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Modelling Credit in the Irish Mortgage Market*

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Abstract: The sharp decline in the performance of international property markets has been central to the financial distress experienced globally. The Irish housing market experienced particularly strong rates of price increases and heightened activity levels by OECD standards. One reason cited for such large price increases has been the significant degree of financial liberalisation experienced by Irish credit institutions. The culmination of much of this liberalisation resulted in large increases in the availability of mortgage credit. In this paper we apply a recently developed model of mortgage credit and examine the implications for Irish house prices of changes in lending patterns. Our results suggest that post 2003, a significant amount of the increase in Irish prices was determined by innovative developments in international finance, which enabled Irish institutions, in particular, to secure alternative sources of lending funds.

I INTRODUCTION

The significant fall in Irish house prices since 2007 coupled with the distress experienced by the Irish financial system over the same time provides a telling example of the inter-relationship between house prices and developments in the financial sector. Ireland, in particular, amongst many other OECD countries experienced a substantial boom in property prices

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between 1995 and 2007. This period also coincided with significant increases in the provision of mortgage credit by financial institutions across many countries. While it is generally accepted that macroeconomic conditions, globally, over the period, were highly favourable to house price appreciation, a legitimate question which arises is whether the greater provision of credit, in itself, additionally fueled this sustained increase in prices. Increases in Irish mortgage lending were particularly pronounced even by international standards and came after a period of considerable financial deregulation and liberalisation in the Irish market. In particular, the capacity of Irish credit institutions over the past 10 years to access funds abroad provided an entirely new source of lending capacity.

In light of the sharp increase in both price levels and activity in the Irish housing market, it is not surprising that it has been the subject of extensive research. A non-exhaustive list of papers includes Murphy (1998), Kenny (1999); Conniffe and Duffy (1999); Roche (1999, 2001 and 2003); McQuinn (2004); Duffy, Fitz Gerald and Kearney (2005); Fitzpatrick and McQuinn (2007); McQuinn and O'Reilly (2007 and 2008). Much of this empirical work focuses on the demand side of the property market, typically through estimating reduced form fundamental house price models, with the latter driven by affordability variables such as incomes, interest rates as well as demographic factors. However, very few studies of the Irish housing market, with the exception of Fitzpatrick and McQuinn (2007), have examined the role played by developments in the credit market.

In this paper, we apply a recent model of residential credit (Addison-Smyth, McQuinn and O'Reilly (2009)) to quantify the impact of changing levels of credit on the Irish property market. We focus, at the outset, on the demand-side of the credit market. Typically, the amount lent by a mortgage institution to an individual is critically dependent on current disposable income and interest rates. We estimate how much a financial institution would lend an individual given plausible assumptions regarding the fraction of income that goes to mortgage repayments and the duration of the mortgage using a standard annuity formula. This long-run mortgage level is then referred to as *borrowing capacity*. For the duration of the sample (1980-2009), it is likely that significant differences have occurred between this mortgage level and the actual mortgage amount issued by financial institutions. Episodes where the actual mortgage level is above the long-run level are regarded by some as instances of excess credit and periods, where it is below the long-run level as periods of credit rationing. House prices are then expressed as a function of average mortgage levels. Therefore, we are able to quantify the impact on the housing market of episodes of perceived excess credit or credit rationing.

While initial results do suggest differences between both mortgage levels over the sample, a significant difference appears to have emerged between the equilibrium or long-run mortgage level and the actual level post 2003. This is at a time when greater liberalisation of Irish financial markets was yielding the provision of greater levels of mortgage credit. A main source of this increased supply was the access of domestic institutions to funding on interbank markets. Consequently, in the second part of the paper we focus on this supply-side development and expand our empirical framework to incorporate the emergence of the *funding rate* – the ratio of the outstanding level of mortgage lending to total domestic deposits. The funding ratio provides an indication of the ability of Irish institutions to access funding on interbank markets.

When we include this additional variable, the results of the expanded model confirms the importance of both supply and demand-side factors in determining the level of credit. The provision of additional lending capacity through access to foreign markets does appear to have been an increasingly important determinant of average mortgage levels for the period post 2000. The results of counterfactual exercises examining the relevance of this development in an Irish case is then compared to a similiar based exercise for the United Kingdom mortgage market. The results are closely related suggesting that developments in the Irish market mirrored those in the UK over the period 2000-2008.

Our paper is structured as follows; in the next section we examine the relatively nascent literature on house prices and mortgage credit. The Addison-Smyth, McQuinn and O'Reilly (2009) model is then described along with some empirical results. We then review changes in the Irish credit market, in particular, analysing the movement towards greater liberalisation and innovation. The initial model is then expanded to reflect these supply-side changes and counterfactual examples are generated to highlight the results. A final section offers some conclusions.

II MODELS OF HOUSE PRICES AND CREDIT

The literature on the role of credit and house prices is still at a somewhat nascent stage. Only a relatively small number of studies have examined the role played by greater financial innovation in the provision of credit and its related effect on house prices. An early example was a study by de Greef and de Haas (2002), who found a strong interdependence between mortgage lending and house prices for the Netherlands – an economy which had been characterised by rapid increases in house prices and significant growth in the

mortgage market throughout the 1990s. Dutch house prices appeared to be influenced by changes in bank lending criteria as well as standard demand and demographic variables. Similarly, Collyns and Senhadji (2002) examined lending booms and real estate bubbles across a range of Asian economies using a VAR panel data approach. They found a dual causality between credit and prices and that bank lending had significantly contributed to property price inflation. At the same time, they found that the relationship between prices and credit was asymmetric in the sense that the elasticity of the price response to credit shocks was much higher during periods of rising prices.

The relationship between house prices and mortgage credit may differ according to the time-period involved i.e. the short or long run. For example, a paper by Hofmann (2003) covering a sample of 20 countries, examined the dynamic interactions between bank lending and property prices. He found multi-directional causality between lending and property prices in the short run. In the long run, however, causality went in one direction from property prices to bank lending. The short run finding is important in terms of the potential for mutually re-enforcing effects between house prices and bank credit during "boom bust cycles" in the housing market.

A further study by Hofmann (2004) examined the specific role of property prices in determining bank credit across a range of 16 developed economies using a cointegrating VAR approach between 1980 and 1998. He found that property prices were an important determinant of long-run movements in credit and in bank lending. A related study by Gerlach and Peng (2005), looking at the relationship between property prices and lending in Hong Kong, found that while there was a strong contemporaneous correlation between residential property prices and bank lending, the direction of causality went from prices to credit. In an Irish application Fitzpatrick and McQuinn (2007) found a mutually reinforcing relationship between house prices and mortgage credit.

In a recent contribution, Goodhart and Hofmann (2008) examined the links between money, house prices, credit and economic activity in a range of industrialised countries spanning the period 1970 to 2006 using a fixed effects VAR estimation approach. They found significant evidence of a multi-directional link between house prices and credit and the real economy. Furthermore, this relationship, specifically the link between house prices and monetary variables had become stronger in recent years, which the authors believe reflects the impact of financial market liberalisation in the 1970s and early 1980s. In examining the UK housing market and credit in particular, Fernandez-Corugedo and Muellbauer (2006) developed a single credit conditions index indicator (CCI) through modelling 10 key indicators of credit over the period 1976-2001. The CCI effectively measures the availability of

credit. They found that a number of factors can lead to a sustainable rise in the CCI, such as increased competition and structural changes within the UK credit market.

III A MODEL OF MORTGAGE CREDIT

The Addison-Smyth, McQuinn and O'Reilly (2009) model of the housing and mortgage market consists of the following two equations,

$$M_t = \gamma_0 B_t^{\gamma_1}. \tag{1}$$

$$P_t = \beta_0 M_t^{\beta_1} H_t^{-\beta_2}. \tag{2}$$

In the first equation, average mortgage levels M are assumed to be a function of the amount of the typical individual's borrowing capacity B, which is based on current disposable income Y and the existing mortgage interest rate R. This borrowing capacity is based on the present value of an annuity, where the annuity is some fraction of current disposable income discounted at the current mortgage interest rate for an horizon equal to the term of the mortgage. This amount is given by the following formula

$$B_t = Y_t \left(\frac{1 - (1 + R_t)^{-\tau}}{R_t} \right). \tag{3}$$

where τ is the duration of the mortgage. Clearly, an upward shift in income or downward movements in the interest rate yields an increase in the average mortgage amount available from Irish credit institutions. This approach is closely related to the notion of a housing affordability index frequently used in assessments of the housing market.[1]

The second equation is a house price P or inverted demand function for housing, where demand for housing is determined by the average loan amount M with the stock of housing H entering negatively. The housing stock H is assumed to accumulate according to the following standard perpetual inventory expression.

$$H_t = (1 - \sigma) H_{t-1} + C_t. \tag{4}$$

[1] This concept measures the ratio of an average monthly mortgage payment based on current interest rates to average family monthly income. The National Realtors Association in the United States publishes a monthly Housing Affordability Index (HAI), which is quoted frequently by the *Wall Street Journal* in its commentaries on the US market. See, for example, http://www.realestatejournal.com/buysell/markettrends/20051223-simon.html

where σ is the depreciation rate of the housing stock and C is housing completions.

We assume the following log-linear empirical structure for the mortgage and house price equations, where lower case denotes a variable is in logs

$$m_t = \gamma_0 + \gamma_1 b_t. \tag{5}$$

$$p_t = \beta_0 + \beta_1 m_t - \beta_2 h_t. \tag{6}$$

All nominal variables are deflated with the consumer price index. Our estimation strategy is to obtain long-run estimates of (5) and (6). We could substitute $\gamma_0 + \gamma_1 b_t$ in for m_t and estimate the following regression

$$p_t = (\beta_0 + \beta_1 \gamma_0) + (\beta_1 \gamma_1) b_t - \beta_2 h_t. \tag{7}$$

which traces the direct impact of the affordability indicator B_t on house prices. However, our interest lies in gauging the impact of the long-run average mortgage level on house prices. This can only be done through estimating long-run regressions for both P_t and M_t.

In the next section we outline our estimation strategies for these regressions.

3.1 *Data and Model Estimates*

Data on house prices and average mortgage levels are taken from the Irish Department of the Environment website.[2] An initial figure for the Irish housing stock in 1980 quarter 1 is also taken from the same source, as is the series for housing completions, while the depreciation rate σ is based on the fixed obsolescence factor of 0.73 per cent per annum used by the Department of the Environment in their estimates of the housing stock. Household disposable income levels, mortgage interest rates and the consumer price index deflator are taken from the CBFSAI macroeconomic database. All data is quarterly and covers the period 1982 quarter 4 to 2009 quarter 1. Table 1 presents summary statistics on the data used.

Table 2 reports the results for a series of unit root tests for all the different variables used. In particular, we report results from two tests of the null hypothesis that each series contains a unit root. The first is the standard Augmented Dickey-Fuller t-test; the second is the DG^{GLS} test of Elliot, Rothenberg and Stock (1996) which has superior power to the ADF test. For

[2] In particular, average mortgage levels are calculated as total housing loans approved divided by the total number of loans.

Table 1: *Descriptive Statistics of Model Variables*

Variable	*Pneumonic*	*Mean*	*Std. Deviation*	*Unit*
House Prices	P	133,351	93,043	Euros
Income	Y	3,008	1,394	Euros
Deflator	D	0.916	0.232	2000 = 1.00
Mortage Interest Rate	R	7.88	3.19	%
Affordability Level	B	138,843	92,719	Euros
Average Mortgage Amount	M	101,498	84,490	Euros
Irish Funding Gap	F	56.9	24.4	%
Housing Stock	H	1,231,112	236,658	Units

Note: N = 105, 1982:4-2009:1.

Table 2: *Unit Root Tests*

	Unit Root Tests					
	p_t	m_t	b_t	f_t	h_t	*5%*
Test						
ADF t-test	–1.469	–0.303	–1.129	1.282	–1.059	–2.89
ADF^{GLS}	–4.645	–0.345	–1.683	1.298	5.574	–13.7

Note: p_t is the log of the actual house prices, m_t is the log of the average mortgage amount, b_t is the log of the amount that can be borrowed, f_t is the log of the Irish funding gap and h_t is the log of the housing stock. The sample period runs from 1982:4-2009:1.

each test, the lag length for the test regressions was chosen using Ng and Perron's Modifed AIC procedure. In both cases, the tests fail to reject the unit root hypothesis at the 5 per cent level of significance for all five variables.

In our model, we assume two long-run relationships given by (5) and (6). To investigate this empirically, in the interests of robustness, we use a variety of long-run estimators. Along with OLS estimates, we also use the dynamic ordinary least squares (DOLS) methodology of Stock and Watson (1993). The DOLS estimator falls under the single-equation Engle Granger (Engle and Granger, 1987) approach to cointegration while allowing for endogeneity within the specified long-run relationships. Single equation approaches have been used in other models of the housing market, such as Muellbauer and Murphy (1997); Fitzpatrick and McQuinn (2007); McQuinn and O'Reilly (2007) and McQuinn and O'Reilly (2008).

The Stock and Watson (1993) DOLS approach explicitly allows for potential correlation between explanatory variables and the error process. It involves adding both leads and lags of the differenced regressors to the

hypothesised long-run specification to correct for correlation between the error process.[3] In our application, the error term is assumed to follow an AR(2) process, while the number of leads and lags is set equal to 2.[4]

An additional estimator used is the ARDL approach suggested by Pesaran, Shin and Smith (2001). This approach has a number of attractions as it not only allows for the long-run relationship to be estimated, it also allows for a test of cointegration along with an examination of the short-run dynamics between the different variables. As a test of cointegration, the ARDL bounds testing approach has a number of attractive features. First, it is relatively straightforward when compared to other procedures such as the Johansen and Juselius approach, it allows the cointegration relationship to be estimated by OLS once the lag order of the model is identified. The procedure does not require the pre-testing of the relevant variables for unit roots unlike other approaches. The approach is applicable irrespective of whether the regressors in the model are purely I(0), purely I(1) or mutually cointegrated. Finally, the test is relatively more efficient in small or finite sample data sizes as is the case with the sample used here. The ARDL approach is employed by specifying the following two error correction representations

$$\Delta p_t = \lambda^P (p_{t-1} - \beta_0 - \beta_1 m_{t-1} + \beta_2 h_{t-1}) + \sum_{i=1}^{4} \beta_{i+2} \Delta p_{t-i} + \sum_{j=0}^{4} \beta_{7+j} \Delta m_{t-j} + u_t^P. \quad (8)$$

$$\Delta m_t = \lambda^M (m_{t-1} - \gamma_0 - \gamma_1 b_{t-1}) + \sum_{i=1}^{4} \gamma_{i+1} \Delta m_{t-i} + \sum_{j=0}^{4} \gamma_{6+j} \Delta b_{t-j} + u_t^M. \quad (9)$$

In order to arrive at the most parsimonious representation for (8) and (9), we use a general-to-specific approach based on the AIC criteria. Once the lag length is decided, (8) and (9) are estimated jointly as a system for improved efficiency using nonlinear three-stage least squares (N3SLS). The final

[3] The error term is liable to be serially correlated so the covariance matrix of the estimated coefficients must be adjusted accordingly. This involves modifying the covariance matrix of the original regressors by specifying and estimating an AR(p) model for the error term. See Fitzpatrick and McQuinn (2007) for more on this.

[4] We experimented with alternative values of k and length of the AR() process, however, our results were not significantly changed. Parameter estimates for the leads and lags in the DOLS estimation are available, upon request, from the authors.

estimated models are presented in Table 3. In both cases, there is clear evidence of error correction of approximately 10 per cent per quarter.

To apply the bounds cointegration test, we calculate an F-test for the joint restriction that the coefficients on p_{t-1}, $m_{t-1}$and h_{t-1} are zero in the case of (8) and on the test that the coefficients on $m_{t-1}$and b_{t-1} are zero in the case of (9). The cointegration results are also presented in Table 3. The F-test results for the cointegration test suggests that the two assumed long-run relationships are indeed cointegrated.

The long-run estimates are presented in Table 4. From the Table, it is evident that all estimators report similiar results for the long-run relationship in question. The results for the coefficient sizes are much the same, while the

Table 3: *Short-Run and Cointegration Estimates of House Prices and Mortgage Levels*

Dependent Variable	Δm_t	Δp_t
Constant	–3.487	12.222
	(–1.704)	(2.334)
ECT_{t-1}	–0.068	–0.169
	(–2.382)	(–3.009)
b_{t-1}	1.277	
	(7.236)	
m_{t-1}		1.011
		(6.272)
h_{t-1}		–0.858
		(–1.716)
Δm_t		0.396
		(6.759)
Δm_{t-2}		0.163
		(2.736)
Δm_{t-3}		0.164
		(2.807)
Δb_{t-4}	0.143	
	(1.855)	
Δp_{t-4}		0.389
		(5.280)

Cointegration – ARDL Bounds Tests

Variables	*F-Test*
p, m and *h*	4.844
m and *b*	10.043

Note: Estimation is conducted over the period 1982:4-2009:1. ECT = error correction term, t-statistics are in parenthesis.

Table 4: *Long-Run Estimates*

Dependent Variable		p_t	
	OLS	*ARDL*	*DOLS*
β_1	1.038	1.011	1.129
T-Stat	24.269	6.272	6.417
β_2	–0.759	–0.857	–1.044
T-Stat	–5.793	–1.715	–2.313
Dependent Variable		m_t	
	OLS	*ARDL*	*DOLS*
γ_1	1.088	1.277	1.129
T-Stat	27.657	7.236	9.615

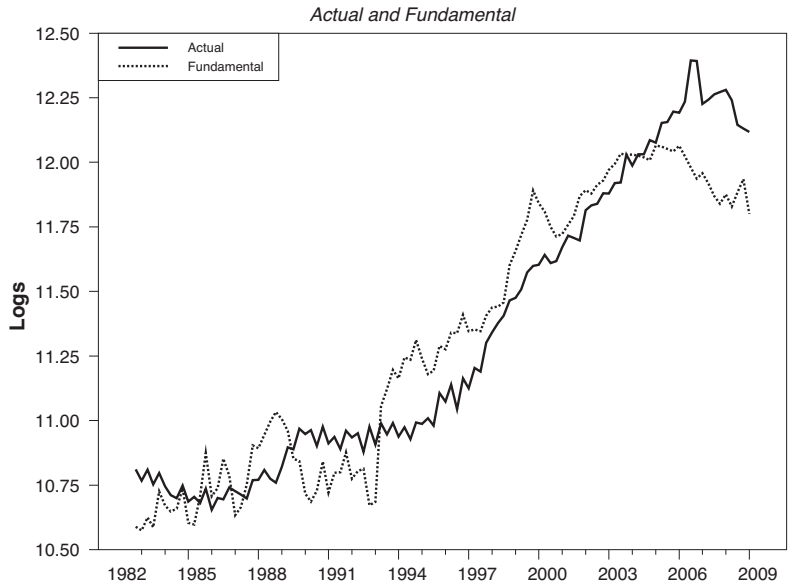
Note: All estimation is over the period 1982:4-2009:1.

t-stats for the OLS, DOLS, and ARDL estimates are all highly significant. In the next section, we examine the implications of these long-run models for the Irish mortgage market.

3.2 *Long-Run Simulations*

Using the long-run (*OLS*) model, we compare the actual mortgage level M_t with the fitted value in Figure 1. This provides a comparison between the

Figure 1: *Irish Mortgage Market – Loan Amounts*



actual mortgage level issued in the market and the long-run level based on the combination of income levels and interest rates. We refer to the long-run level as the "fundamental" level. While a long-run relationship does exist between the two series, there are periods where deviations occur. For example, during the mid-1990s, the *fundamental* mortgage level was somewhat in excess of the actual amount suggesting a degree of credit rationing. Credit institutions were lending out less than what would have been expected, given the state of macroeconomic fundamentals within the Irish economy. However, in recent times, the opposite is the case – actual loan amounts issued were considerably in excess of what prevalent income and interest rates suggest they should be.

In Figure 2, we present two graphs. In the first one we compare the actual house price with the fitted value from (6). It is evident that actual mortgage levels are a very good determinant of house prices. In the second graph in Figure 2, we trace through to house prices the implication of the deviation between the actual and fundamental loan level depicted in Figure 1. In other words, we solve (6) with the fundamental value m_t, thereby providing an indication of what house prices would be if the mortgage credit market was in equilibrium. We label this price the "scenario" level. In Figure 3 we plot the difference between both prices. From the graphs, it is evident that house prices in Ireland, from 2005 onwards, were significantly in excess of what the level would have been if mortgage lending had been at equilibrium levels.

Figure 2: *Irish Housing and Mortgage Market*

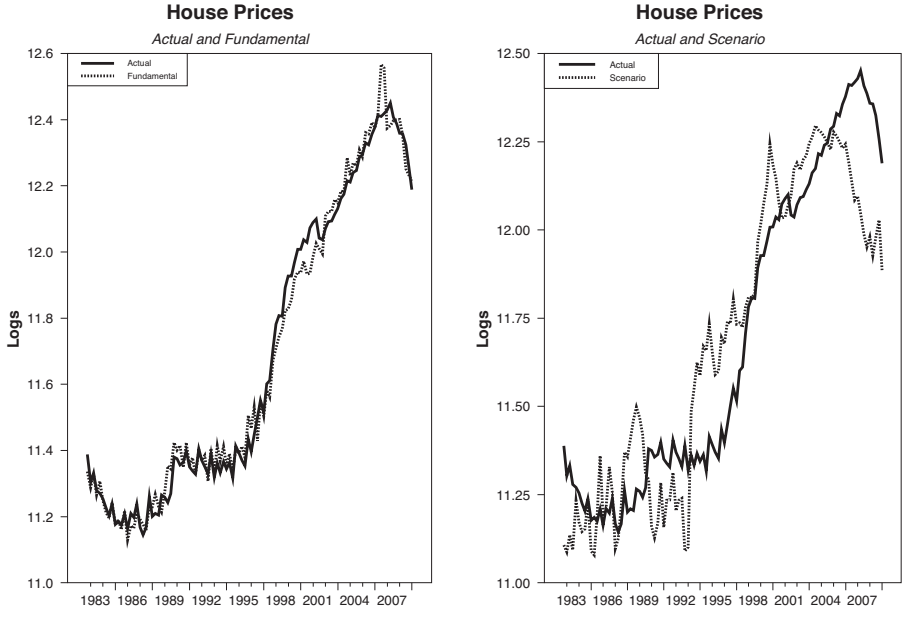
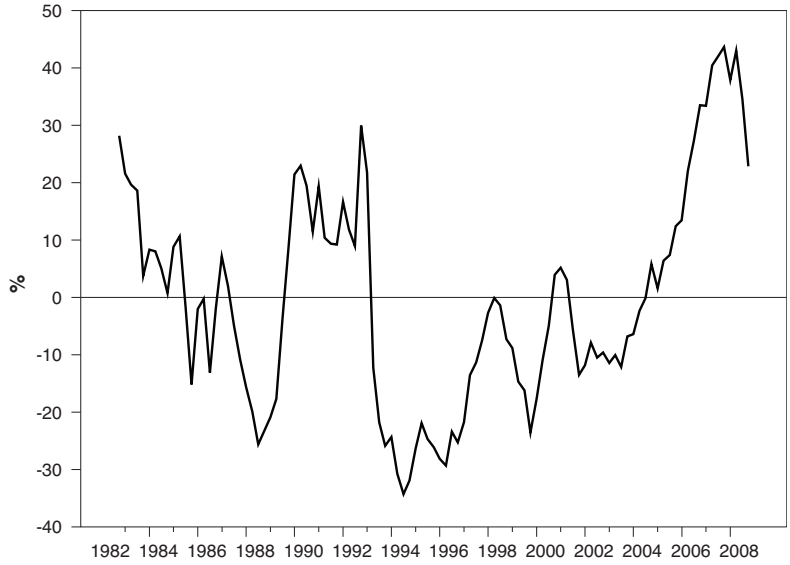


Figure 3: *Under/Overvaluation in House Prices Due to Credit Market Disequilibrium*



Therefore, it would appear that the relaxation of credit conditions in the Irish financial system contributed significantly to house price growth over the period. On average, from 2005-2008, the difference between the actual house price and the price associated with equilibrium credit conditions was 18 per cent, while for 2007 and 2008, the difference was 24 per cent.

IV FINANCIAL MARKET INNOVATION

In this section we briefly outline some of the changes in credit provision in the Irish banking sector due to financial market innovation and its impact on the mortgage market. The significant increase in the availability of mortgage credit in an Irish context can be observed in Table 5. The total value of mortgages issued increased threefold between 2000 and 2007. The total number of new mortgages went from just under 50,000 in 1995, to 80,000 in 2000 and to over 120,000 mortgages by 2005. The average size of a mortgage also increased considerably over the period. In 1995 the average mortgage extended by an Irish credit institution was €54,094 , by 2005, this had climbed to €231,206. The net consequence of this is that, by European standards, Ireland (along with the UK), is characterised by particularly high levels of residential indebtedness.

Table 5: *Summary Irish Mortgage Lending Statistics*

Variable Unit		*1985*	*1990*	*1995*	*2000*	*2005*	*2008*
Outstanding Level of Residential Lending	Euros Million	6,470	6,563	11,938	32,546	98,956	147,904
% of GDP	%	25.7	17.9	22.3	31.3	61.5	77.1
Total Value of Mortgages Issued	Euros Million						
Average Mortgage Issued	Euros	880 28,192	1,492 42,856	2,666 54,094	9,004 111,355	27,753 231,206	15,140 270,948
Total Number of Mortgages Issued		31,203	34,812	49,288	80,856	120,037	55,879

This surge of increased credit availability came after a period of considerable financial deregulation and liberalisation in the Irish market. The mid to late 1980s and the 1990s saw the ending of the formal guidelines on bank lending to the private sector and the indicative guidelines on the sectoral allocation of credit by banks; the introduction of new interest-rate arrangements in 1985; a major relaxation of exchange controls in 1988 with a further relaxation in 1992. The primary liquidity ratio was also subject to liberalising measures as it was reduced four times from a level of 10 per cent in 1991 to 2 per cent in 1999, in conformity with the requirements of the new operational framework of the Eurosystem. The removal of credit and interest-rate controls would have given banks more freedom in determining the level and allocation of credit that they would like to supply. Furthermore, the removal of exchange-rate controls would have increased banks' ability to attract deposits from non-residents.

Another seminal influence has been monetary union in Europe, which was quickly followed by the full integration of the Euro Area money market. A final feature of the liberalisation of the loan market was the cessation of Central Bank guidelines on the sectoral allocation of credit. This is highly relevant in the context of residential lending patterns as the Bank had consistently favoured the supply of credit to so-called *productive* enterprises and accordingly had discouraged its supply to the property market, which it had not perceived as being *productive*. Although many of these liberalising measures took place a long time ago, up to 20 years ago in some cases, their full effects may have taken some time to come through.

Traditionally, credit institutions' total domestic deposit liabilities has been the main funding source for mortgage supply in the Irish market. However, an additional source of funding available over the past 10 years has been cross-

border funding in the form of interbank borrowing and debt issuance. This is approximated by the funding rate and is defined as the ratio of the outstanding level of mortgage lending to total domestic deposits. Such a source of funding was negligible before the mid-1990s but has grown exponentially since then. Both the timing of its emergence and its subsequent rate of growth would suggest that the funding rate has had a significant influence on the domestic mortgage and housing markets. Figure 4 highlights the nature of the increase in the funding rate in an Irish case over the past 10 years.

To empirically address supply-side changes in the credit market, we modify the long-run model for average mortgage levels (5) to incorporate the Irish funding rate, i.e.

$$m_t = \gamma_0 + \gamma_1 b_t + \gamma_2 f_t. \tag{10}$$

Our definition of the Irish funding rate is the ratio of the outstanding level of mortgage lending to total domestic deposits. We subtract deposits from financial intermediaries from the total deposits figure as these amounts, which, typically account for 30 per cent of total deposits, tend to reflect shorter-term interbank deposits, rather than deposits available for longer-term mortgage lending. Data for the outstanding level of mortgage lending and total residential deposits are from the CBFSAI.[5]

Two estimators (OLS and DOLS) are used to estimate this specification and the results are presented in Table 6. In both cases, the funding rate appears to be a significant determinant of average mortgage levels. The coefficient on the affordability variable is still very significant in both cases.

Using the OLS results from Table 6, in Figure 5, we graph the actual loan amount with the original fundamental level (fundamental 1) from equation (5)

Table 6: *Alternative Long-Run Mortgage Credit Regression*

Dependent V ariable	m_t	
	OLS	*DOLS*
γ_1	0.568	0.609
	(13.725)	(4.790)
γ_2	0.795	0.772
	(14.789)	(4.697)

Note: All estimation is over the period 1982:4-2009:1, t-stats are in paratheses.

[5] Data for total domestic deposits and deposits due to financial intermediation are taken from Table C9 of the CBFSAI's Quarterly Bulletins.

Figure 4: *Supply of Credit in the Irish Mortgage: The Market Funding Rate*

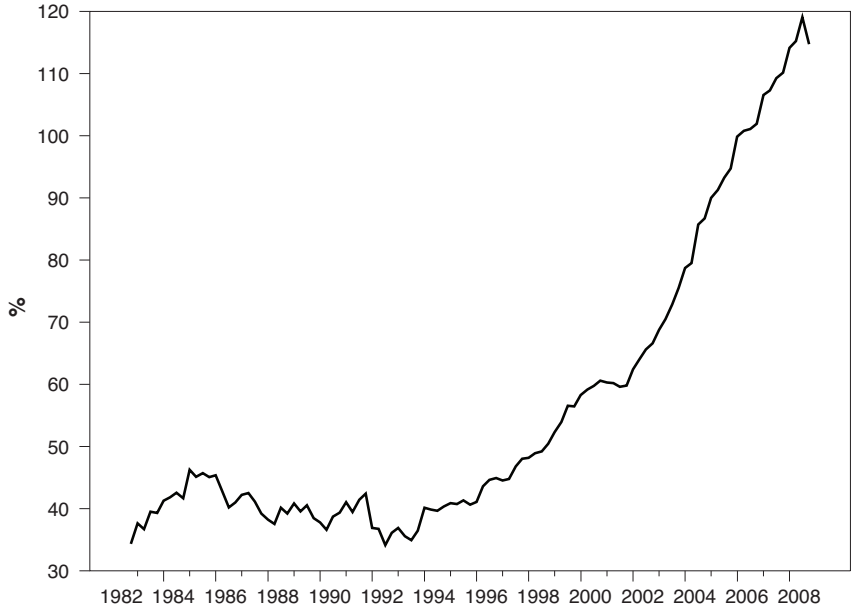


Figure 5: *Irish Mortgage Market – Augmented Model*

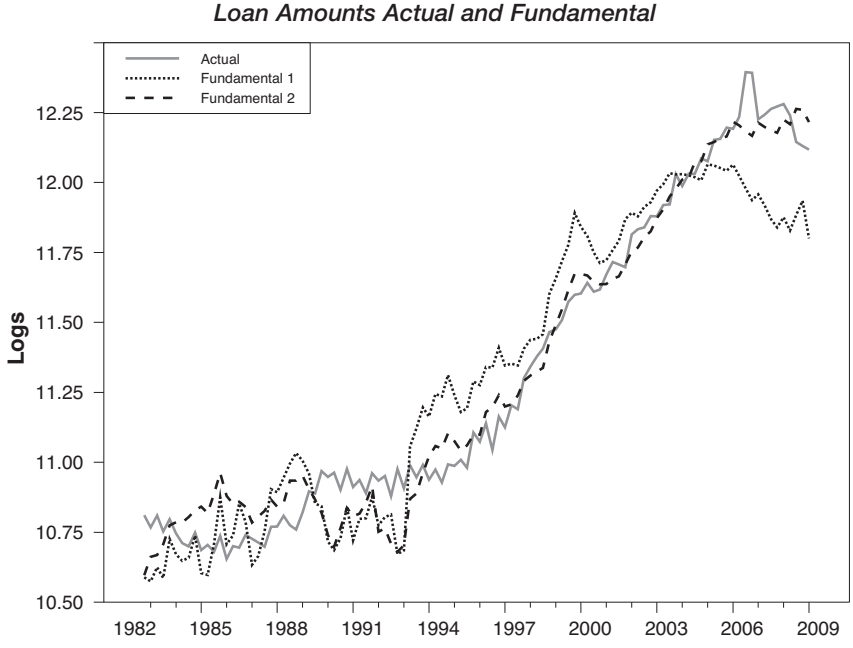


Figure 6: *Irish Housing and Mortgage Market – Augmented Model*

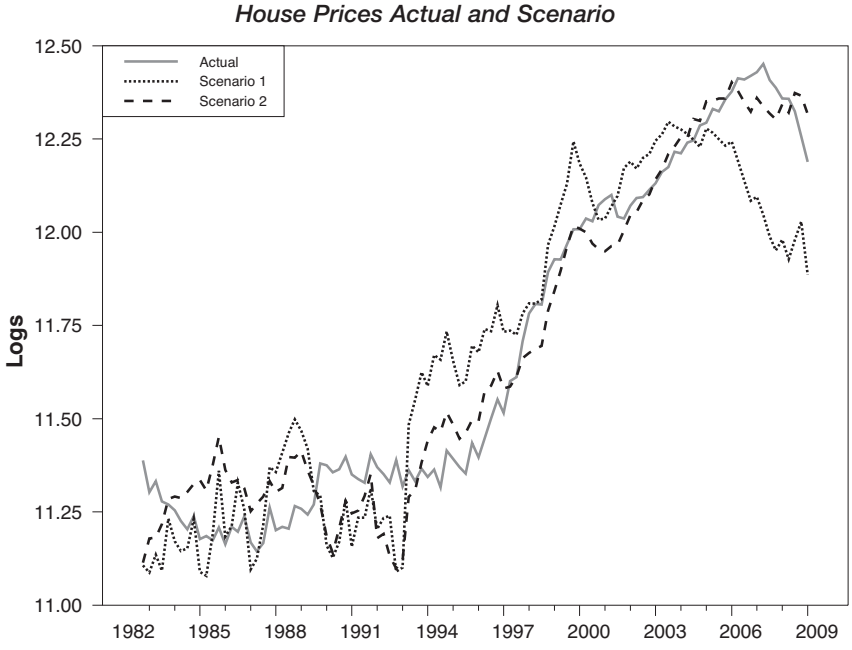


Figure 7: *Counterfactual Scenario*

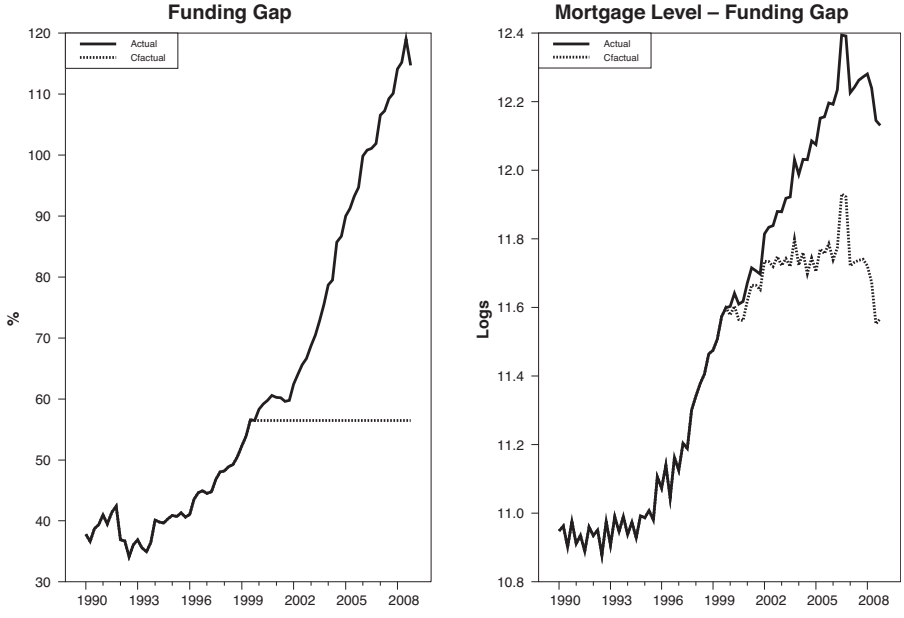
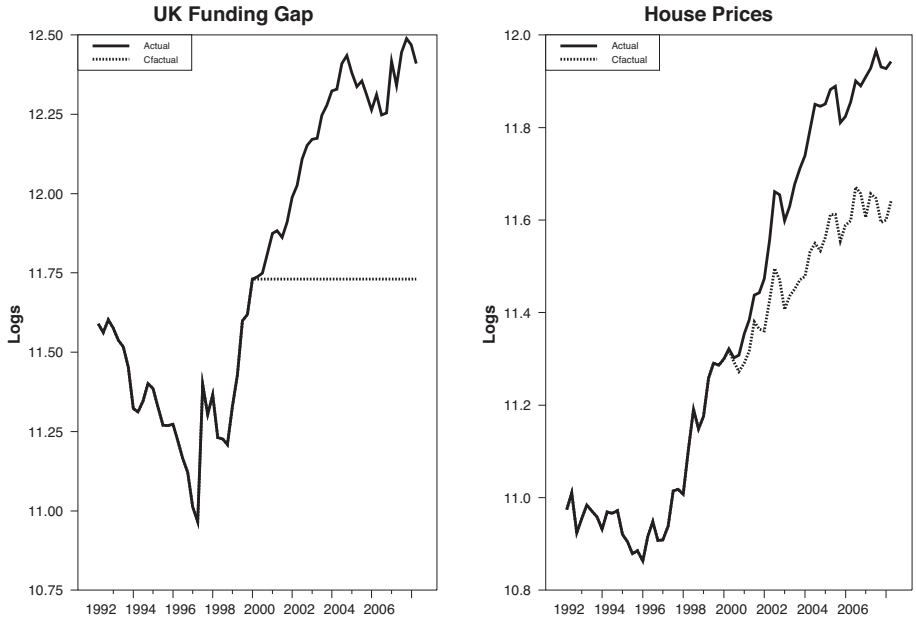


Figure 8: *UK Housing and Mortgage Market – Counterfactual Scenario*



and the new fundamental level (fundamental 2) from equation (10). It is clear that the inclusion of the additional variable improves the ability of the model to explain average mortgage levels, particularly, over the past 4 years. In Figure 6, we again trace through to house prices the implication of the different fitted values for the mortgage level. We label this price scenario 2 and include the actual house price along with the house price associated with the original fundamental mortgage level (scenario 1) as per Figure 2.

As a final exercise, we conduct a counterfactual simulation to investigate the growing relevance of the funding rate. Given that the funding rate has increased significantly since 2000, we keep the rate constant from 1999 onwards. We trace the impact of this change through to the housing market. The result is presented in Figure 7. The graphs illustrate the significant impact that this credit market innovation post 2000 has had on both Irish mortgage and house price levels. Between 2005 and 2008, on average, house prices, were almost 30 per cent per annum larger than what they would have been if this funding mechanism was kept at its 1999 rate.

In Addison-Smyth, McQuinn and O'Reilly (2009) the same model and counterfactual exercise are conducted for the UK housing and mortgage market over the period 1992-2008. In Figure 8 we replicate the result for the

UK scenario.[6] It is clear that a very similar picture emerges for the UK market – post 2000, the ability of UK credit institutions to access funding from abroad appears to have increased average mortgage levels with knock-on implications for house prices. The difference between the actual price and the counter-factual level is almost identical to that in the Irish market, with actual prices in 2008 also being, on average, some 30 per cent greater than what they would have been if this alternative source of funding had not been available.

V CONCLUSIONS

In the decade up to 2007, the Irish housing market was synonymous with strong price growth and very high levels of activity. The demand for housing was driven by a broad increase in affordability levels buoyed by exceptional economic and employment growth and historically low interest rates. In parallel, mortgage lending and the supply of credit increased rapidly. Since the latter part of 2007, however, the housing market and the supply of credit have contracted sharply. The resultant fall in the value of "housing related" loans observed by many mortgage providers has seriously eroded confidence both within financial market circles and in the wider economy. A growing consensus has emerged, which attributes at least some of the recent overvaluation in property markets to excessive mortgage lending.

This paper proposes a simple intuitive-based model of the mortgage market. First, the average level of mortgage credit is modelled solely as a function of affordability, where affordability is a combination of people's disposable income and mortgage interest rates. We then model house prices as a function of the average mortgage amount. The model is applied to the property and mortgage market in Ireland over the period 1982-2008.

Corresponding to the application of a similiar type model to the UK mortgage market, our results reveal that, for a given income level and interest rate, the loans extended by Irish credit institutions varied, at times, quite significantly over the period 1982 to 2008. This was especially the case since 2004, where increases in the loan amount issued relative to its equilibrium level, in itself, caused Irish house prices to increase, on average, by 18 per cent per annum. Given the changes in the Irish mortgage markets over this period, the model was then expanded to take account of the additional supply of funds within the mortgage industry. A funding rate variable, which seeks to capture the abilty of Irish banks to secure funding from abroad, was found to have had

[6] This is actually Figure 7 in Addison-Smyth, McQuinn and O'Reilly (2009).

a significant impact on Irish house prices. With a counterfactual simulation, the resulting model is used to quantify the contribution to mortgage levels from this source. This result, which correlates with the experience in the UK over the same period, is of interest given the future uncertainty concerning this source of institutional funding.

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