AN INSTITIÚID UM THAIGHDE EACNAMAÍOCHTA AGUS SÓISIALTA
ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

ESRI Working Paper No. 797

February
2025

Monetary policy shocks, changing credit conditions and the house price to rent ratio: The case of the Irish property market

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Abstract

In this paper we assess the implications of monetary policy shocks on the house price to rent ratio in the case of the Irish property market. Crucially, in light of the particular circumstances of the market, we allow for the interaction between mon-etary policy and changing credit conditions in terms of how the house price to rent ratio is impacted in such a context. In particular, we allow for interest rates to im-pact the ratio directly through the user cost of capital but also indirectly through a credit conditions indicator. In a number of applications, changing credit condi-tions have been demonstrated to act as a wedge between the house price to rent and the user cost ratio. Additionally, we also use a modelling system, which allows for interest rates to impact house prices separately. Results from this system show that a contractionary monetary policy shock has a greater impact on house prices than rental prices. This has important implications from a policy perspective in terms of the overall impact of monetary and macroprudential policy on the hous-ing market.

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1. Introduction

Recently a number of contributions have highlighted the complex interaction of monetary policy and financial stability considerations in impacting key housing market variables. The recent tightening of monetary policy by Central Banks in response to inflationary pressures has highlighted again the impact that changes both in policy and market interest rates can have on the housing market, while the substantial implications of the global financial crisis (GFC) have motivated a significant literature examining the impacts of changing credit conditions on the residential market. However, it is clear that there is a significant interaction between key monetary policy and financial stability variables in terms of their impact on the housing market. Accordingly, it is likely that movements in key monetary variables such as official and market interest rates can have an impact on the housing market through a number of channels.

As noted by Duca, Muellbauer and Murphy (2021), there are relatively few studies of rental market dynamics vis-á-vis that of house prices. Typically, rental markets have been examined through the dynamics of the house price to rent ratio. This ratio is of particular importance in assessing the sustainability or otherwise of housing costs and relative tenure patterns in housing markets. Variants of this framework applied to housing markets can be found in Blackey and Follain (1995), Murphy (2005), Campbell, Davis, Gallin and Martin (2009), Diaz and Luengo-Prado (2008), Gallin (2008), Diaz and Luengo-Prado (2012), Duca, Muellbauer and Murphy (2011), Browne, Conefrey and Kennedy (2013) and McQuinn, Monteiro and O'Toole (2021).

Following earlier work by Dias and Duarte (2016), this paper builds on an empirical specification by Kim (2007), Duca, Muellbauer and Murphy (2009), Duca, Muellbauer and Murphy (2016) and Cronin and McQuinn (2016) which allows for credit conditions to act as a "wedge" between the house price to rent ratio and the user cost. In particular, given the likely impact of interest rate shocks on credit conditions, the paper allows for a broader and more comprehensive assessment of monetary policy shocks on the house price to rent ratio.

Crucially, the modelling framework adopted in the present application allows for monetary policy shocks to impact the house price to rent ratio via a number of different channels. Initially, the shock operates directly through the familiar user cost of

capital formula, however, it also operates via a credit conditions channel. This latter development is of particular importance in light of the significant role played by credit market conditions in impacting house price movements (Duca, Muellbauer and Murphy (2021)).

In allowing for the intersection between monetary policy and financial stability factors in influencing housing market variables, this paper builds on Egan, McQuinn and O'Toole (2024) who address this issue in a model of house prices. In particular, in adopting the house price to rent ratio model of Kim (2007) we model the credit conditions indicator as a function of income levels and mortgage interest rates, with the resulting indicator being the residual element of the model. This captures the exogenous shift in credit conditions in the Irish mortgage market. Consequently, interest rates impact the house price to rent ratio through this channel along with the more standard channel of the user cost of capital. We also avail of a recently developed model of the Irish housing market (Egan, McQuinn and O'Toole (2024)) to enable a broader understanding of the monetary policy impact on the housing market. This enables us to estimate the impact of interest rates directly on house prices as well as on the house price to rent ratio.

The Irish mortgage market is of particular interest in this regard; the market witnessed a significant increase in both house prices and rents in the period leading up to the global financial crisis (GFC) as the Irish economy expanded profoundly from the mid 1990s. The market was then impacted substantially as the credit fuelled bubble, which had characterised developments in the provision of mortgage finance prior to 2007, abruptly collapsed with the onset of the GFC. Since 2013, however, the Irish mortgage market has once again seen a persistent and significant increase in both house prices and rents with Irish housing costs being among the highest across EU countries (Disch and Slaymaker (2023)). Given the prominent role played by changing credit conditions and the accomodative monetary policy regime over the past 25 years, the Irish market is an interesting example of the interaction between monetary policy and financial stability factors in the housing market.

Our results show that a contractionary monetary policy shock has a greater impact on house prices than rental prices. Although the difference is marginal, it serves to cause a fall in the price-to-rent ratio over the simulation period. The results have

some important implications for policy. The greater impact of monetary policy on house prices may strengthen its transmission through home-ownership. The larger changes in house prices relative to rent can generate especially sizable changes in the net worth of mortgagors who typically hold significant illiquid assets but have limited liquid wealth, thus amplifying their consumption response to monetary policy.

The rest of the paper is structured as follows; the next section outlines a number of channels through which the housing market and monetary policy are connected, changes in the Irish housing and mortgage market are then discussed, while the empirical model is subsequentially introduced. A following section outlines the results of the estimation while a final section offers some concluding thoughts.

2. Monetary Policy and the Mortgage Market

There are a number of channels which highlight the interaction between monetary policy and the residential housing market. Di Maggio et al. (2017), for example, describe the "cash flow channel" whereby changes in the official policy rates directly impacts mortgage repayments for those households on variable rate mortgages. An increase in interest rates results in a decline in net disposable income with knock-on implications for household consumption decisions.

Related to this channel is the sensitivity of house prices to interest rate movements through variations in the discount rate and the consequent impact on expectations about future returns. This risk premium channel is particularly significant in terms of how much prospective buyers can borrow, which in turn impacts house prices and credit levels. Campbell, Morris, Davis, Gallin and Martin (2009), using a dynamic Gordon growth model, split the rent to house price at each date into the expected present discounted values of rent growth, real interest rates, and a housing premium over real rates. They show that housing premia are variable and forecastable and account for a significant fraction of rent–price ratio volatility at the national and local levels.

A third channel illustrating the relationship between monetary policy and the housing market is the related wealth effects of changes in house prices accruing from interest rate movements. An increase in rates, would result in a decline in house prices and hence adversely impact consumption levels. Similarly, in a number of residential mar-

kets, households can use their housing wealth as collateral to finance consumption. In a series of contributions Mian and Sufi (Mian et al. (2013), Mian and Sufi (2014), Mian and Sufi (2017), and Mian and Sufi (2018)) outline the credit-driven housing net worth (HNW) channel, which recognises that when housing is the dominant source of household wealth, mortgage credit availability can influence how that form of wealth affects economic activity and in particular how a fall in house price effects a decline in consumption. In particular, the credit-driven housing net worth (HNW) channel has been shown to have a significant impact on such expenditure, as well as on other macroeconomic variables such as employment.

3. Irish Housing and Mortgage Market

As can be seen from Figure 1, Irish macroeconomic conditions started to improve significantly from the mid-1990's. The move towards lower and more stable interest rates globally coupled with the birth of the "Celtic Tiger" resulted in robust income and employment growth in the domestic economy. Furthermore, the combination of strong income growth and lower interest rates resulted in a pronounced pick-up in housing demand. Figure 2 plots Irish house prices and rents over the period 1995 - 2024. The particularly sharp rise in Irish house prices is apparent with the Irish property boom being the largest across OECD countries between 1995 and 2007, with average annual house price increases of 9 per cent arising during that period.

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 domes-

tic credit to domestic deposit ratio and the ratio of the same credit variable to overall economy-wide output. 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. 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 2007 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 2024 the average loan size is now back to a rate of 4.6 times disposable income.

4. Model

We now outline the modelling system which we use to assess the full impact of interest rate changes on the house price to rent ratio model.[1] The price to rent approach to assessing housing markets can be characterised by an underlying notion of arbitrage, with the returns to investing in housing relative to some other asset evaluated, or the costs and benefits of renting a house relative to buying compared. The approach, which builds on the Jorgensen (1963, 1967) theory of the user cost of capital, was first applied to housing markets by Poterba (1984) and assumes that, absent substantial frictions and credit restrictions, arbitrage between owner-occupied and rental housing ensures that the house rent to price ratio depends on the real user cost of capital.

Himmelberg et al. (2005) construct a variant measure of the user cost of housing: the imputed annual rental cost of owning a home. This measure compares the value of living in "a" property for year (the "imputed rent") and the income lost for not investing in an alternative investment (the "opportunity cost of capital"). It takes into account differences in taxes, expenses, anticipated capital gains and risk. This approach assumes that absent substantial frictions and credit restrictions, arbitrage between owner-occupied and rental housing implies that the house price to rent depends on the real user cost of capital i.e.

$$rent_t = hp_t \times (r_t + \sigma_t - \triangle hp^e/hp). \tag{1}$$

where $rent_t$ is the actual rent level, hp_t is house prices, hp^e is expected real house prices, σ_t is the natural rate of depreciation of the house and r_t is the risk free interest rate and the additional risk premium to compensate homeowners for the higher risk of owning versus renting.

If we re-arrange (1), we get the following

$$\left(\frac{rent_t}{hp_t}\right) = RUSER_t. \tag{2}$$

We now label the right hand side of (1) as $RUSER_t$. Inverting (2) and taking logs, we get the following:

[1] For more on this model in an Irish context, see McQuinn, Monteiro and O'Toole (2021).

$$l\left(\frac{hp_t}{rent_t}\right) = -lRUSER_t. \tag{3}$$

Following work by Kim (2007) who demonstrates that the equilibrium log price to rent ratio can be affected by binding credit conditions[2], Duca, Muellbauer and Murphy (2009) and Cronin and McQuinn (2016) augment Equation (3) in the following manner:

$$l\left(\frac{hp_t}{rent_t}\right) = f(-lRUSER_t, CC_t). \tag{4}$$

where CC_t are changing credit conditions.

Drawing on previous research, we now separately specify models for a number of variables on the right-hand side of (4). This allows us to capture more broadly the impact of monetary policy shocks on the $\left(\frac{hp_t}{rent_t}\right)$ ratio. For example, the interest rate, r_t, in (1) we assume to be heavily influenced by the residential mortgage interest rate in the Irish market, rmt_t, and is modelled as follows:

$$rmt_t = \beta_0 + \beta_1\ euribor_t + \epsilon_t \tag{5}$$

where $euribor$ is assumed to reflect the European Central Bank's (ECB) monetary policy rate. This follows work by Egan and McQuinn (2023) and measures the degree of transmission from the ECB policy rate to the domestic Irish mortgage market rate.

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 series seeks to capture exogenous shifts in credit standards in the Irish market.

As noted in McCarthy and McQuinn (2017), changes in the loan-to-income ratio were one of the most important changes which occurred in the Irish credit market in the period preceding 2007. This is achieved in the same way as Egan, McQuinn and O'Toole (2024) by estimating the following regression:

$$LTI_t = f(Afford_t). \tag{6}$$

[2]Kim (2007) uses maximum LTVs as an indicator of credit conditions

where

$$Afford_t = \kappa Y_t \left(\frac{1 - (1 + rmt_t)^{-\tau}}{rmt_t} \right). \tag{7}$$

$Afford_t$ is an affordability variable, first introduced by McQuinn and O'Reilly (2008). They argue 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 Y_t and the existing mortgage interest rate rmt_t. 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 of current disposable income κY_t that goes toward mortgage repayments and is discounted at the current mortgage interest rate for a horizon equal to the term of the mortgage τ. Thus, the amount that can be borrowed captures the impact of both changes in mortgage interest rates and household disposable income (Y_t).

Therefore, the adjusted LTI series is given as the residuals from (6); those changes in credit conditions that are not warranted by "fundamental" demand-side variables:

$$CC_t = LTI_t - \widehat{LTI_t}. \tag{8}$$

House prices, hp, are specified and estimated as in Egan, McQuinn and O'Toole (2024) i.e. they are specified as follows:

$$hp_t = \alpha_0 + \alpha_1 Afford_t + \alpha_2 CC_t + \alpha_3 Pop_t - \alpha_4 Cap_t + \epsilon_t. \tag{9}$$

where $Afford_t$ is defined as in (7) and CC_t is the credit conditions indicator defined in (8), Pop_t is the population between the ages of 25 to 44 over the total population and Cap_t refers to the total housing capital stock.

By including a separate expression for hp_t, we can also estimate deviations in rental prices owing to a monetary policy shock. This is an important feature of our model as it allows us to distingush between the impact of the monetary shock on house prices and those of rents in the residential market.

In specifying a series for changes in hp^e/hp, the *expected* house prices, we follow a

number of applications in the literature[3] and use a four period moving average of the actual house price series.[4]

Table 1 provides a summary of the data used in the estimation, while Table 2 presents the long-run estimates for (4).[5] Table 3 outlines the results for the loan to income model, (6), while Tables 4 and 5 summarises results for the monetary policy pass through relationship, (5), and the model of house prices, (9) respectively. Both of these are estimated in an error correction framework as in Egan & McQuinn (2023) and Egan, McQuinn & O'Toole (2024).

Finally, Table 5 outlines the results for the following error-correction version of (4), where the house price to rent ratio is now expressed as $hprent_t$:

$$\begin{aligned} \Delta l\ hprent_t = -\gamma_0[(lhprent_{t-1}) - (\gamma_1 lRUSER_{t-1} + \gamma_2 CC_{t-1})] \\ +\gamma_i \sum_{i=3}^{4} \Delta l\ hprent_{t-i+2} + \gamma_j \sum_{j=0}^{4} \Delta lRUSER_{t-j} + \gamma_k \sum_{k=0}^{4} \Delta CC_{t-k} + \epsilon_t. \end{aligned} \tag{10}$$

A key component of the overall model setup is that the residential mortgage lending rate, (rmt), is endogensised via Equation (5). As rmt is a determinant of both the credit conditions indicator, CC, and the user cost expression, $ruser$, it allows us to asses the impact of a shock to the ECB's monetary policy rate on the house price to rent ratio via two separate channels.

5. Empirical results

We now use the system of equations presented in Section 4 to assess the implications of a monetary policy shock. In particular, we apply a 1 per cent shock to the ECB's policy

[3] Such as Blackey and Follain (1995), Murphy (2005), Campbell et al. (2006), Diaz and Luengo-Prado (2012), Gallin (2008), Duca et al. (2011) and, in an Irish context, Browne et al. (2013) and Cronin and McQuinn (2016)

[4] 4 quarter in the case of quarterly data.

[5] For robustness, two different estimators OLS and fully-modified OLS (FMOLS)) are applied.

rate on the system given by Equations (5) through 10.

The response of the key variables is presented in Figure 6. The figure shows that the policy shock first raises the residential mortgage lending rate by around 0.4 per cent above its baseline. This in turn causes an increase in the user cost, $ruser_t$. The fall in credit conditions, CC_t ultimately leads to downward pressure on house prices. Notably, the impact of the contractionary monetary policy shock has a greater impact on house prices than rental prices. Although the difference is marginal, it serves to cause a fall in the price-to-rent ratio over the simulation period. As pointed out by Banerjee et al. (2024), if rents are sticky, monetary tightening can push down house prices relative to rents. Under standard asset pricing logic, the price of a house equals the present discounted value of future rents. If rents do not respond much to monetary tightening, a higher discount rate will push down house prices, lowering the price-to-rent ratio.

The results have some important implications for policy. The greater impact of monetary policy on house prices may strengthen its transmission through home-ownership. The larger the changes in house prices relative to rent can generate especially sizable changes in the net worth of mortgagors who typically hold significant illiquid assets but have limited liquid wealth. As shown by Cloyne et al (2020), this amplifies their consumption response to monetary policy.

Our findings highlight the importance for policymakers to understand the complex relationship between monetary policy and financial stability policy levers. The findings indicate that the effects of monetary policy changes are amplified via the additional credit conditions channel, resulting in larger than expected changes in the trade-off between house prices and rents for any given monetary policy shock.

6. Concluding Comments

The recent tightening of monetary policy internationally by authorities seeking to temper inflationary pressures has once again focused attention on the housing market impact of monetary shocks. Over the past 10 years, considerable research has addressed the impact of credit conditions and financial stability issues on the housing market in the aftermath of the global financial crisis (GFC). However, recently a nascent literature has sought to examine the interaction of monetary policy and macroprudential policy

measures in order to achieve a more comprehensive assessment of these levers on the housing market.

In this paper we augment a traditional model of the house price to rent ratio to allow for changing credit conditions and, using a broader model of the Irish housing market, we assess the implications of tightening monetary policy on the Irish residential property market. In particular, we allow changing interest rates to impact the ratio through both the user cost of capital and through a credit conditions indicator. Our results reveal that allowing for this additional channel provides a further insight into the way in which interest rate shocks can impact a key dynamic within the housing market. In particular, house prices appear to be more significantly impacted by an interest rate shock than rent levels.

In identifying and estimating the impact of this additional monetary policy channel on the housing market, we believe it highlights the importance for policy makers in recognising the complex relationship between both monetary policy and financial stability policy levers. The results suggest that the impacts of monetary policy changes are amplified through the additional credit conditions channel, resulting in greater than expected changes in the trade-off between house prices and rents for a given monetary policy shock.

References

[1] Banerjee, R.N.,Gorea, D., Igan, D, and Pinter, G. (2024). Monetary policy and housing markets: insights using a novel measure of housing supply elasticity, BIS Quarterly Review, Bank for International Settlements, December.

[2] Blackey D.M. J.R. and Follain (1995). In search of empirical evidence that links rents and user costs, NBER working paper No. 5177.

[3] Browne F., Conefrey T. and G. Kennedy (2013). Understanding Irish house price movements - a user cost of capital approach, Central Bank of Ireland Research Technical Paper 4/RT/13.

[4] Campbell S. D., Davis M.A., Gallin J. and R. F. Martin (2009). "What moves housing markets: A variance decomposition of the rent–price ratio." *Journal of Urban Economics*, Volume 66, Issue 2, September, Pages 90-102.

[5] Cloyne, J, C Ferreira and P Surico (2020): Monetary policy when households have debt: new evidence on the transmission mechanism, *Review of Economic Studies*, vol 87, no 1, pp 102–29

[6] Cronin D. and K. McQuinn (2016). "Credit availability, macroprudential regulations and the house price to rent ratio". *Journal of Policy Modeling*, 38, pp. 971-984.

[7] Cronin D. and K. McQuinn (2023). "Household consumption and the housing net worth channel in Ireland". *Economic and Social Review*, Vol. 54, No. 2 Summer, pp. 125-147.

[8] Dias D.A. and J.B. Duarte (2019). "Monetary policy, housing rents and inflation dynamics". *Journal of Applied Econometrics*, 34 (5), pp. 673-87.

[9] Diaz, A. and M.J. Luengo Prado (2012). Homeownership: Economic benefits in: Susan J. Smith, Marja Elsinga, Lorna Fox O'Mahony, Ong Seow Eng, Susan Wachter, Richard K. Green, editors. International Encyclopedia of Housing and Home, Vol 2. Oxford: Elsevier; pp. 439445.

[10] Disch, W. and R. Slaymaker (2023). Housing affordability: Ireland in a cross-country context. Economic and Social Research Institute (ESRI) research series Number 164, July.

[11] Di Maggio M., Kermani A., Keys B.J., Piskorski T., Ramcharan R., Seru A. and V. Yao (2017). "Interest rate pass-through: Mortgage rates, household consumption and voluntary deleveraging", *American Economic Review*, 107(11): pp.3550-3588.

[12] Duca J., Muellbauer, J. and Murphy, A. (2011). "House prices and credit constraints: Making sense of the U.S. experience", *Economic Journal*, Royal Economic Society, vol. 121(552), pgs. 533-551, 05.

[13] Duca J., Muellbauer, J. and Murphy, A. (2016). "How mortgage finance reform could affect housing", *American Economic Review*, 106 (5), pgs. 620-624.

[14] Duca J., Muellbauer, J. and Murphy, A. (2021). "What drives house price cycles? International experience and policy issues", *Journal of Economic Literature*, vol. 59, no. 3, September pp. 773–864.

[15] Egan P and K. McQuinn (2023). "Interest rate pass-through in Euro Area mortgage markets: The long shadow of the great financial crisis". *CESifo Economic Studies*, Volume 69, Issue 4, December, pp. 234–248.

[16] Egan P, McQuinn K. and C.O'Toole (2024). "How supply and demand affect national house prices: The case of Ireland", *Journal of Housing Economics*. Volume 65, September, 102006.

[17] FitzGerald, J. (2018). National accounts for a global economy: The case of Ireland." Special article, Quarterly Economic Commentary, Economic and Social Research Institute, (ESRI), Summer.

[18] FitzGerald, J. (2020). Understanding recent trends in the Irish economy. Special article, Quarterly Economic Commentary, Economic and Social Research Institute, (ESRI), Autumn.

[19] Gallin, J. (2008). "The long-run relationship between house prices and rents". *Real Estate Economics*, 36(4),pp. 635–658.

[20] Himmelberg, C., Mayer, C., and Sinai, T. (2005). Assessing high house prices: Bubbles, fundamentals, and misperceptions (Federal Reserve Bank of New York Staff report no.218, September).

[21] Honohan P., Donovan D., Gorecki P. and R. Mottiar (2010). The Irish banking crisis: Regulatory and financial stability policy, MPRA Paper 24896, University Library of Munich, Germany.

[22] Jorgenson, D. W. (1963). "Capital theory and investment behaviour". *American Economic Review Papers and Proceedings*, 53(2), 247–259.

[23] Jorgenson, D. W. (1967). The theory of investment behaviour. In R. Ferber (Ed.), Determinants of investment behavior. New York: Columbia University Press.

[24] Kelly R., McQuinn K. and R. Stuart (2011). "Exploring the steady-state relationship between credit and GDP for a small open economy - the case of Ireland", *Economic and Social Review*, Vol. 42(4), pp.455-477.

[25] Kim Y. (2007). Rent-price ratios and the earnings yield on housing, Unpublished manuscript, University of Southern California.

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

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

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

[29] McQuinn K., Monteiro T. and C.O'Toole (2021)."House price expectations, labour market developments and the house price to rent ratio: A user cost of capital approach" *The Journal of Real Estate Finance and Economics*, 62, pp.25-47.

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

[31] Mian, A., Rao, K. and Sufi, A. (2013). "Household balance sheets, consumption and the economic slump." *The Quarterly Journal of Economics* 128, pp. 1687-1726.

[32] Mian, A. and Sufi, A. (2014). "What explains the 2007-2009 drop in employment?" *Econometrica* 82, pp. 2197-2223.

[33] Mian, A. and Sufi, A. (2017). "Household debt and business cycles worldwide." *The Quarterly Journal of Economics* 132, pp. 1755-1817.

[34] Mian, A. and Sufi, A. (2018). "Finance and business cycles: The credit-driven household demand channel." *The Journal of Economic Perspectives* 32, pp. 31-58.

[35] Murphy, A, (2005). Modelling Irish house prices: A review and some results, mimeo, December. https://www.nuff.ox.ac.uk/users/murphya/Centre.htm

Table 1: Summary statistics

Variable	Unit	Mean	Std. Error	Minimum	Maximum
hp_t	Index	80.7	50.0	15.6	181.7
$rent_t$	€	716.2	354.8	184.6	1,612.0
r_t	%	6.8	4.3	2.4	16.4
Y_t	€	32,257	17,658	5,593	63,364
LTV	Ratio	50.7	19.6	26.9	86.4
LTI	Ratio	2.9	1.1	1.6	4.8

Note: Data is quarterly and covers the period 1980Q1 to 2024Q2. In the case of hp_t, the index =100 in 2015.

Table 2: House price to rent model

	Estimator	
Variable	OLS	FM-OLS
Constant	-2.098	-2.052
	(-38.166)	(-26.937)
$LRUSER_t$	-0.096	-0.120
	(-3.739)	(-3.340)
CC_t	0.483	0.452
	(3.525)	(2.383)

Note: Estimation is with quarterly data covering the period 1981Q1 to 2024Q2 and T-Stats are in parentheses.

Table 3: Loan to income (LTI) model

Variable	Coefficient	T-Stat
Constant	-5.071	-27.539
Log(AFFORD/PCD)	0.515	33.040
R^2	0.860	

Note: Estimation is with quarterly data covering the period 1980Q1 to 2024Q2.

Table 4: Change in residential mortgage rate - error correction model

Dependent Variable	$\Delta(rmt_t)$	
Variable	Estimate	T-Stats
Long run		
$euribor_t$	0.52	5.21
Short run		
ecm_{t-1}	-0.09	-3.53
Δrmt_{t-1}	0.61	8.69
$\Delta euribor_{t-1}$	0.54	6.55
R^2	0.533	

Note: Estimation is with quarterly data covering the period 1997Q3 to 2024Q2.

Table 5: Change in house price - error correction model

Dependent Variable	$\Delta l(hp_t)$	
Variable	Estimate	T-Stats
Long run		
$lAfford_t$	1.64	7.78
CC_t	1.60	5.60
$lCap_t$	-9.27	-5.27
Short run		
ecm_{t-1}	-0.07	-5.14
$\Delta l(hp_{t-4})$	0.33	5.18
$\Delta l(hp_{t-4})$	0.280	3.813
$\Delta lAfford_t$	0.39	5.91
$\Delta lAfford_{t-1}$	-0.16	-2.84
ΔCC_t	0.19	3.89
R^2	0.478	

Note: Estimation is with quarterly data covering the period 1981Q1 to 2024Q2. Note that the Pop variable has been dropped from our final estimated model for parsimony

Table 6: Change in house price to rent ratio - error correction model

Dependent Variable	$\Delta l(hprent_t)$	
Variable	Estimate	T-Stats
Long run		
$lRUSER_t$	-0.09	-3.37
CC_t	0.48	3.53
Short run		
ecm_{t-1}	-0.016	-1.862
$\Delta l(hprent_{t-3})$	0.205	2.771
$\Delta l(hprent_{t-4})$	0.280	3.813
$\Delta lRUSER_t$	-0.026	-4.773
$\Delta lRUSER_{t-4}$	0.009	2.594
ΔCC_t	0.009	2.594
R^2	0.225	

Note: Estimation is with quarterly data covering the period 1981Q1 to 2024Q2.

Figure 1

Key Irish Macroeconomic Variables: 1995 - 2024

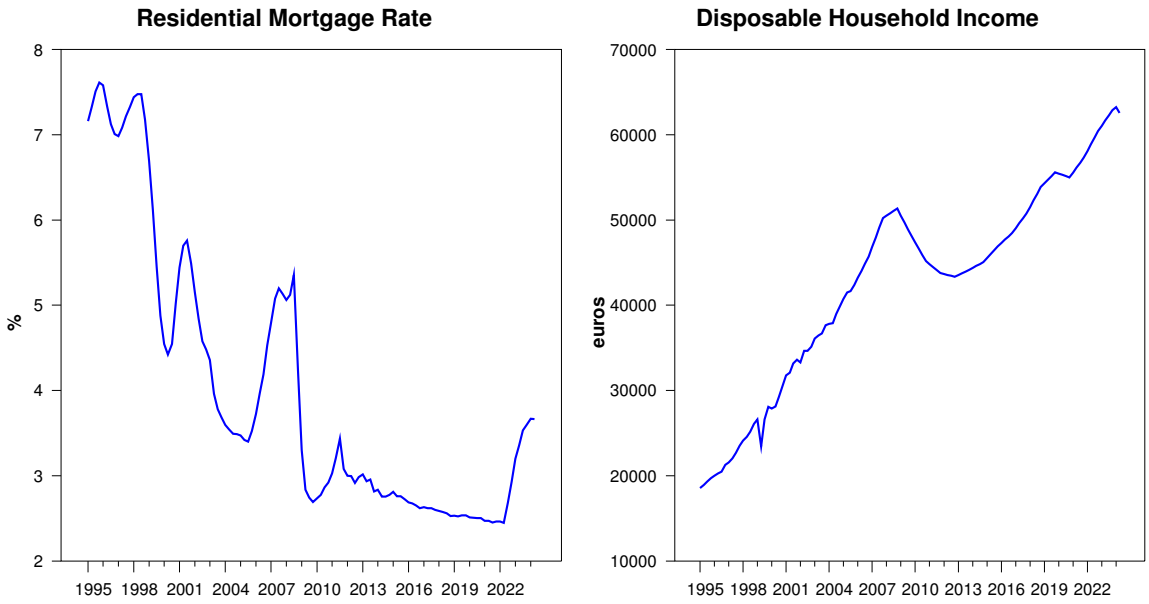

Figure 2

Key Irish Housing Market Variables: 1995 - 2024

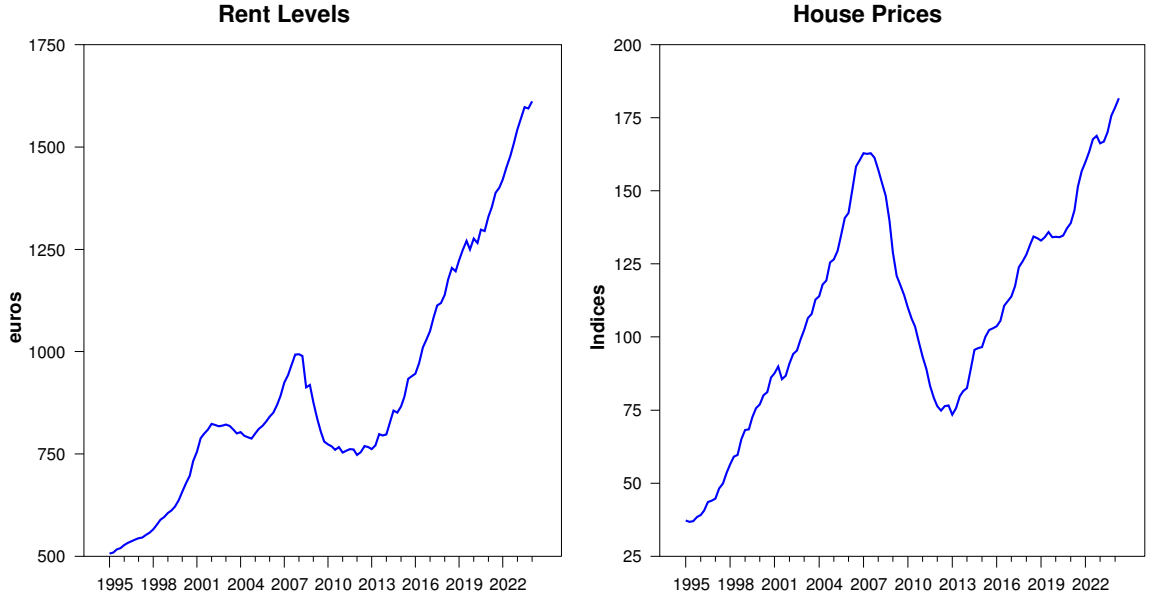

Figure 3

Key Irish Macro Credit Conditions Variables: 1995 - 2024

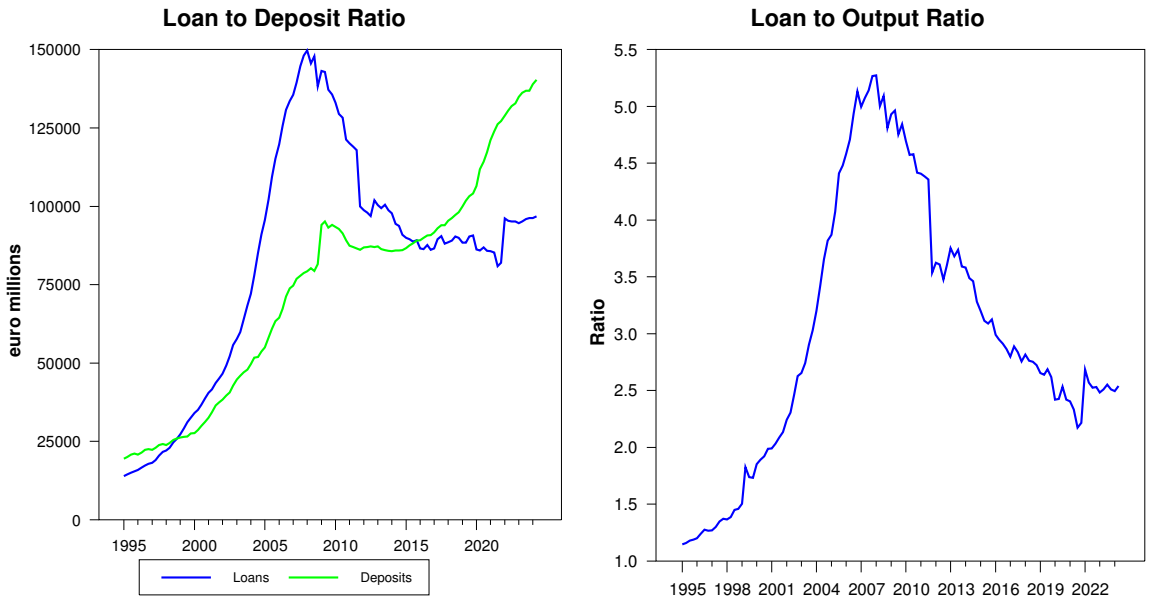

Figure 4

Key Irish Micro Credit Conditions Variables: 1995 - 2024

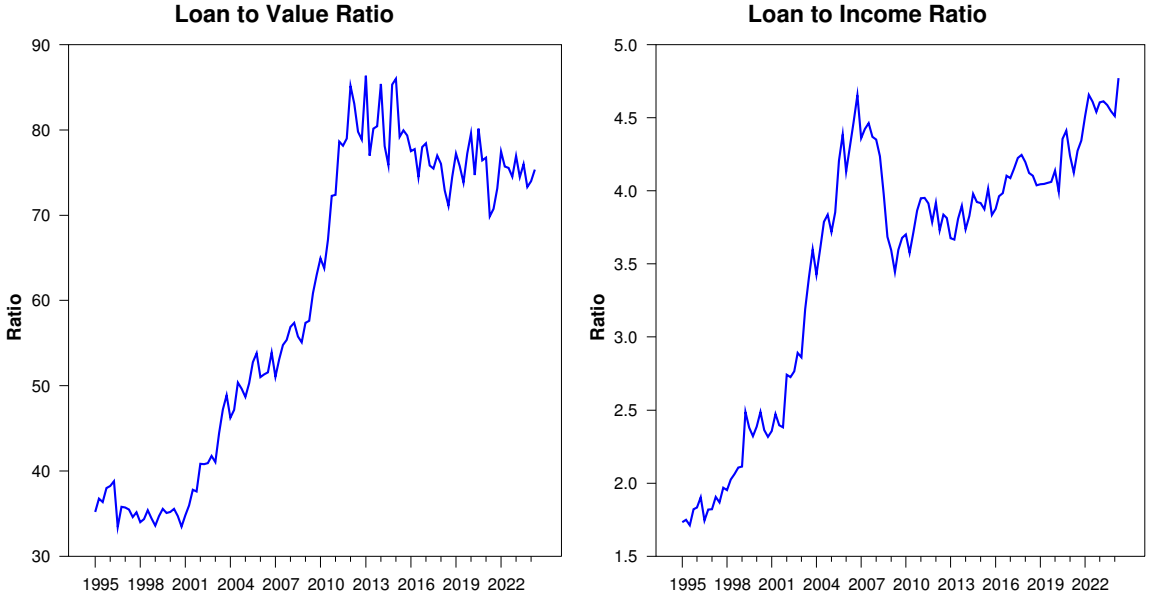

Figure 5

Residuals from LTI Model

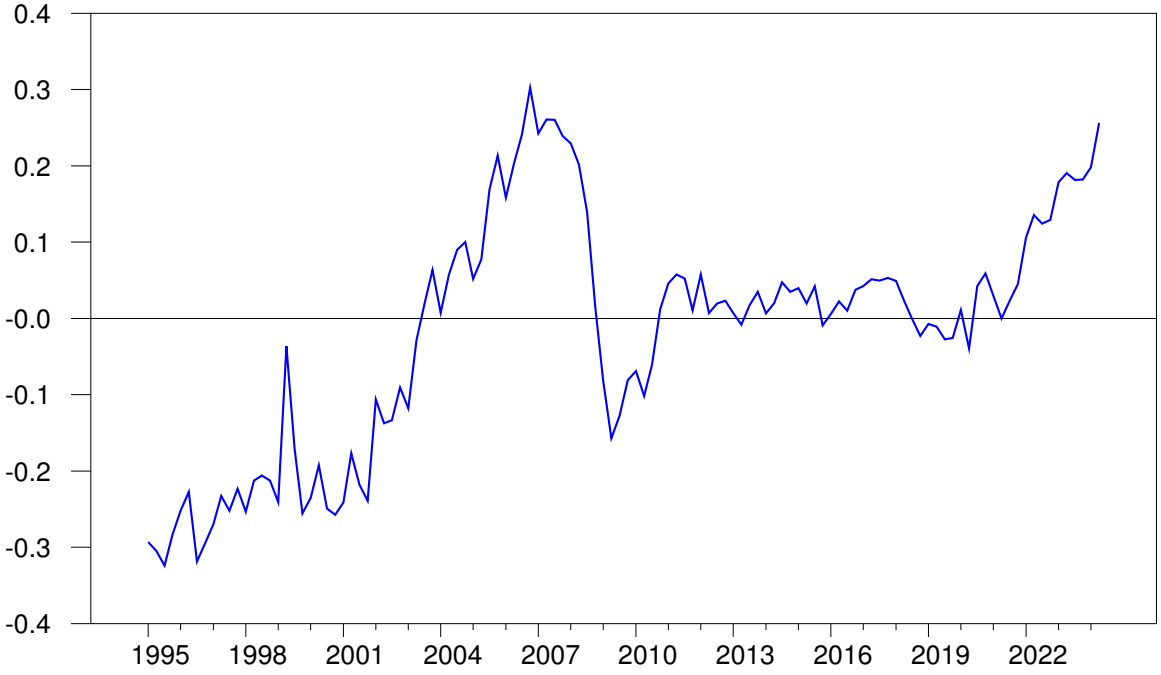

Figure 6

Deviation from baseline of 1% shock to ECB policy rate