On the Hook for Impaired Bank Lending: Do Sovereign-Bank Interlinkages Affect the Net Cost of a Fiscal Stimulus?*

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Recently, some notable contributions suggest that discretionary fiscal policy can be an effective and self-financing policy option in the presence of extreme macroeconomic conditions. Given the special relationship between the Irish sovereign and its main financial institutions, this paper assesses the implications for the Irish fiscal accounts of certain macroeconomic policy responses. Using a comprehensive empirical framework, the paper examines the relationship between house prices, unemployment, and mortgage arrears. Loan loss forecasts over the period 2012–14 are then generated for the mortgage book of the main Irish financial institutions under two different scenarios. It is shown that macroeconomic policies, which alleviate levels of mortgage distress, improve the solvency position of the guaranteed Irish institutions, thereby reducing the sovereign's future capital obligations. Thus, the unique situation the sovereign finds itself in vis-á-vis its main financial institutions may have significant implications for the net cost of a fiscal stimulus.

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1. Introduction

Given the continued adverse macroeconomic fallout across many countries from the financial crisis of 2007/08, it is evident that policymakers are still struggling with the appropriate policy response. In many cases, it would appear that the suite of policy options available is quite limited, given, on the one hand, the expansive stance taken by most monetary authorities and the apparent fiscal constraints imposed by the seismic increases in both public and private debt levels on the other. Consequently, the recent renewed focus on the capacity of fiscal policy[1] to act as an efficient and possibly self-financing stabilization tool, in certain exceptional circumstances, is of interest.

In the context of the financial crisis, the Irish economy certainly presents as an exceptional case. The implications both in terms of output and employment have been truly severe with Irish GDP, which in 2011 was still 9 percent below its 2007 peak level.[2] Unemployment, which between 2000 and 2007 had averaged just over 4 percent, now stands at nearly 15 percent. Many of the pre-crisis vulnerabilities in the economy emanated from an overreliance on property and construction, with the residential mortgage market enjoying an unprecedented boom both in terms of continued price increases and the volume of housing units built. Nearly 40 percent of the current stock of Irish mortgages was issued between 2004 and 2007, when house prices were at their peak. Given the 50 percent fall (in nominal terms) in house prices since, a significant degree of negative equity is now being experienced by many Irish households. Combined with the rapid increase in unemployment and a resulting mortgage arrears situation, concerns about significant credit risk in the mortgage books of Irish banks was one of the main reasons for the financial crisis that engulfed the Irish banking sector. The assets and liabilities of the main Irish financial institutions were guaranteed by the Irish exchequer in September 2008.

A core component of the 2010 program of support agreed upon between Ireland, the European Union, and the International Monetary Fund is a commitment to address the degree of loan

[1]See DeLong and Summers (2012) and Blanchard and Leigh (2013), for example.

[2]In real terms.

impairment on the mortgage books of Irish financial institutions. To date, the Irish exchequer has recapitalized the balance sheets of Irish financial institutions by €64 billion.[3] As mandated by the program, in 2011, the capital requirements of financial institutions guaranteed by the Irish state were determined on the basis of a loan loss forecasting (LLF) exercise. Central to this is an assessment of the future performance of the Irish mortgage market.

In this paper, we illustrate that sovereign-bank interlinkages can have an impact on the net cost of a fiscal stimulus. As an example, we show how a fiscal stimulus, which returns out-of-work mortgaged households to employment, alleviates the solvency pressures of Irish financial institutions and consequently reduces their estimated future capital requirements. We use an empirical framework consisting of a house price model, a recently developed credit risk model of the Irish mortgage market, and the output of a large-scale structural model to quantify the savings in future capital requirements of such a stimulus. In particular, we focus on the strong relationship between unemployment and house prices in the Irish economy. Examining the relationship between macroeconomic feedback effects and mortgage relief programs is not specific to the Irish market. Recent research (Congressional Budget Office 2013 and Remy and Moore 2013) highlights the relevance of the issue in the U.S. mortgage market, where some mortgage resolution strategies are claimed to generate a small savings, in overall terms, to the government.

In response to the financial crisis, a number of considerations limit the suite of macroeconomic policy options available to the Irish authorities. Adoption of the euro in 1999 curtails the potential effectiveness of monetary policy, with a traditional devaluation, for example, being precluded. On the fiscal side, having been "poster boys" for good behavior on the public finances front during the Celtic Tiger era, Irish exchequer receipts subsequently collapsed due to an overreliance on transactions-based taxes in the property sector. Combined with the substantial cost of bank recapitalizations, Irish debt dynamics are currently somewhat precariously placed.[4]

[3]This constitutes circa 40 percent of Irish GDP in 2011.

[4]The Irish deficit in 2011 was 13.4 percent of GDP, while the most recent estimate for 2012 by the Irish Department of Finance is 8.2 percent. Furthermore, the Irish debt-to-GDP ratio, which in 2007 had fallen to less than 25 percent, has grown between 2007 and 2011 by over 80 percentage points.

This, along with traditional skepticism concerning the size of fiscal multipliers for small open economies, has heavily conditioned consideration of a fiscal response to Ireland's present problems.

To date, policy responses to the distressed mortgage problem have been essentially microfounded in design, somewhat labored in implementation, and hindered by legislative uncertainty. It is apparent that Irish financial institutions have struggled with "working through" the distressed nature of their loan books. In November 2011, the Irish government published the Keane Report,[5] which set out a roadmap for the institutions, stressing the need to segment the distressed components of their mortgage book and tailoring loan-modification responses on a cohort-type basis. The Central Bank of Ireland has been engaged with the institutions since late 2011, requiring the preparation of mortgage arrears resolution strategies. However, as of late 2012, most of the new products envisioned by the institutions were only at a "testing" phase. Given the increasing number of mortgaged households entering the arrears category, the scale of operation confronting Irish institutions is somewhat daunting.

The rest of the paper is structured as follows: in the next section we outline the overall empirical framework adopted, highlighting at the outset the important relationship between house prices and unemployment in an Irish context. The credit risk model used to relate mortgage arrears and capital requirements to key economic variables such as house prices, unemployment, and income is then presented. Finally, the scenario results from a large-scale structural model of the Irish economy are used to examine the impact of specific government programs on these macroeconomic variables. Hence, the impact of the programs can then be traced back to the mortgage books of the financial institutions.

2. Outline of Empirical Approach

In our empirical approach, we focus initially on a model of house prices and unemployment. This feeds into an existing credit risk

[5]This was prepared by an interdepartmental mortgage arrears working group, which reported to the Irish government on September 30, 2011. Available online at http://www.finance.gov.ie/sites/default/files/mortgagearr2_0.pdf.

model of the Irish mortgage market with scenarios from a large-scale structural model of the Irish economy (HERMES) used to gauge the impact of increased government expenditure on unemployment rates in the economy.

Central to our analysis is the relationship between mortgage arrears and key macroeconomic factors such as house prices and unemployment. In particular, for the Irish economy we find a very strong relationship between unemployment rates and house prices. Over the sample in question (1983–2011), which spans both before and after the introduction of the euro, Irish house prices and unemployment rates have a significantly inverse relationship (a correlation coefficient of –0.82). This period covers profound changes in Irish house prices—over the period 1995–2007 house price increases in Ireland were the largest across the OECD, while since 2007 the falls in Irish prices have also been the largest.

Unemployment has been found to be a key determinant of house prices across a wide number of countries—as shown in studies of U.S. prices in both Peek and Wilcox (1991) and Rapach and Strauss (2007), of Chinese prices in Deng, Ma, and Chiang (2009), of Spanish prices in Aspachs-Bracons and Rabanal (2009), of prices in fourteen developed countries in Ceron and Suarez (2006), and of Australian prices in Williams (2009). Very often, unemployment is included not just as a proxy for business-cycle developments but also as an indicator of market expectations and consumer confidence (Gerlach and Peng 2005 and Andrews 2010, for example), while in Muellbauer and Murphy (1997) and Fernandez-Corugedo and Muellbauer (2006) it is included, among other variables, as an indicator of the related concept of market risk.

The significance of unemployment in the Irish property market may be due to a combination of these issues. The confidence factor is highly relevant, particularly, given the emergence of the "Celtic Tiger" in the mid-1990s. The persistent decline in unemployment throughout the mid-1990s from a stubbornly high level in the 1980s was evidence that the pickup in Irish economic activity earlier in the decade was now feeding into higher living standards for the domestic population. Given the relative youth of the Irish population at the time, this increase in the level of employment, with a doubling of the labor force between 1990 and 2000, precipitated a significant demand for housing services both in terms of the increased

affordability of the expanding workforce and the confidence in future prospects prompted by declining unemployment rates. Irish labor market developments, arguably, captured the profound change in affordability more accurately than changes in aggregate income levels and other business-cycle indicators. Finally, as a measure of potential credit risk, unemployment is especially relevant in the Irish case, where the post-2007 escalation in the rate of those out of work has gone hand in hand with the growing mortgage arrears problem.

2.1 A Model of House Prices

To demonstrate the specific relationship between unemployment and house prices, we adopt a standard house price model, popular in the international literature. This approach involves inverting the demand function for housing and rearranging such that the dependent variable is now the price of housing as opposed to the quantity. Similar applications can be observed in Peek and Wilcox (1991), Muellbauer and Murphy (1994, 1997), Meen (1996, 2000), and Cameron, Muellbauer, and Murphy (2006). The model, which assumes that the demand for housing services is proportional to the housing stock, can be derived, in log-linear fashion, as follows:

$$ln\left(\frac{hc}{pop}\right) = \alpha_1\, ln\left(\frac{y}{pop}\right) - \alpha_2\, ln\, rent + \alpha_3\, ln\, pop - \alpha_4\, ln\, urx. \tag{1}$$

hc is the housing stock, pop is the population level, y is disposable income, $rent$ is the real rental rate of housing in the economy, and urx is any other demand shifter for housing services—in our case, the rate of Irish unemployment. The coefficients α_1 and α_2 are the income and price elasticities of demand for housing. In equilibrium, the real rental rate of housing can be assumed to be equal to the real user cost. This can be outlined as follows:

$$p(r - p^e/p) \equiv p \times uc, \tag{2}$$

where r is the mortgage interest rate, p is house prices, e denotes expectations, and uc is the user cost of housing. While expressions for the user cost can be augmented to include taxation considerations and expenditure rates of maintenance and repair, very often the

Table 1. Summary of Data: 1983:Q1–2011:Q3

Variable		Mean	Std. Error	Minimum	Maximum
House Prices	P_t	54.35	37.47	16.07	130.50
Population	POP_t	3.8	3.4	3.5	4.5
Disposable Income	Y_t	12,351	7,347	3,617	25,736
Unemployment	URX_t	10.70	4.88	3.70	17.30
Deflator	PCD_t	0.95	0.24	0.53	1.35
User Cost	$USER_t$	4.44	3.48	−1.70	10.91
Mortgage Rate	R_t	7.82	3.46	3.43	15.40

Note: Y_t is in €'s and nominal terms; URX_t, R_t, and $USER_t$ are in percentage terms; P_t is an index; and PCD_t is an index with 2,000 = 100. POP_t is millions of people.

Table 2. Unit-Root Tests

Test	$ln\ p_t$	$ln\ y_t/pop_t$	$USER_t$	$ln\ cap/pop$	$ln\ pop_t$	$ln\ urx_t$	1%
ADF t-test	−1.97	−1.43	−3.09	−1.56	−0.83	−1.41	−3.46
ADF Z-test	−11.11	−1.44	−17.87	−2.57	−2.93	−4.02	−20.3
Phillips-Perron	−0.74	−0.82	−2.84	−0.01	2.27	−0.93	−3.49

Note: The lag lengths for all the unit-root tests are determined by standard AIC and BIC tests.

main determinants of the expression are the mortgage rate and expected house price inflation. Thus, substituting (2) into (1) provides the following inverted demand curve for housing:

$$ln\ p = \frac{\alpha_1}{\alpha_2}\ ln\ \left(\frac{y}{pop}\right) - \frac{1}{\alpha_2}\ ln\ \left(\frac{hc}{pop}\right) - ln\ uc + \frac{\alpha_3}{\alpha_2}\ ln\ pop - \frac{\alpha_4}{\alpha_2}\ ln\ urx. \tag{3}$$

House prices are positively related to real income per capita and population levels and are negatively related to the per capita housing stock, the user cost of capital, and the unemployment rate.

In table 1, we report a summary of our data, while in table 2 standard unit-root tests are presented. For all variables, the null hypothesis of a unit root cannot be rejected. In the interest of robustness, we then use four different estimators to estimate the inverted

demand function (3)—standard OLS, dynamic OLS (DOLS), fully modified OLS (FMOLS), and the autoregressive distributed lag (ARDL) approach by Pesaran, Shin, and Smith (2001). Hyashi (2000), amongst others, has noted the difficulties associated with inference based on t-stats estimated with OLS. The use of alternative estimators such as DOLS, FMOLS, and ARDL enables inference to be based on standard errors adjusted for considerations such as correlation between the regressors and the error process and serial correlation. The DOLS approach of Stock and Watson (1993) falls under the single-equation Engle and Granger (1987) approach to cointegration, while allowing for endogeneity within the specified long-run relationship. The Philips-Hansen fully modified OLS procedure is designed to allow for statistical inference in multivariate linear regressions with integrated processes.[6]

The ARDL approach has a number of attractions, as it not only allows for the long-run relationship to be estimated, but 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. Firstly, it is relatively straightforward when compared with other procedures such as the Johansen and Juselius approach, and it also allows the cointegration relationship to be estimated by OLS once the lag order of the model is identified. Unlike other approaches, the procedure does not require the pre-testing of the relevant variables for unit roots. 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 than other estimators for small or finite sample data sizes. Table 3 summarizes the results of the initial estimation.

Across all estimators, only the unemployment and population variables are significant and correctly signed. While the user cost of capital and per capita capital are significant for the FMOLS estimator, they are counterintuitively, positively signed. For the user cost variable, we used a variety of expected prices for the capital gains expression, including a four-quarter moving average, a naïve expectations approach, and—following Himmelberg, Mayer, and Sinai

[6]Both approaches have been used in an Irish context in Fitzpatrick and McQuinn (2007).

Table 3. Initial Long-Run Model Estimates 1983:Q1–2011:Q3

Variable	OLS Estimate	DOLS Estimate	FMOLS Estimate	ARDL Estimate
Constant	−19.04	−28.81	−35.48	−24.29
	(−3.23)	(−3.79)	(−7.08)	(−2.16)
$ln\,(y_t/pop_t)$	0.56	−0.09	−0.17	0.42
	(4.45)	(−0.49)	(−1.27)	(1.52)
$ln\,(hc_t/pop_t)$	−0.09	0.94	0.88	−0.28
	(−0.21)	(1.60)	(2.11)	(−0.31)
$USER_t$	0.001	0.01	0.01	0.01
	(0.61)	(2.71)	(3.87)	(2.01)
$ln\,urx_t$	−0.35	−0.48	−0.50	−0.48
	(−11.91)	(−8.12)	(−15.9)	(−7.86)
$ln\,pop_t$	1.78	2.25	2.66	2.06
	(4.61)	(4.63)	(8.25)	(2.84)

Note: t-stats are in parentheses.

(2005) and Duca, Muellbauer, and Murphy (2011)—lagged house price appreciation over the prior four years. However, the overall results were not sensitive to the alternative specifications. Income per capita is only significant in the case of OLS, while it is negatively signed in the case of both the DOLS and FMOLS results.

Given the significance of the unemployment variable in all regressions (it has the largest t-stats in all four cases), these results are not altogether too surprising.[7] As an indicator of economic activity, unemployment, in the Irish case, would appear to be more informative from the housing market perspective than either income levels or interest rates as per the user cost of capital expression.[8] In table 4 we present the results of a more parsimonious model which includes

[7]The unemployment rate may outperform current income per capita as a labor market variable partly because the persistence of swings in the Irish unemployment rate may better track structural shifts in labor prospects and, therefore, be more reflective of permanent income than current income per capita.

[8]Note we also run our models with mortgage interest rates in place of the user cost; similiar results are obtained.

Table 4. Parsimonious Long-Run Model Estimates 1983:Q1–2011:Q3

Variable	OLS Estimate	DOLS Estimate	FMOLS Estimate	ARDL Estimate
Constant	−36.23	−42.21	−45.62	−33.39
	(0.00)	(0.00)	(0.00)	(0.00)
$ln\ urx_t$	−0.49	−0.44	−0.44	−0.53
	(0.00)	(0.00)	(0.00)	(0.00)
$ln\ pop_t$	2.71	3.10	3.32	2.53
	(0.00)	(0.00)	(0.00)	(0.00)
Cointegration—ARDL Bounds Tests				
				F-Test
				7.53
				(0.00)

Note: p-values are in parentheses.

just unemployment and population. The coefficient on the unemployment variable is very similar across the four estimators (between 0.44 and 0.53 in absolute terms). In figure 1, we plot both the actual and fitted values from this model along with the residuals based on the OLS approach. The performance of the model in terms of fit can be favorably compared with the results from four different models of Irish house prices used in Kennedy and McQuinn (2012).[9]

One feature of the model is the relative stability of the unemployment effect on house prices through time. Figure 2 is a plot of the recursive estimate of the coefficient on the labor variable from 1991 to 2011. The estimate stays between a bound of –0.4 and –0.6, which, given the turbulent nature of the period in question, is quite reassuring.[10]

[9]In particular, see figure 4 on page 12 of Kennedy and McQuinn (2012).

[10]Given the change in economic conditions post-2007, we performed a standard Chow test to examine whether there had been a significant change in the stability of the long-run model. However, we were unable to reject the null hypothesis. We are grateful to a referee for this suggestion.

Figure 1. Actual and Fitted House Prices: 1984:Q1–2011:Q3

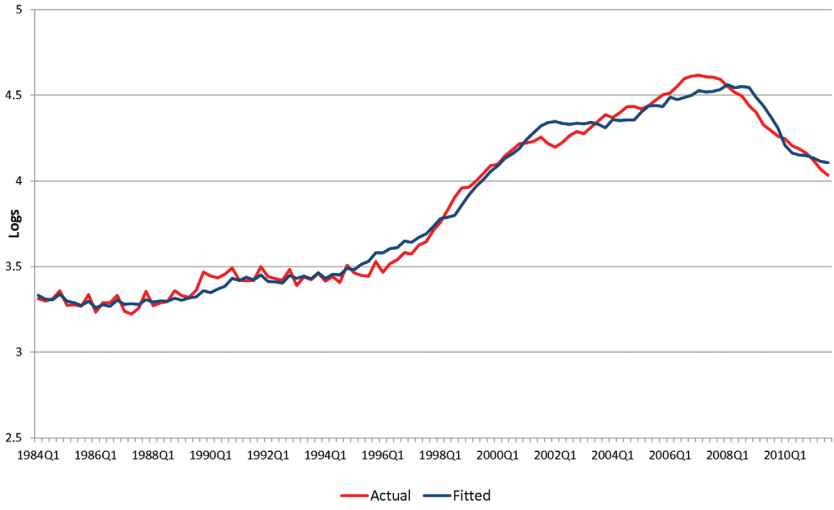


Figure 2. Recursive Estimate of the Unemployment Coefficient: 1991:Q1–2011:Q3

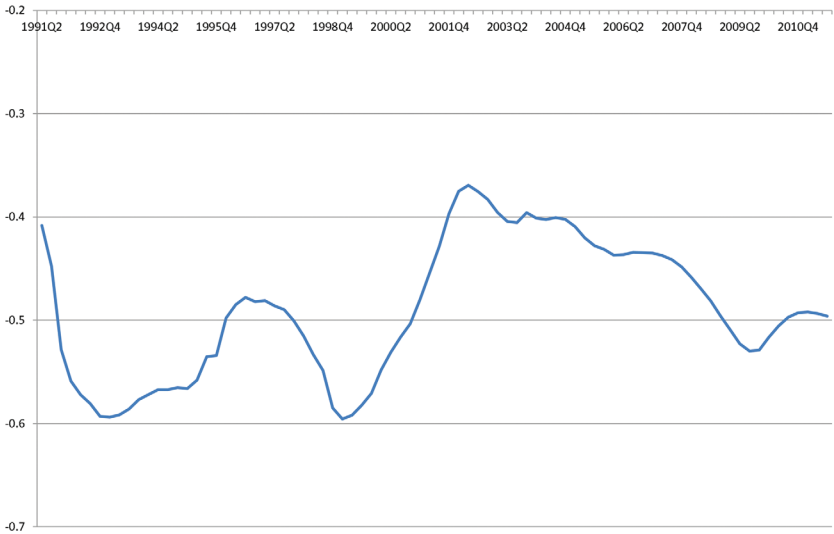


Table 5. Loan-to-Value Model: 1983:Q1–2011:Q3

Variable	Coefficient	t-Stat
Constant	0.45	1.06
$ln\, ltv_{t-1}$	0.44	5.38
$ln\,(y_{t-2}/pop_{t-2})$	0.35	3.53
$ln\,(y_{t-3}/pop_{t-3})$	−0.33	−3.24
$\Delta ln\, urx_{t-2}$	0.26	3.70
$ln\, tltv$	0.48	4.58
R^2	0.95	

2.2 Credit and Irish House Prices

One issue, which arises particularly in the case of Irish house prices over the period in question, is the potential role played by the easing of credit standards. The liberalization of the domestic credit market has been documented in studies such as Kelly, McQuinn, and Stuart (2011), while Addison-Smyth, McQuinn, and O'Reilly (2009) examine the role played by greater access to wholesale finance by Irish financial institutions on house price movements. To test the sensitivity of the model estimates in table 3 to changing credit standards, we employ the approach in Duca, Muellbauer, and Murphy (2011), who address the issue in the U.S. housing market. Namely, we first construct an adjusted loan-to-value (ltv) series for the Irish housing market over the period 1983 to 2011. This is achieved in the same way as in Duca, Muellbauer, and Murphy (2011) by estimating the following regression:

$$ln\, ltv = \beta_0 + \beta_1\, ln\, ltv_{t-1} + \beta_2\, ln\, \left(\frac{y}{pop}\right)_{t-2} + \beta_3\, ln\, \left(\frac{y}{pop}\right)_{t-3} + \beta_4\, \Delta ln\, urx_{t-2} + \beta_5\, ln\, tltv, \tag{4}$$

where $tltv$ is the Hodrick-Prescott filter trend of the loan-to-value ratio. The results are in table 5. Note, we apply the general-to-specific approach in terms of the final specification. The adjusted series ltv^A is then the actual series minus all the variables on the right-hand side of (4), with the exception of the lagged dependent

Table 6. Long-Run Model Estimates with Credit Variable Included: 1983:Q1–2011:Q3

Variable	OLS Estimate	DOLS Estimate	FMOLS Estimate	ARDL Estimate
Constant	−18.90	−25.39	−37.51	−26.28
	(−3.11)	(−3.13)	(−7.58)	(−2.18)
$ln\,(y_t/pop_t)$	0.56	−0.19	−0.10	0.48
	(4.06)	(−0.882)	(−0.69)	(1.55)
$ln\,(hc_t/pop_t)$	−0.07	1.41	0.50	−0.54
	(−0.14)	(1.88)	(1.14)	(−0.51)
$USER_t$	0.00	0.01	0.01	0.01
	(0.60)	(2.43)	(4.26)	(2.03)
$ln\,urx_t$	−0.36	−0.48	−0.50	−0.47
	(−11.51)	(−8.37)	(−16.08)	(−7.22)
$ln\,pop_t$	1.77	2.05	2.76	2.18
	(4.49)	(4.02)	(8.70)	(2.83)
$ln\,ltv_t^A$	−0.02	−0.25	0.27	0.14
	(−0.11)	(−0.91)	(2.18)	(0.50)

Note: t-stats are in parentheses.

variable. This adjusted series is then assumed to capture movements in the ltv, which are not associated with demand-side factors and changing trends but, rather, with changes in credit conditions. We then add ltv^A to (3) and estimate the long-run models for the four different estimators. The results, presented in table 6, differ only marginally from those presented in table 3—the adjusted loan-to-value variable itself is only significant in the FMOLS case.

2.3 Potential Endogeneity of Unemployment?

The increased relevance of the residential and commercial property sectors of Irish economic activity from 2000 onwards raises the possible endogeneity of unemployment in modeling house prices. The overreliance of the domestic economy and particularly the Irish financial sector on construction-related activity was one of the reasons for the severity of the economic downturn after the international financial crisis. From 2000 to 2007, this sector accounted

for an increasing amount of domestic investment and employment levels.

Therefore, we address this endogeneity issue with an instrumental-variables approach. We take two instruments for Irish unemployment —UK unemployment and the rate of foreign direct investment (FDI) flows in and out of the country. In specifying the instruments, we are looking for variables that are correlated with Irish unemployment but not correlated with the error term in the house price regression.[11]

The proximity of a much larger labor market such as the United Kingdom's to the Irish one has resulted in a close relationship over the years with an ensuing highly elastic Irish labor supply function. This traditional close relationship between the two markets has been noted in many studies of the Irish labor market—for example, the large-scale model of the Irish economy, HERMES (see Bradley et al. 1993 for details), specifically assumes that wage rates in the Irish economy are a function of the differential in unemployment between both countries (see Curtis and FitzGerald 1994, FitzGerald 1999, and Bergin et al. 2010 for more on this). Clearly, it is highly unlikely that there would be reverse causation between Irish house prices and UK unemployment. Similarly, FDI flows in and out of the Irish economy over the period in question are likely to have been an important determinant of changing unemployment levels, while they are unlikely to be correlated with the error term from a house price regression.

Results for the instrumental-variables (IV) estimation, along with those of the OLS from table 4, are presented in table 7 along with some standard IV diagnostic tests. The coefficient on the unemployment variable is now at 0.54 compared with 0.49 for OLS. For the diagnostic tests, we can clearly reject the null hypothesis that unemployment is an exogenous variable, thereby suggesting our IV approach is warranted. We cannot reject the overidentifying restriction, which assumes that one instrument is valid and then tests for the validity of the subsequent instrument. Finally, the partial R^2 score along with the F-stat suggests that our choice of instruments are significant as explanatory variables for Irish unemployment in

[11]We also estimate a VAR with house prices, unemployment, and population and find evidence of unemployment Granger-causing house prices but not the other way around. These results are available, upon request, from the authors.

Table 7. Instrumental-Variables Regression: 1983:Q1–2011:Q3

Variable	OLS Estimate	IV Estimate
Constant	−36.23	−33.29
	(0.00)	(0.00)
ln urx$_t$	−0.49	−0.54
	(0.00)	(0.00)
ln pop$_t$	2.71	2.53
	(0.00)	(0.00)
H_0: Variable Is Exogenous		
F-Test		24.03
		(0.00)
χ^2		18.58
		(0.00)
Overidentifying Restriction		
χ^2		1.34
		(0.25)
First-Stage Regression Summary Statistics		
Partial R^2		0.76
F-Test		127.54
		(0.00)
Note: p-values are in parentheses.		

the first-stage regression. A common rule of thumb for models with one potential endogenous regressor is that the F-stat against the null that the excluded instruments are irrelevant in the first-stage regression should be larger than 10 (Stock, Wright, and Yogo 2002).

2.4 Short-Run House Price Model

Based on the preceeding long-run estimates of house prices, we now estimate a short-run error-correction model. We take the long-run IV estimates as reported in table 7 for the error-correction term itself

Table 8. Error-Correction Models: 1983:Q1–2011:Q3

Variable	Model 1 Estimate	Model 2 Estimate
ECT_{t-1}	−0.20	−0.20
	(0.00)	(0.00)
$\Delta ln\, p_{t-4}$	0.72	0.70
	(0.00)	(0.00)
$\Delta ln\, urx_t$	−0.23	−0.29
	(0.00)	(0.00)
$\Delta ln\, urx_{t-2}$	−0.23	−0.20
	(0.00)	(0.01)
$\Delta ln\, urx_{t-5}$	0.19	0.18
	(0.00)	(0.00)
$IVRES_t$		0.11
		(0.28)
R^2	0.68	0.68
Exclusion Test on $IVRES_t$		
F-Test		1.16
		(0.28)

Note: p-values are in parentheses.

and specify the following:

$$\begin{aligned}\triangle ln\, p_t = \lambda \left(ln\, p_{t-1} - \gamma_0^{IV} - \gamma_1^{IV} ln\, urx_{t-1} - \gamma_2^{IV} ln\, pop_{t-1}\right) \\ + \sum_{i=1}^{4} \theta_i \triangle ln\, p_{t-i} + \sum_{i=0}^{4} \theta_{i+5} \triangle ln\, urx_{t-i} \\ + \sum_{i=0}^{4} \theta_{i+9} \triangle ln\, pop_{t-i} + u_t. \qquad (5)\end{aligned}$$

The model is estimated, and applying a general-to-specific approach yields the results under the "Model 1" heading in table 8. As can be seen, the model clearly error-corrects, with the coefficient suggesting a 20 percent correction per quarter to any disequilibrium in the long-run relationship.

From the model, it is evident that the contemporaneous change in unemployment enters the short-run model for house price changes.

From the previous section, it is obvious that this may give rise to a simultaneity bias in the regression results. To deal with this, we apply a Hausman test as performed in Gerlach and Peng (2005) and Fitzpatrick and McQuinn (2007). A two-stage least-squares procedure is again adopted where an auxiliary regression is estimated with the change in unemployment regressed on the same set of instrumental variables—in this case, the change in UK unemployment and the change in FDI flows. The residuals from this auxiliary regression, $IVRES_t$, are then entered in (5) and the initial short-run model is reestimated. If the OLS estimates of (5) are consistent, then the coefficient on the residuals should not be significantly different from zero. The results for this regression are under the "Model 2" heading in table 8. As can be seen, it is not possible to reject the null hypothesis; therefore, it would appear that movements in unemployment appear to have played a structural role in determining Irish house price changes.

We use the model presented in (5) for our subsequent policy simulations. In the next section we present the credit risk model for mortgage loans.

2.5 A Model of Mortgage Arrears

A loan loss estimate for a financial institution can be summarized as the combination of three related concepts: (i) the size of the property exposure, (ii) the loan-level probability of default, and (iii) the loss given default. In the case of a property/mortgage loan, the first is simply the sum of the current balances outstanding on the loan, while the last is the proportion of the current balance the bank can recover through repossession of the property. This is usually approximated by the negative equity on the loan and some measure of the costs associated with any repossession. The probability of default is the most complex to estimate. We adopt the migration model of loan delinquency outlined in Kelly (2011), which takes historical loan performance and estimates a transition matrix through which the migration probability of any loan to default can be estimated. Furthermore, the transitional probabilities are conditional in that they are a function of key macroeconomic variables.

Likely causes of mortgage delinquency and ultimately default can be generally classified into two different hypotheses. The first is the

equity effect, whereby an individual, mainly from a strategic perspective, will not continue servicing a mortgage due to the presence of significant negative equity on the loan. This is similar to viewing a mortgage as an American option with a strike price equal to the mortgage value where the effect is likely to be more pronounced in non-recourse markets, such as some U.S. states.

The second likely determinant of arrears rates is affordability or the ability to repay the mortgage amount. In this instance falls in income—typically, although not exclusively, through an unemployment shock—leave the individual unable to meet the repayment burden of the mortgage. Given the rapidly deteriorating conditions in both the housing market and the general economy in Ireland post-2007, there is significant a priori evidence for both conjectures. Unemployment in Ireland rose from approximately 4 percent to nearly 15 percent between 2007 and 2011, while house prices, as of mid-2012, have fallen consistently since the second quarter of 2007, resulting in the subsequent peak-to-trough fall being second only to Japan as the largest ever recorded across the OECD.[12]

A particular characteristic of the Irish mortgage market is the relatively large number of loans extended over a relatively short period of time. Between 2004 and 2007, 330,000 loans were extended—this is almost 40 percent of the total stock of mortgages currently outstanding. This significant increase in lending by Irish financial institutions was facilitated by their ability, post-2003, to attract substantial wholesale deposit funding from abroad. The already buoyant nature of the residential and commercial property markets generated considerable demand for this increased source of funding. Given this increase in lending, there is significant a priori evidence to suggest that credit standards in the Irish mortgage market deteriorated somewhat over this period, with greater LTV rates and higher debt-to-income ratios being permitted (McCarthy and McQuinn 2011). Consequently, in the mortgage arrears model we also include a loan duration effect, which captures the fact that newer loans yield a higher risk of delinquency.

We estimate two sets of empirical models—one for primary dwelling houses (PDHs) and one for buy to lets (BTLs). The

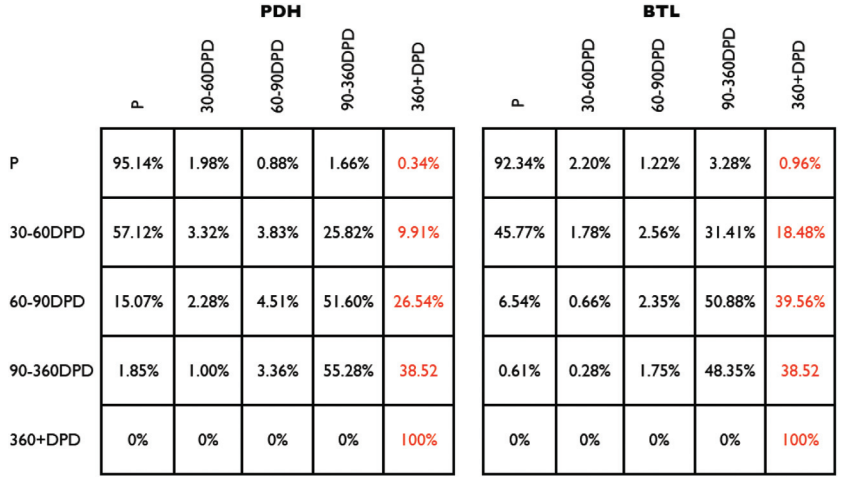
[12]O'Connell and Woods (2012) place the macroeconomic performance of the Irish economy during the post-crisis period in an international context.

residential investment loan book is highly concentrated around the peak of house prices, with 75 percent of the BTL mortgages issued between 2003 and 2007, compared with 58 percent in the PDH book. The average balance of an investment mortgage is €218,090, which is 68 percent greater than the average of the PDH book. Therefore, this provides strong evidence to suggest that PDH owners respond differently to economic indicators than BTL owners. In summary, BTLs would appear quicker to react to economic circumstances than PDHs—individuals and households clearly place a premium on retaining the family home and will, accordingly, endure considerable financial difficulties before relinquishing the asset.

Kennedy and McIndoe Calder (2011) provide a comprehensive overview of the loan-level data used in the modeling work. The data consist of 600,000 mortgage loans from the mortgage books of three leading Irish financial institutions covered in the financial measures program (FMP). These institutions are Allied Irish Bank, Bank of Ireland, and Permanent tsb. All three cover approximately 85 percent of the Irish mortgage market. Data are available at a monthly frequency from December 2009 to December 2011. The loan-level data includes information on the repayment and arrears status of each loan, the loan amount, and the original house price. House prices are brought forward from the point of origination with regional house prices from the Central Statistics Office. Unemployment is also incorporated in the modeling framework in a regional manner—using regional identifiers, the corresponding unemployment rate is matched to the respective loan at a NUTS 3 level.

A mortgage holder in the Irish market is assumed to be in one of five different states: performing (P), 30–60 days past due (DPD), 60–90 DPD, 90–360 DPD, and 360+ days DPD. Separate models are estimated for each transition. Loans can improve as well as deteriorate, and the assumption is made that once a loan progresses into 360 days arrears, it does not recover. In figure 3 the unconditional transitional probabilities between the different performing states are presented. The relatively poor performance of the BTL market vis-à-vis that of the PDHs is apparent. For example, for a performing PDH loan today, there is a 0.34 percent chance that this loan will be 360 days arrears in one year, whereas for BTLs, the equivalent rate is almost 1 percent—a threefold difference. The key "tipping point" for PDHs is the 60- to 90-days-arrears state; from the table

Figure 3. One-Year Unconditional Transitional Probabilities



PDH	P	30-60DPD	60-90DPD	90-360DPD	360+DPD
P	95.14%	1.98%	0.88%	1.66%	0.34%
30-60DPD	57.12%	3.32%	3.83%	25.82%	9.91%
60-90DPD	15.07%	2.28%	4.51%	51.60%	26.54%
90-360DPD	1.85%	1.00%	3.36%	55.28%	38.52
360+DPD	0%	0%	0%	0%	100%

BTL	P	30-60DPD	60-90DPD	90-360DPD	360+DPD
P	92.34%	2.20%	1.22%	3.28%	0.96%
30-60DPD	45.77%	1.78%	2.56%	31.41%	18.48%
60-90DPD	6.54%	0.66%	2.35%	50.88%	39.56%
90-360DPD	0.61%	0.28%	1.75%	48.35%	38.52
360+DPD	0%	0%	0%	0%	100%

it is evident that once a loan progresses to this state, it has more of a chance of moving into a 360-days-arrears position than it has of progressing back to a performing position.

To model the transition intensities from one state to another, a proportional hazard model is adopted, where the dependent variable, the rate of progression from one state to another, is bounded between 0 and 1.

$$\lambda_{A,B}(t,z) = \lambda_{A,B,0}(t) exp\{\beta_{A,B,1} Vint_i + \beta_{A,B,2} Vint_i^2 + \beta_{A,B,3} LTV_i + \beta_{A,B,4} URX_i^{N3}\}, \quad (6)$$

where $Vint$ is the vintage of the loan, LTV is the loan-to-value ratio, and URX^{N3} is the unemployment rate in the NUTS 3 region the loan is based in. The results of the different models are summarized in table 9. In general, LTV and unemployment have positive (negative) coefficients on the deteriorating (improving) transitions. Estimates show that a 1 percent increase in unemployment levels is associated with a 1.2 percent increase in the risk of a performing loan missing a payment in the PDH book. Delinquency rates in the BTL book are even more responsive to changes in unemployment, with the transitional rate from the performing to the 30- to

Table 9. Coefficient Estimates for Macro Effects on Transition Intensities

	PDH		BTL	
	LTV	**UN**	**LTV**	**UN**
Deteriorating Transitions				
P to 30–60 DPD	0.0063*	0.012*	0.007*	0.028*
	(0.0062, 0.0066)	(0.010, 0.013)	(0.006, 0.008)	(0.024, 0.031)
30–60 DPD to 60–90 DPD	0.0017*	−0.001	0.0036*	0.00449*
	(0.0014, 0.0020)	(−0.0036, 0.0005)	(0.0031, 0.0041)	(0.0001, 0.009)
60–90 DPD to 90–360 DPD	0.0002	−0.001*	0.0019*	0.0028
	(−0.0001, 0.0005)	(−0.004, 0.0004)	(0.0013, 0.0024)	(−0.0022, 0.0078)
90–360 DPD to 360+ DPD	0.0001	0.0033*	0.0013*	0.0119*
	(−0.0001, 0.0002)	(−0.0004, 0.044)	(0.0004, 0.00023)	(0.003, 0.020)
Improving Transitions				
30–60 DPD to P	−0.0033*	−0.009*	−0.004*	0.002
	(−0.0035, −0.0031)	(−0.01, −0.007)	(−0.005, −0.003)	(−0.002, 0.006)
60–90 DPD to 30–60 DPD	−0.0041*	−0.007*	−0.0046*	−0.0075*
	(−0.0045, −0.0037)	(−0.0102, −0.0037)	(−0.0056, −0.0037)	(−0.008, −0.006)
90–360 DPD to 60–90 DPD	−0.0062*	−0.019*	−0.007*	−0.012*
	(−0.0057, −0.0056)	(−0.0234, −0.015)	(−0.008, −0.006)	(−0.022, −0.001)

Notes: P = performing and DPD = days past due. This table shows the LTV and UN coefficients for each transition intensity in the proportional hazard model, $\lambda_{A,B}(z) = \lambda_{A,B,0} exp\{z^T \cdot \beta_{A,B}\}$, where λ is the transition intensity between states A and B (e.g., P to 30–60 DPD), z^T is a covariate vector containing $Vint_{t,i}, Vint^2_{t,i}, LTV_{t,i}$, and $UN_{12,t,i}$—the number of months since origination, number of months since origination squared, current loan-to-value ratio, and regional unemployment at the loan level. The 95 percent confidence intervals for coefficients are given in parentheses. * denotes significance with 95 percent confidence. Other possible transition paths (i.e., 60–90 DPD to P, 90–360 DPD to 30–60 DPD, and 90–360 DPD to P) are not estimated due to the limited number of transitions on these paths—less than 0.5 percent of all transitions. Any loan moving from 90–360 DPD to P is assumed to travel through 30–60 DPD and 60–90 DPD.

60-days-past-due (DPD) cohort increasing by 2.8 percent due to a 1 percent increase in the rate of unemployment.

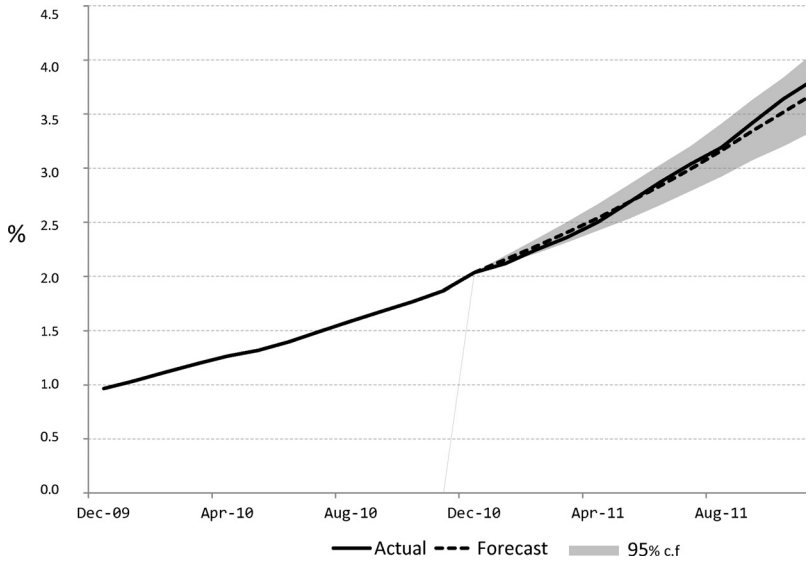
Unemployment also plays an important role in the cure rates for delinquent loans. There is a 2 percent increase in the cure rate for loans 90–360 DPD to 60–90 DPD for a 1-percentage-point fall in unemployment levels. This effect is weaker for the BTL segment, with a 1.2 percent increase in the same cure rate. With almost one-quarter of BTL borrowers also having a PDH loan, these results are consistent with the behavioral hypothesis whereby individuals prioritize payment of PDH loans over those for investment purposes. In the event of job loss, these individuals are more likely to service the mortgage on their primary dwelling and are more likely to cure arrears on the PDH loan upon reentry to the labor market.

While significant, the effect of house price movements, through current LTV, is weaker. An increase of one in the current LTV level results in a 0.5 percent increase in the hazard rate of loans from performing to 30–60 DPD. If part of the loan delinquency rates can be explained by borrowers' behavior when the loan enters negative equity, default probabilities could exhibit a non-linear relationship with LTV ratios. While house prices and unemployment movements are modeled linearly at the individual transition level, given that ten different transitions are modeled in total, the cumulative effect could well be non-linear. Furthermore, the large cross-sectional dimension of the data does allow for coefficient estimation across a wide range of loan-to-value ratios.

Given the importance of the forecast results for the overall exercise, we conduct an out-of sample test of the predictive ability of the migration model. Transition intensities are estimated over the sub-sample December 2009 to December 2010 and arrear pools are then forecast through 2011. Figure 4 presents the actual and forecast changes in the default (360+ DPD) pool, with 95 percent confidence intervals generated via bootstrapping.[13] As can be seen, the model provides an accurate estimate of the arrears trends through 2011, with only a small level of forecast error. The forecast always remains within the 95 percent confidence bands.

[13]The bootstrapping is conducted with 100,000 replications.

Figure 4. Out-of-Sample Forecast of PDH Default Pool (360+ DPD) January–December 2011



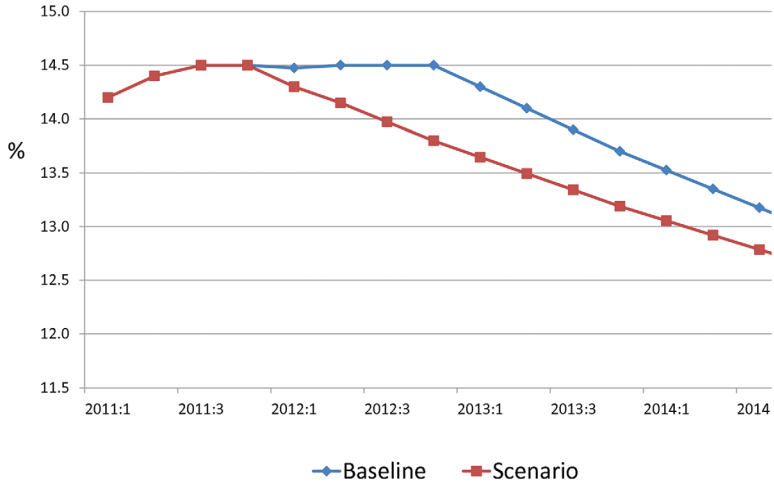
3. Forecasts and Policy Scenario

Taking the results of (4) and (5), we now generate three-year loan loss forecasts over the period 2012 to 2014 for the main Irish financial institutions. Two sets of forecasts are provided—an initial "baseline" forecast, which is the most likely envisaged outcome at this stage, and a scenario forecast, which captures the impact of a fiscal stimulus on the LLFs. From (5), it is clear that future paths are required for unemployment and house prices in order to generate forecasts of the different transition rates. Given the relationship between house prices and unemployment in (4), however, our framework suggests that all that is required is future unemployment rates and population levels.

Future population levels are taken from EuroStat,[14] which suggests an annual increase in Irish population levels between 2011 and

[14]See the European Commission website for details: http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search-database.

Figure 5. Baseline and Scenario Unemployment Forecasts: 2012:Q1–2014:Q4



2015 of 0.15 percent. For the unemployment rate, we take the latest forecasts from the International Monetary Fund's Article IV publication.[15] The initial baseline forecast for unemployment is presented in figure 5 and shows a gradual improvement in the Irish labor market, with unemployment rates falling to 13 percent by 2014. In figure 6, the corresponding house price forecast is generated, with prices expected to decline before recovering throughout the forecast period. By end 2014, prices are forecast to be 7 percent up on levels at the end of 2011, while still over 40 percent down on the peak level in early 2007. Feeding these forecasts through the LLF model yields the baseline future loss rate in figure 7—losses increase from 3 percent of the book in 2012 to almost 8 percent by 2014.

3.1 Scenario

To gauge the impact of a fiscal stimulus, we use the results of an existing structural model of the Irish economy—the HERMES model estimated and maintained by the Economic and Social Research

[15]For more on the Article IV for Ireland, see http://www.imf.org/external/country/irl/index.htm.

Figure 6. Baseline Real House Price Forecast: 2012:Q1–2014:Q4

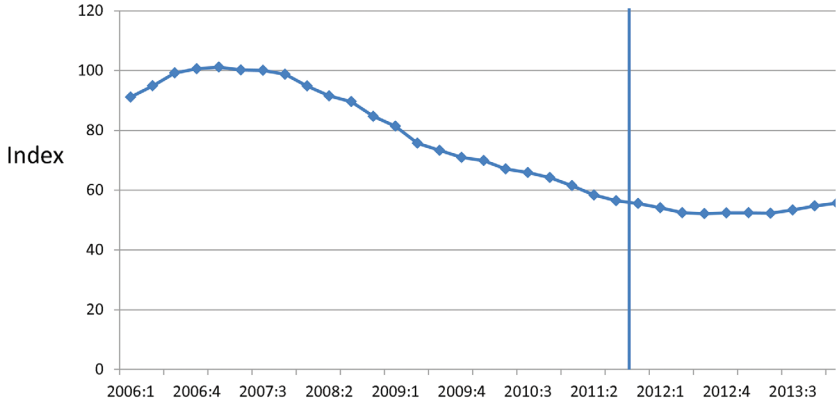
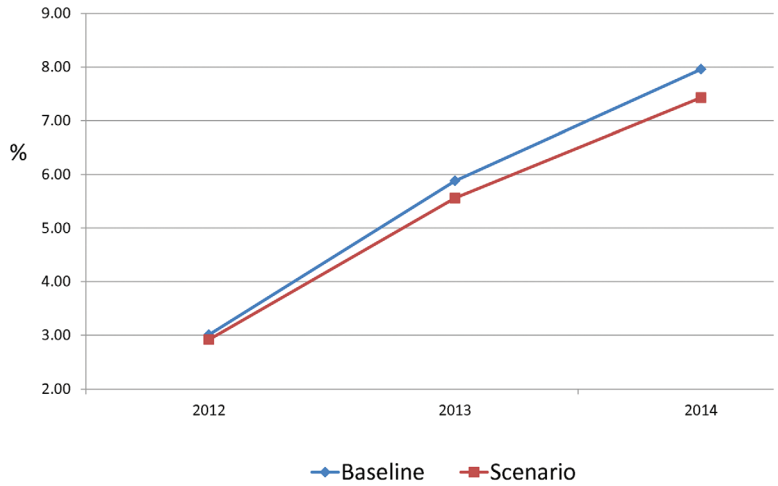


Figure 7. Baseline and Scenario Loan Loss Forecast Rates: 2012–14



Institute (ESRI).[16] While there have been other recent efforts at estimating the responsiveness of Irish economy activity to fiscal stimuli (see Bénétrix and Lane 2009, for example), we note the arguments cited by Coenen et al. (2010) in favor of using structural models such

[16]For more details of the ESRI, see http://www.esri.ie.

as HERMES to quantify the effects of policy changes. The HERMES model, which estimates the supply side of a small open economy, separates economic activity in the Irish economy into traded and non-traded components. It was first estimated in the 1980s (Bradley et al. 1993), and the most recent specification of the model is outlined in Conefrey and FitzGerald (2009). Consequently, the model can be taken to incorporate a significant amount of information and empirical evidence of the Irish economy. The particular scenario results used in this analysis are presented originally in Bergin et al. (2010), where an array of different scenarios are performed, including changes in wage rates, personal taxation rates, and public investment.

We take the results of the change in public investment scenario outlined in table 8 of Bergin et al. (2010). The original scenario is a cut in expenditure of €1 billion; however, for illustrative purposes we take an increase of €2 billion.[17] The scenario only takes into account the demand side of the impact on investment. It does not, for example, take into account the longer-term supply-side impact of increasing national output and productivity as a result of the greater level of public infrastructure. Other research such as FitzGerald and Morgenroth (2006) has illustrated the importance of this omitted supply-side channel on national output. Also, it is worth noting that the implicit fiscal multiplier in HERMES reports a relatively minor effect for output and employment to such changes[18]—this contrasts with other recent studies such as O'Farrell (2012) in an Irish context[19] and a cross-country application by Blanchard and Leigh (2013), which suggests a possible range of 0.9 and 1.7 for the multiplier in a period of depressed economic activity.

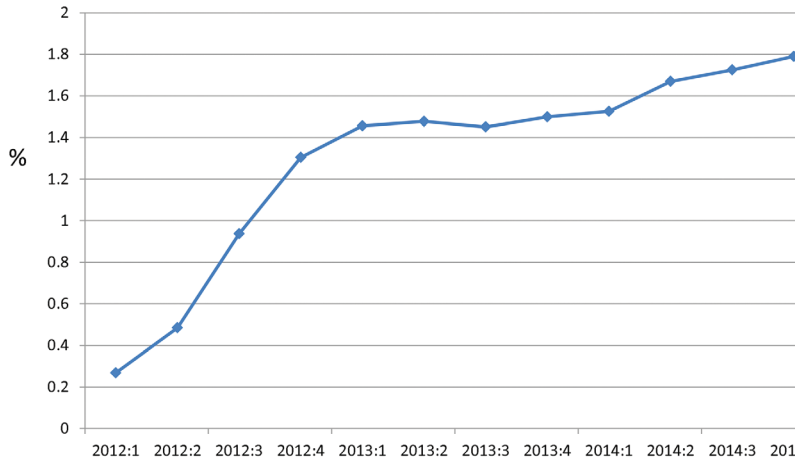
The HERMES model framework does allow for some "crowding-out" effects. For example, as currently modeled, the investment shock increases labor demand and wages, with negative implications for competitiveness. As a result, some manufacturing output does get "crowded out." The modeling framework does not address unused

[17]The results of the HERMES model are symmetric and linear; thus, scenario results can be interpreted in this manner.

[18]GDP increases by 0.3 percent in the first year due to an increase in expenditure of €1 billion.

[19]This suggests a GDP multiplier in the first year of a €1 billion stimulus of 1.6.

Figure 8. Scenario House Price Percentage Improvement Relative to Baseline 2012–14



capacity in the economy. However, it can be argued that with the present unemployment rate of 14 percent, a small government stimulus is unlikely to result in significant upward wage pressures or labor market tightening, and therefore the crowding-out effect may not be as binding in the current economic environment.

More generally, the issue of crowding out is of particular interest in an Irish context. Giavazzi and Pagano (1990), in a noted contribution, suggested the presence of an expansionary expectational effect amongst Irish households vis-à-vis the fiscal consolidation policies pursued in the late 1980s. However, Bradley and Whelan (1997), using a small structural model, query this result, arguing that the positive growth experienced in the economy at that time was more due to external factors than household expectations.

The resulting impact on unemployment can be observed from figure 8, with the "scenario" rate in 2014 almost half a percentage point below the baseline. When the lower unemployment rate is fed through the short-run house price model (4), the difference between the two house price forecasts can be observed in figure 8. By the end of the forecast horizon, the new scenario price is almost 2 percent above the baseline. After simulating the credit risk models for both PDHs and BTLs, the subsequent scenario future loss rate

Table 10. Difference in Three-Year Losses (€ million): 2012–14

Loan Type	Outstanding Amount	Difference between Scenarios
PDH	111,989	303
BTL	29,487	360
Total		663

is plotted in figure 7, along with the baseline rate. While the difference between the two loss rates would appear to be quite small (approximately 0.5 percent by 2014), these rates are applied to very large numbers. Table 10 outlines the outstanding levels of both the PDH and BTL mortgage books. When the loss rates are applied for the two different forecasts, the overall difference and savings in bank capital loss terms as a result of the stimulus is just over €660 million.

3.2 Implications for Government Debt Financing

Our analysis does not include other potential benefits from such a stimulus—for example, the increased tax revenue, reductions in welfare expenditure, and greater consumption levels—which would inevitably occur. Additionally, it is worth pointing out that the other non-mortgage loan books of the FMP institutions also face credit risk issues—significant losses have been forecast, for example, for the small and medium-sized enterprises (SMEs) books of Irish institutions. A fiscal stimulus is also likely to reduce future capital losses associated with these books.

As a final calculation, we examine the net impact of such a stimulus on the government debt—this is particularly warranted given the precarious nature of the Irish public finances post-2007. From table 8 of Bergin et al. (2010), the cumulative borrowing requirement after three years associated with such a stimulus is €1,290 million. While there is still a net cost to the exchequer of such a policy, the €660 million savings in capital losses does reduce the borrowing requirement for such a stimulus by over half.[20]

[20]In the simulations of HERMES used to generate the policy scenario, a risk premium of 2 percentage points above the German borrowing rate is applied to Irish government borrowing.

A macroeconomic policy response of this nature does give rise to certain moral hazard concerns as well as the possibility of both supply- and demand-side distortions in the housing market. Some borrowers and lenders may incorporate such a response into future decision making, thereby giving rise to the possibility of excessively risky behavior. However, the likelihood of such effects must be balanced by the scale of the present difficulties in the Irish market. With between 40 and 50 percent of mortgaged households experiencing negative equity and a quarter of mortgages in some form of repayment distress, the capability of prudential policies alone to resolve the Irish mortgage crisis is debatable.

4. Conclusions

Identifying the appropriate policy response to an issue the scale of the Irish mortgage crisis poses a considerable challenge. The guarantee, by the sovereign, of all liabilities and deposits of the Irish banking system in September 2008 has effectively left the State responsible for the solvency positions of these institutions. Consequently, a continued deterioration in the levels of mortgage distress heightens the institutions' credit risk, resulting in the Irish State having to foot any ensuing capital shortfall. To date, the policy response has mainly consisted of forbearance practices, with financial institutions gradually under pressure to tailor different modification strategies. Legislative uncertainty has also impeded a more efficient resolution of the crisis. In particular, the delay in the introduction of the proposed "personal insolvency legislation"[21] and the

[21] On January 25, 2012, the Irish government approved and published the heads of the proposed Personal Insolvency Bill. The Bill proposes the introduction of three non-judicial debt-settlement arrangements and a reform of the existing bankruptcy regime. The new arrangements will allow for the write-down or restructuring of both secured and unsecured debt owed by certain eligible individuals. There has been general agreement that changes to the existing regimes for the resolution of personal insolvency have been necessary for some time and the proposals contained within the Draft Bill build upon those contained in a report of the Irish Law Reform Commission on Personal Debt Management and Debt Enforcement published in 2010. The Draft Bill was also preceded by the publication of a report by the Mortgage Arrears and Personal Debt Expert Group in 2010 and a report by the government's Inter-Departmental Mortgage Arrears Working Group (the Keane group) in September 2011.

implications of the Dunne ruling in 2009[22] have significantly reduced the available policy options.

Using a number of different empirical models, this analysis demonstrates that the unique relationship between the Irish sovereign and its main financial institutions has implications for the net cost of a fiscal stimulus. A growing body of evidence is now available that suggests a close relationship between developments in the Irish labor market and mortgage distress levels.[23] This is particularly the case in an Irish context, where a substantial number of mortgage loans were taken out over a period of very high house prices (2005–7), consequently rendering many mortgaged Irish households vulnerable to unemployment-related income shocks.

Therefore, government policies that return distressed households to employment are likely to yield an additional benefit above and beyond that traditionally considered. Namely, by alleviating levels of mortgage distress, the solvency position of these institutions is ameliorated, thereby reducing the Irish State's future capital obligations. This impact on the sovereign's fiscal accounts, while of particular interest in the case of Ireland, is also worthy of consideration in other countries where the financial system is also experiencing significant loan impairment issues.

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[22]The Dunne ruling in December 2009, in effect, declared the entire law on repossessions in the Irish market to be invalid. The ruling stated that where the actual proceedings themselves or a letter demanding possession had been made after December 1, 2009, lenders had no right to obtain possession. The reason for this decision is a gap which arose from the introduction of a new act—namely, the Land and Convincing Law Reform Act 2009, which replaced previous acts, including the Registration of Title Act 1964. In repealing the 1964 Act, the 2009 Act failed to save elements of the 1964 Act which would have permitted lenders to repossess properties where mortgages were taken out before December 2009 and which went into arrears after that date.

[23]See Lydon and McCarthy (2011), for example.

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