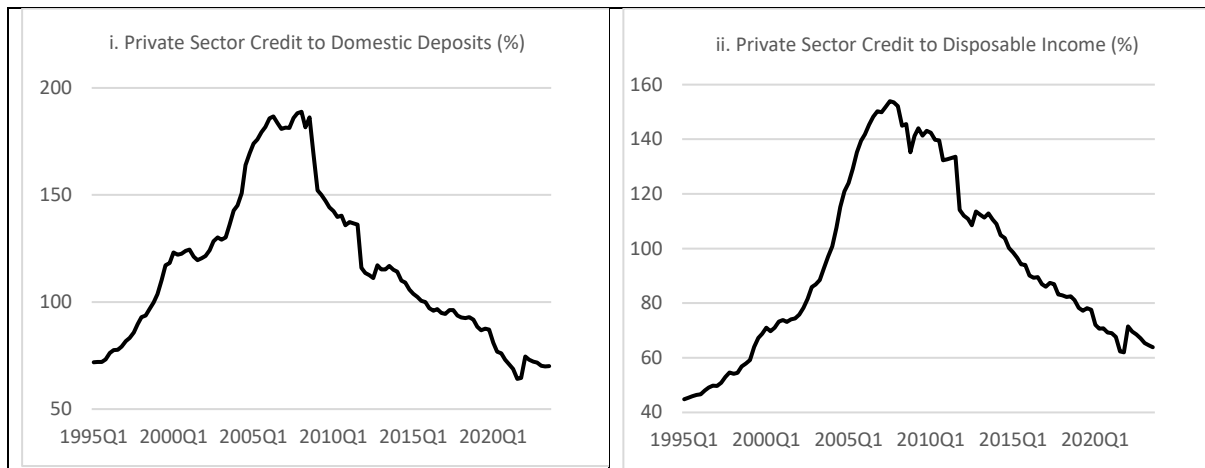**Figure 3.** Aggregate Credit Market Variables: 1995Q1 – 2023Q3

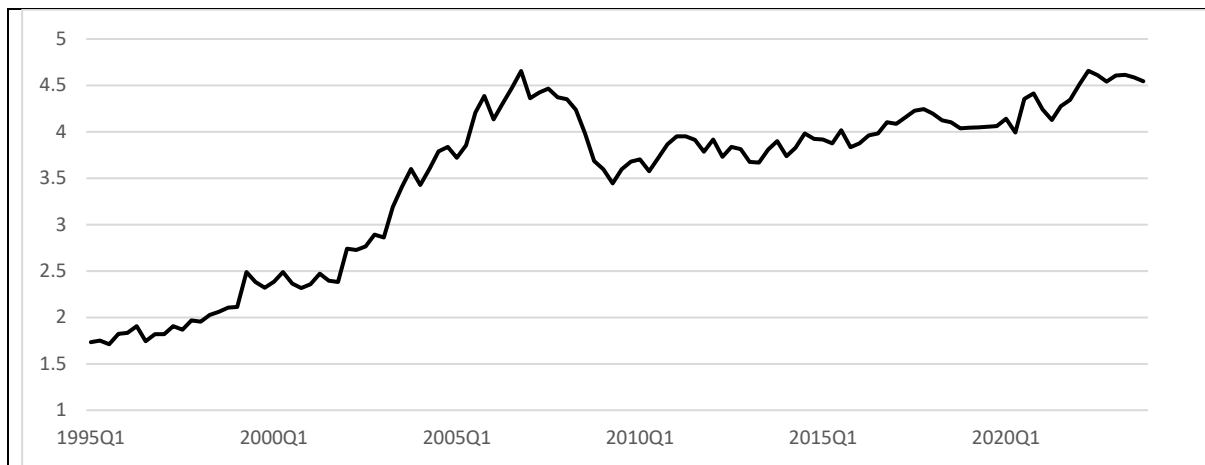**Figure 4.** Average Loan to Income Ratio (Multiple): 1995Q1 – 2023Q4

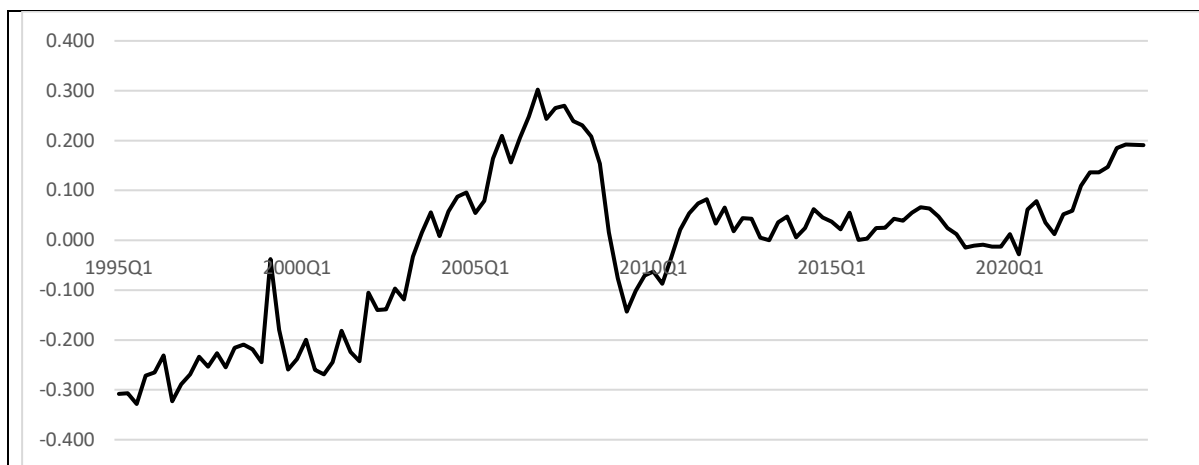**Figure 5.** Residuals from loan-to-income regression: 1995Q1 – 2023Q4

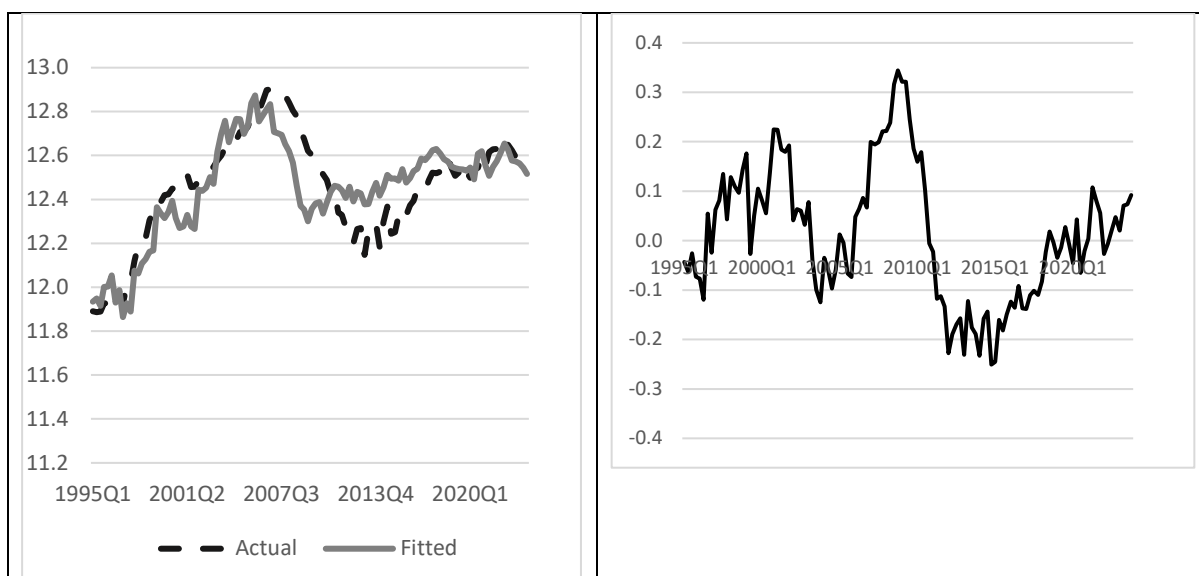**Figure 6.** House price model results: 1995Q1 – 2023Q3

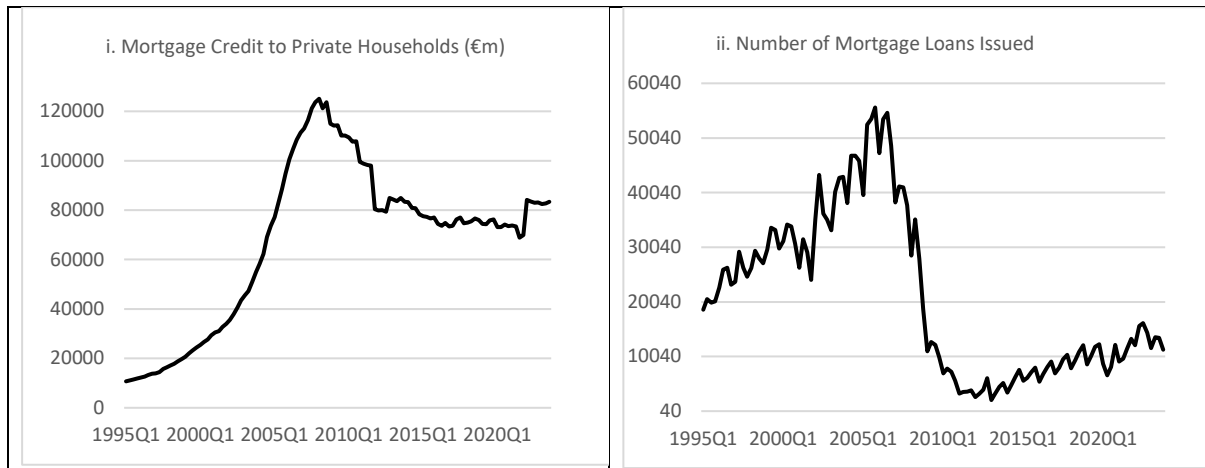**Figure 7.** Aggregate Mortgage Credit Market Variables: 1995Q1 – 2023Q3

Figure 8. Residuals from short-run house price regression: 1981Q2 – 2023Q4
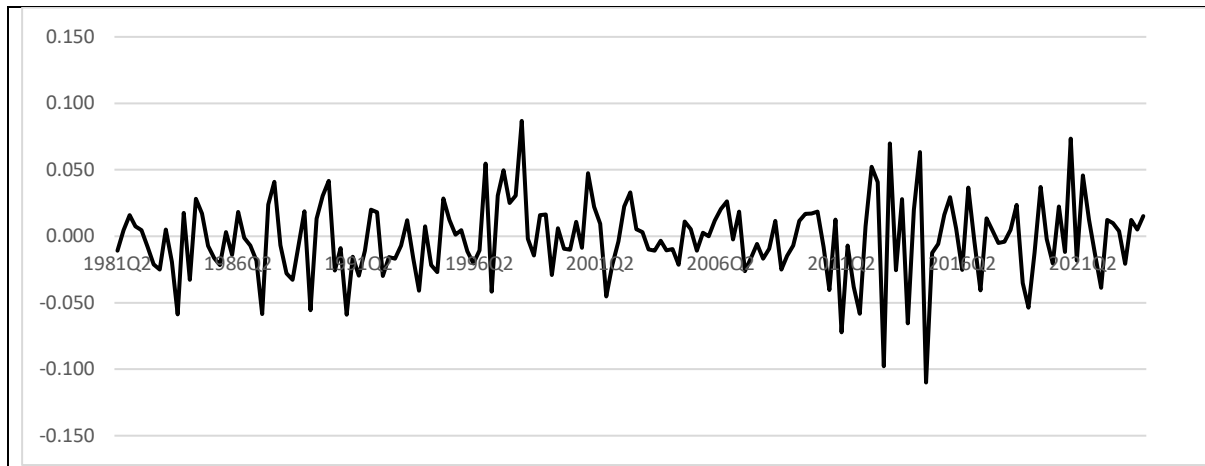
Table 1. Summary of main variables used in the analysis: 1980Q1 – 2023Q4

Variable	Mean	Std. Error	Minimum	Maximum
hp_t	€188,804	€112,843	€38,230	€400,165
lti_t	2.91	1.09	1.62	4.66
pcd_t	0.781	0.255	0.241	1.246
$afford_t$	€148,021	€107,210	€11,016	€330,042
$pop2544_t$	1,165,154	227,117	802,125	1,451,825
$tpop_t$	4,069,704	571,043	3,394,850	5,257,200
rmt_t	6.83	4.31	2.45	16.43
cap_t	1,845,117	156,293	1,650,000	2,056,924
pdr_t	€31,732	€17,341	€5,593	€62,286

Note: lti_t is measured in actual multiples, pcd_t is in index form, $pop2544_t$, $tpop_t$ and cap_t are in actual units and rmt_t is in interest rates.

Table 2. Initial long-run regression results: 1980Q1 – 2023Q4

Dependent Variable	$log(lti_t)$		$\log\left(hp_t / pcd_t\right)$	
	Estimate	T-Stat	Estimate	T-Stat
$Constant$	-5.358	(-27.093)	76.075	(11.489)
$\log\left(afford_t / pcd_t\right)$	0.538	(32.181)	0.986	(16.309)
$log(lti\_res_t)$			1.390	(13.329)
$log\left(pop2544_t / tpop_t\right)$			1.082	(5.051)
$log(cap_t)$			-5.137	(-10.294)
$\overline{R^2}$	0.855		0.885	
DW	0.086		0.191	

Note: N = 176 observations in both cases.

Table 3. Long-run house price regression results (FMOLS): 1980Q1 – 2023Q4

Dependent Variable	$\log \left(hp_t / pcd_t \right)$	
	Estimate	T-Stat
$\log \left(afford_t / pcd_t \right)$	0.830	(12.293)
$log(lti\_res_t)$	1.061	(9.039)
$log \left(pop2544_t / tpop_t \right)$	0.673	(2.786)
$log(cap_t)$	-3.495	(-6.268)
DW	0.124	

Note: N = 176 observations.

Table 4. Short-run house price regression results: 1980Q1 – 2023Q4

Dependent Variable	$\Delta\log \left(hp_t / pcd_t \right)$	
	Estimate	T-Stat
ECM_{t-1}	-0.084	(-4.537)
$\Delta\log \left(hp_{t-1} / pcd_{t-1} \right)$	-0.183	(-3.035)
$\Delta\log \left(hp_{t-3} / pcd_{t-3} \right)$	0.199	(3.417)
$\Delta\log \left(hp_{t-4} / pcd_{t-4} \right)$	0.443	(7.376)

$\Delta log(lti\_res_t)$	0.277	(4.356)
$\Delta \log\left(afford_t / pcd_t\right)$	0.321	(4.129)
$\Delta log\left(pop2544_t / tpop_t\right)$	0.706	(3.354)
$\overline{R^2}$	0.427	
DW	2.148	

Note: N = 171 observations.

Appendix. Data description and sources

Variable	*Source*
House prices	Central Statistics Office; Department of Housing, Planning and Local Government
Total value of housing assets	Central Bank of Ireland
Household new worth	Central Bank of Ireland
Mortgage approvals numbers	Department of Housing, Planning and Local Government[6]
Household disposable income	Central Statistics Office
Consumer price index	Central Statistics Office
Population	Central Statistics Office
Mortgage interest rates	Central Bank of Ireland

---

[6] This series is only available up to 2016. Data from the Banking Payments of Ireland of Ireland mortgage approvals report is used to update the earlier series. This is available at https://www.bpfi.ie/about-bpfi/.

Housing stock data	Central Statistics Office[7]
Employment data	Central Statistics Office
Credit and deposits data	Central Bank of Ireland

---

[7] The housing stock variable is compiled using a perpetual inventory method, where the initial value is taken from Census data from the Central Statistics Office. This is then updated with housing completions data from the Central Statistics Office. The rate of depreciation is also taken from the Central Statistics Office.