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POLICY PAPER

Quantifying Revenue Windfalls from the Irish Housing Market

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Abstract: The speed and severity of the decline in the Irish fiscal position in recent years raises a number of important issues regarding the assessment of fiscal policy within the EU. From a position of relative strength, with large surpluses and a low debt to GDP ratio, the Irish public finances have rapidly deteriorated, culminating in an Excessive Deficit Procedure being launched in early 2009. In hindsight, it is evident that tax revenues were on an unsustainable path in recent years due, in large part, to structural imbalances within the economy, mainly associated with the housing market. The excess growth in the latter culminated in large and transitory tax revenue windfalls, which ultimately proved unsustainable. These windfalls contributed to large general government and cyclically adjusted budget surpluses. This paper seeks to quantify the windfall gains associated with property taxes through modelling housing related tax receipts over the period 2002 to 2009. From this, estimates are derived as to the underlying or property adjusted fiscal position, which is found in various years, to have diverged greatly from actual outturns.

I INTRODUCTION

Recent Irish fiscal performance lies in sharp contrast with developments over the previous decade when Ireland was in many senses the "model economy" in a European Union context. Up to 2007 the combination of a low

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debt and robust surpluses, according to the standard EU fiscal assessment criteria, meant that the Irish budgetary position was the envy of many in Europe. The fiscal performance was helped initially by robust export led growth in the period to 2002, followed by tax intensive domestic demand. In 2006, Ireland recorded a General Government Surplus of 3 per cent of GDP, which at the time was the second largest surplus in the Euro Area. Furthermore, the debt to GDP ratio in Ireland at 25 per cent of GDP, was the second lowest in the Euro Area. This apparently robust fiscal position was reflected in a lower yield on Irish sovereign bonds relative to the traditional safe haven German bund as well as by "AAA" credit ratings.

While underlying fiscal positions have weakened appreciably throughout the Euro Area and the EU, the speed and magnitude of the deterioration in Ireland stands out. In 2009, the estimated General Government Deficit in the Euro Area was 6.3 per cent, compared with an estimated deficit of 14.3 per cent in Ireland. Furthermore, the gross debt ratio in Ireland more than doubled between 2007 and 2009. The deterioration in Ireland's fiscal performance in both absolute terms and relative to the Euro Area has been accompanied by a rapid increase in the yield and spread on Irish government bonds and a series of downgrades from the "AAA" mark by credit rating agencies. A summary of statistics outlining the dramatic change in Ireland's relative fiscal performance are presented in Table 1.

Table 1: *Summary of Select Public Finance Data: Ireland and the Euro Area*

	2000-05	*2006*	*2007*	*2008*	*2009e*
	General Government Balance, % of GDP				
Ireland	1.5	3.0	0.1	–7.3	–14.3
Euro Area	–2.1	–1.3	–0.6	–2.0	–6.4
	Gross Debt, % of GDP				
Ireland	32.2	24.9	25.0	43.9	64.0
Euro Area	69.2	68.7	66.2	69.7	78.7
	Irish 10 year Sovereign Bonds, averages %				
Yield	4.45	3.74	4.24	4.42	5.24*
Spread Relative to German Bund	0.05	–0.04	0.01	0.43	2.05

Source: Datastream and European Commission for fiscal variables. Yield* and spread for 2009 are measured over the first half of the year.

Much of the deterioration in the Irish fiscal position has been caused by a sharp macroeconomic slowdown, which has been amplified by a financial and

global economic crisis. At the same time, the unwinding of structural imbalances within the economy primarily as a result of an overheated property market has also been a major contributory factor. Tax receipts associated with property construction soared over the period 2002-2007, however, the level of housing construction underpinning this was clearly unsustainable as has been evidenced by the dramatic fall off in activity levels since. To put Ireland's supply of residential housing in perspective, on average between 2002 and 2007 over 75,000 houses were built in the country per annum, in the United Kingdom for the same period, just over two and half times that amount was built despite the UK's population being 14 times that of Ireland's.

In this paper, we seek to quantify the impact of this obvious disequilibrium in the housing market on exchequer tax receipts. In particular, we focus on two large components of taxation receipts, which are directly affected by housing market activity – stamp duty and value added tax (VAT) receipts. The windfalls associated with these taxes cannot be easily captured by standard cyclical adjustment measures and are difficult to model due to their volatility and the absence of appropriate tax bases. Instead we relate receipts of both tax items to standard activity measures of the housing market – price levels and housing supply. Then drawing on previous work done on the housing market, we are able to estimate tax receipts for both categories, which are equivalent to what *fundamental* levels of activity in the housing market were over the period 2002-2009. By fundamental, we mean the level which is compatible with the level of economic variables such as income and interest rates. We then contrast the receipts associated with fundamental activity with actual receipts to quantify what the windfall amounts are.

Of course activity from the housing market also affects general taxation receipts such as personal income tax through the number of people employed in the sector and also in ancillary services (e.g. real estate, banking, etc.) with associated multiplier effects on incomes, consumer spending and company profits.[1] These indirect effects, however, are extremely difficult to quantify with any degree of certainty and hence are not focused on here, but would have contributed to stronger income and consumer spending related tax receipts.

In this paper, we concentrate on the direct effects of housing on taxation, with particular emphasis on stamp duty and VAT receipts as these taxes are closely aligned with housing market developments. We believe that by drawing upon existing studies of the property market in tackling this question, we are providing an interesting dimension to an issue, which is

[1] The increase in employment in the construction sector was substantial, at the outset of 2002 almost 185,000 people were employed, whereas by 2007 this had risen to 267,000.

attracting increasing attention from the likes of the European Commission, the OECD and the European Central Bank.[2]

The rest of the paper is structured as follows: in the next section we outline the different tax categories and the magnitude of their increases over the period in question, we also provide a brief literature review of studies seeking to quantify tax windfalls. The underlying models used to determine what the fundamental level of taxation receipts are, are then presented in Section III, followed by empirical results in Section IV. A final Section offers some concluding comments.

II BACKGROUND ON PROPERTY RELATED TAX RECEIPTS

Tax receipts in Ireland increased very sharply during the domestic-demand driven period between 2002 and 2007. On an Exchequer basis, tax revenues increased by over 9 per cent per annum over this period, reaching a peak of €47.2 billion (25 per cent of GDP) in 2007. While there is no specific property tax in Ireland, the housing market influences tax receipts directly and indirectly. In terms of the former, three of the main tax categories in Ireland are heavily influenced by activity levels within the housing market, namely, stamp duty, capital gains tax (CGT) and VAT receipts (see Table 2). These taxes recorded exceptionally strong annual rates of increase over the period. Stamp duties and CGT recorded the strongest increases with average annual rates of increase of 19.3 and 32.3 per cent respectively. VAT increased by just over 10 per cent per annum. It is important to note, however, that only a certain proportion of these taxes can be directly attributed to housing related transactions, which is elaborated upon below.

Table 2: *Stamp Duty, Capital Gains (CGT) and Value Added (VAT) Receipts in 2002 and 2007*

	2002		*2007*		*Average*
	Euros Millions	*Share of Tax Revenue*	*Euros Millions*	*Share of Tax Revenue*	*Increase Per Cent*
Stamp Duty	1,167	4.0	3,186	6.7	19.3
CGT	628	2.1	3,105	6.6	32.3
VAT	8,885	30.3	14,497	30.7	10.6
Total Revenue	29,294	100.0	47,249	100.0	9.2

Source: Department of Finance, Exchequer Returns.

[2] We refer to specific studies in a literature review section.

We now look at the individual tax components directly affected by the housing market. In Table 3 we summarise both the share of the individual tax component attributable to residential construction along with the components share of total tax revenue.

Table 3: *Individual Tax Components Residential Contribution and Share of Total Tax Revenue*

	Residential Share of Component Per Cent			*Component Share of Total Revenue Per Cent*		
	Stamp	*VAT*	*CGT*	*Stamp*	*VAT*	*CGT*
2002	57.1	16.2	31.7	4.0	30.3	2.1
2003	63.7	19.3	32.2	5.3	30.3	4.5
2004	70.0	21.8	28.8	5.9	30.1	4.3
2005	73.5	23.5	29.8	6.9	30.8	5.0
2006	80.4	24.1	31.1	8.2	29.5	6.8
2007	74.7	21.1	27.7	6.7	30.7	6.6
2008	63.3	13.9	27.7	4.0	32.9	3.5

Source: Revenue Commissioners and Department of Finance. Authors' estimates based on CGT subdivided according to consideration values and asset type.

2.1 *Stamp Duty*

Stamp duties are payable on a wide range of legal and commercial documents, including conveyances of property, leases of property and shares. Receipts grew rapidly in the 5 year period to 2007, doubling as a share of overall tax revenue (see Table 3). Much of the increase in stamp duty receipts reflected robust activity within the housing market and, in particular, a marked increase in housing transactions. Table 3 shows that land and property related transactions, account for the bulk of stamp duty receipts. All other things being equal, residential property related stamp duty receipts should reflect the number and the value of houses bought and sold in a period, although first-time buyers are generally exempt from duty.

2.2 *VAT*

Value added tax (VAT) is the most important source of tax revenue in Ireland and is payable on new housing at the lower rate of 13.5 per cent. It is possible to attain VAT receipts attributable to new housing. Table 3 shows that value added tax on new housing increased as a share of overall receipts in recent years and accounted for nearly a quarter of all VAT receipts in 2007. As is the case with stamp duty, only the residential specific part of VAT receipts is focused upon.

2.3 *CGT*

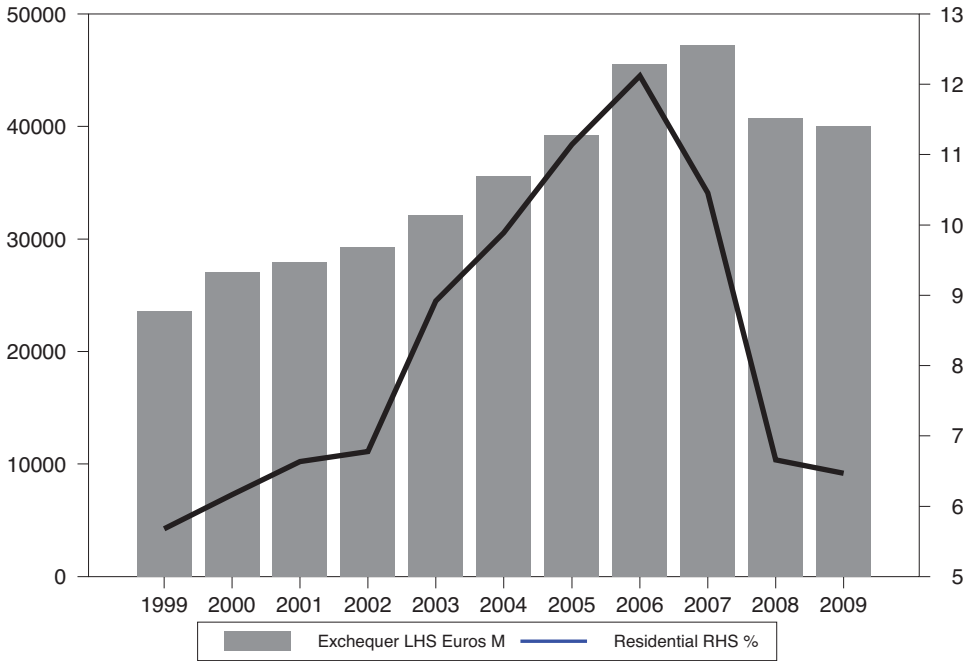
Capital gains tax is driven by activity and profitability levels in asset markets, principally property and equity. Tax receipts arising from this source increased significantly and more than trebled as a share of total tax revenue between 2002 and 2007, with annual average growth of 32 per cent. A breakdown of CGT into asset types is not readily available but can be estimated according to reference aggregate consideration values across broad asset categories. From this, the contribution from housing can be estimated. It is evident that property related transactions account for a sizable proportion of CGT receipts. In terms of actual receipts, the CGT series tends to be highly seasonal and lumpy, with for example, three-quarters of annual receipts in the peak years of 2006 and 2007 received in just two specific months (February and November).

2.4 *Summary*

The increasing importance of property related taxes in recent years in Ireland is very evident. In Figure 1 we plot both total exchequer returns and the percentage coming from residential construction. These developments have been a feature common to a number of countries within the Euro Area and the OECD and has been the subject of a number of studies. In particular, Joumard and Andre (2008) assessed revenue buoyancy in a number of developed economies and noted that the recent housing boom generated significant revenues from transactions taxes, notably in Ireland between 2003 and 2006. Similarly, the European Commission (2009) highlighted the importance of revenue windfalls across the EU, where they were found to be quite large, reaching a maximum of 0.9 per cent of GDP in 2006 in the Euro Area. In a panel analysis covering the period 1999 to 2007, for the case of Ireland, the Commission reported that revenue windfalls appeared to be linked to developments in asset prices. Furthermore, the same report highlighted the danger of interpreting revenue windfalls associated with asset price booms as permanent improvements in the underlying budgetary position. The need to improve the identification of these windfalls (as well as forecasting) was also highlighted particularly for taxes associated with volatile asset classes.

The relationship between asset prices and fiscal revenues was examined in a paper by Morris and Schuknecht (2007). In the case of 16 OECD countries, they found evidence that asset prices were a significant factor in driving unexplained changes in the cyclically adjusted budget balance, which if not accounted for, could lead to erroneous public finance conclusions. The authors recommended that asset price movements should be taken account of in fiscal monitoring exercises, particularly during times marked by buoyant real estate

Figure 1: *Total Exchequer Returns and Percentage Coming from Residential Construction*



and equity markets. A more recent paper by Morris *et al.* (2009) examined government revenue windfalls across a range of EU countries including Ireland and explicitly tried to model these windfalls, which were found to exert a largely cyclical pattern and mainly driven by profit related taxes and in a number of cases by developments in housing markets. In the case of Ireland over the period from 1998 to 2007, revenue windfalls were found to be prevalent in seven of the ten years. In particular, significant windfalls were found in the cases of VAT and stamp duty receipts, notably in 2005 and 2006. A recent paper by Lutz (2008) examined the relationship between property taxes and house prices in the US, with the former found to be quite responsive to changes in house prices although there was quite a lag in terms of the time it took for house price appreciation to feed through to property taxes.

In summary, "revenue windfalls" appear to have been extremely prevalent in recent years. Property related windfalls are, however, notoriously difficult to model due to their volatility and also due to the absence of appropriate tax bases and/or a breakdown in the standard tax base-elasticity relationship. This point was recognised in a recent comprehensive review of tax forecasting in Ireland by a Department of Finance Working Group (2008). This report

found that capital taxes "... are inherently difficult to forecast accurately and it is not clear that any meaningful improvements are possible". As a result, the Report argued for caution in attempting to model such taxes. Part of the motivation for this paper, lies in trying to get a measure of property related tax windfalls.

III MODELLING APPROACH

In light of the above, the aim of this paper is to estimate the property windfall component of tax revenue receipts as a result of disequilibrium in the Irish housing market. To do this we model the tax components as a function of variables proxying for activity in the housing sector. We discuss our choice of activity variables in the next section. We then estimate what the "fundamental" level of activity would have been in the Irish housing sector over the period 2002-2009. By the "fundamental" level, we mean the long-run level, which would have been compatible with the level of fundamental variables, such as interest rates and income levels in the economy, over the period. Using our models for the taxation items, we then solve for the taxation receipts compatible with fundamental activity. The difference between this level and actual receipts constitutes the revenue windfall.

As discussed above, there are three main property related taxes, namely stamp duty, VAT and CGT. Using publically available data, it was possible to subdivide these taxes into a residential property component. Each series was then deseasonalised, which is elaborated upon below. In the case of CGT however, housing related tax receipts proved to be highly seasonal. The resultant deseasonalised data proved to be unsatisfactory and, as a result, this series was omitted from the analysis. It was decided to proceed by concentrating on VAT and stamp duty residential property tax receipts.

3.1 *Indicators of Activity in the Housing Market*

In order to model housing related tax receipts a number of approaches were adopted, which broadly aimed at overcoming the problems associated with the absence of housing transactions/turnover data, of which there is no time series available. In particular, while there is readily available data on new housing units, there is no comparable series for the existing homes market. In order to proceed therefore, some alternatives were needed to mirror developments in the housing market, with the most natural choices being house price and house completions, which, combined, broadly reflect activity levels within the market.

The following variables are used in the empirical approach:

P_t = actual house prices.
B_t = amount that can be borrowed.
Y_t = disposable income per household.
R_t = mortgage interest rate.
S_t = actual residential related stamp duty receipts.
V_t = actual residential related VAT receipts.
H_t = actual housing completions.

The data is monthly and covers the period from January 2002 to June 2009. Stamp duty and VAT data are from the Department of Finance's Exchequer returns statistics. The data on house prices is from the *permanent/tsb*–ESRI national house price series. The house completions data is from the Department of the Environment, Heritage and Local Government's housing statistics database. Data on interest rates and disposable income levels is taken from the CBFSAI's macroeconomic database. Table 4 presents a summary of the data.

Table 4: *Summary of Monthly Data*

Variable	*Pneumonic*	*Mean*	*Minimum*	*Maximum*	*Units*
2002:1–2007:2					
Stamp	S	66	19	136	Euros m
Vat	V	199	46	490	Euros m
Housing Supply	H	6,269	3,513	9,899	Units
House Prices	P	246,594	180,141	311,078	Euros
Income	Y	4,735	4,213	5,667	Euros
Amount Borrowable	B	272,096	224,842	300,611	Euros
Interest Rates	R	3.91	3.46	6.04	%
2007:3–2009:6					
Stamp	S	49	12	106	Euros m
Vat	V	188	17	455	Euros m
Housing Supply	H	4,751	2,121	7,696	Units
House Prices	P	279,289	245,295	309,071	Euros
Income	Y	5,573	5,432	5,667	Euros
Amount Borrowable	B	266,376	258,317	296,588	Euros
Interest Rates	R	5.73	5.09	6.04	%
2002:1–2009:6					
Stamp	S	61	19	136	Euros m
Vat	V	196	17	490	Euros m
Housing Supply	H	5,809	2,121	9,899	Units
House Prices	P	256,513	180,141	311,078	Euros
Income	Y	4,966	4,213	5,667	Euros
Amount Borrowable	B	272,615	224,842	300,611	Euros
Interest Rates	R	4.34	3.46	6.04	%

3.2 *Modelling House Prices*

To generate a fundamental house price, we use the McQuinn and O'Reilly (2007, 2008) house price model, which focuses on the role played by the demand-side factors income and interest rates. In particular, the demand for housing is assumed to be mainly a function of the amount that prospective house purchasers can borrow from financial institutions and this, in turn, is dependent on current disposable income and the existing mortgage interest rate. The relationship between income levels, interest rates and the typical amount of a mortgage offered by a financial institution is generally based on the present value of an annuity. The annuity is the fraction of current disposable income κY_t that goes toward mortgage repayments and is discounted at the current mortgage interest rate for a horizon equal to the term of the mortgage τ. Thus, the amount that can be borrowed B_t is given by

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

This mimics the reality that people seek to maximise the amount they can borrow subject to the lending criteria of mortgage lending institutions.[3]

This expression for income and interest rates is then nested within a general model of the housing market. X_t is defined as the time-varying component of B_t:

$$X_t = Y_t \left(\frac{1 - (1 + R_t)^{-\tau}}{R_t} \right) \tag{2}$$

Both X_t and the constant κ are then incorporated within the following inverted demand function:

$$P_t^D = \kappa X_t S^{-\mu}. \tag{3}$$

An inverted housing supply equation is given by the following:

$$P_t^S = \delta S^{\phi}, \tag{4}$$

[3] The approach is closely related to the notion of a housing affordability index frequently used in assessments of the housing market. 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 δ, the intercept in the supply function, can be regarded as a standard supply side shifter. For presentational purposes, we assume a value of 30 years for τ the mortgage horizon and 30 per cent for κ the proportion of income going on the mortgage repayment. However, in empirical applications, the values are incidental, as in log estimation they are subsumed into the constant term[4].

In the short-run, supply is assumed to be inelastic, i.e. $S = \bar{S}$. Therefore, the short-run price of housing depends on the amount that can be borrowed. In order to derive the long-run equilibrium price level, we set $P_t^D = P_t^S$ and solve, yielding the following equilibrium expression for S^{LR}:

$$S^{LR} = \left(\frac{\kappa X_t}{\delta}\right)^{\frac{1}{(\phi + \mu)}}. \tag{5}$$

The corresponding expression for the long-run price is given as:

$$p^{LR} = \kappa^{\frac{\phi}{(\phi + \mu)}} \ \delta^{\frac{\mu}{(\phi + \mu)}} \ X_t^{\frac{\phi}{(\phi + \mu)}}. \tag{6}$$

Taking logs of equation (6) yields the following, where lower case denotes a variable is in log format:

$$p^{LR} = \left(\frac{\phi}{\phi + \mu}\right) \log(\kappa) + \left(\frac{\mu}{\phi + \mu}\right) \log(\delta) + \left(\frac{\phi}{\phi + \mu}\right) x_t. \tag{7}$$

Grouping the constants together, this expression can be simplified as:

$$p_t = \alpha + \psi x_t. \tag{8}$$

From the long-run model, an estimate of $\left[\frac{\phi}{\mu + \phi}\right]$ can be retrieved from the coefficient ψ. So, this price is now a function of how much can be borrowed and the own price elasticities of the demand and supply curves. The intercept α is a composite of the supply shifter δ and the parameters ϕ, μ and κ.

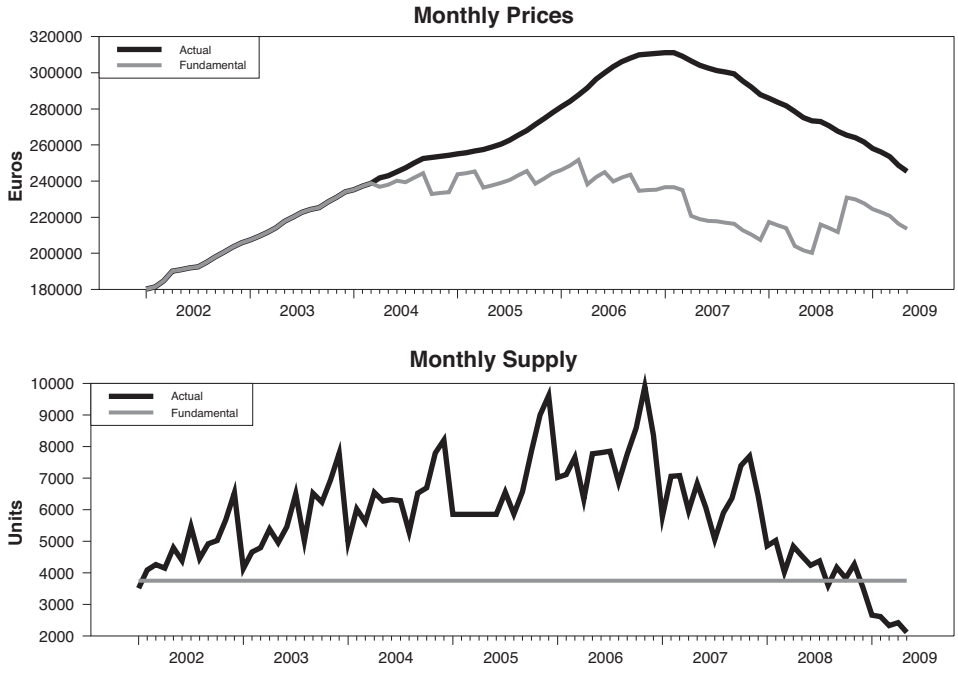
3.3 *Estimates of Housing Market Disequilibrium*

This model, equation (8), is used to generate a fundamental price for Irish housing. In particular, the fitted value from equation (8) can be regarded as

[4] The assumption of a constant proportion of income going on mortgage repayments is relatively robust when examined over a 30 year period using aggregate data. However, in earlier estimates of the model, we did test the sensitivity of the results to alternative assumptions of κ. This resulted in very small changes to the long-run estimates.

the price level justified by fundamentals within the economy – income and interest rates. In the first graph in Figure 2, we plot the actual price level with the fundamental price. From this, it can be seen that in 2007, the difference between these two prices reached a peak at approximately 30 per cent. Since then, the gap has narrowed considerably with the fall in actual prices resulting in a greater alignment of the two prices.

Figure 2: *Actual and Fundamental Irish Housing Variables 2002-2009 (June)*



Irish housing supply increased by a substantial amount over the period in question. Throughout the 1980s and early 1990s, new house completions in Ireland had averaged 25,000 units per annum. However, from 1995 onwards, supply levels escalated considerably and by 2007 over 90,000 units were built. This clearly represented an unsustainable level of supply, particularly, when considering that the equivalent level in the United Kingdom in 2007 was 210,000 units. The subsequent slowdown in Irish activity levels throughout 2008 and into 2009 has been dramatic with the annualised level for 2009 suggesting that just 25,000 units will be built. Therefore, at present, there is considerable uncertainty regarding the sustainable level of housing supply in Ireland over the medium term. Although not always directly comparable, there are nonetheless a range of estimates on medium-term housing demand

in Ireland. A relatively recent analysis of the construction sector by the Central Bank (McGuire and Smyth, 2005) estimated that the medium-term demand was somewhere in the region of 50,000 units per annum. This figure in itself was quite a significant upward revision from previous estimates. The IMF more recently estimated that the sustainable level of house completions in Ireland was between 50,000 to 70,000 units per annum. The Department of Finance estimate that the sustainable level of residential house building is in the region of 60,000 to 70,000 units per annum. We adopt a more cautious estimate and suggest that the present structural level of housing supply in Ireland is in the region of 45,000 units per annum. In the second graph in Figure 2 we plot the actual monthly supply levels between 2002 and 2009 along with the monthly equivalent of the structural level, which is 3,750 units.

3.4 *Modelling Tax Components*

The two tax components stamp duty and VAT, which we denote by the vector Q_t, are specified as a function of house prices and supply:

$$Q_t = f(P_t, H_t). \tag{9}$$

We model both items in a log-linear manner, the expression for VAT is given by:

$$v_t = \alpha_0 + \alpha_1 p_t + \alpha_2 h_t + \varepsilon_t. \tag{10}$$

while stamp duty is modelled as follows:

$$s_t = \beta_0 + \beta_1 p_t + \beta_2 h_t + \varepsilon_t. \tag{11}$$

IV EMPIRICAL RESULTS

Tax returns, when examined on a monthly basis, exhibit considerable seasonality. Much of this reflects the structure of the tax code in Ireland as well as preferences. For example, in terms of the latter and in the case of stamp duty, receipts tend to be low in the winter months before spiking in the autumn reflecting house buying preferences. As regards VAT, receipts tend to be quite lumpy, with large payments in the first month of the year. From a modelling perspective, we address this issue in a number of ways. First, we deseasonalise both the monthly residential property stamp and VAT receipts using the TRAMO/SEATS seasonal adjustment programme (Gomez and Maravall, 1996). We then compare the results with the deseasonalising option

in RATS.[5] The approach in RATS follows that of Sims (1974) by removing all power from frequencies in a band about the seasonals. Finally, we use rolling averages of the data. We estimate the long-run models in the analysis with the resulting data from the different deseasonalising approaches. The results are almost identical between the TRAMO/SEATS and RATS approaches. Therefore, for our final estimates, we use the RATS approach.

In Table 5, we present the time-series properties of the different variables. The two unit root tests are the standard Augmented Dickey-Fuller t-test and the ADF^{GLS} test of Elliot, Rothenberg and Stock (1996) which has superior power to the ADF test. For each test, the lag length for the test regressions was chosen using Ng and Perron's Modified AIC procedure. In both cases, the tests fail to reject the unit root hypothesis at the 5 per cent level of significance for all three variables. We also find strong evidence of cointegration between the individual tax items and the two housing indicator variables – prices and supply. Based on this, we then proceed to our long-run estimation.

Table 5: *Unit Root and Cointegration Results*

Test	s_t	v_t	p_t	h_t	5%
Unit Root					
ADF t-test	0.118	–0.159	–2.187	0.343	–2.89
ADF^{GLS}	0.199	–0.365	–4.144	3.699	–13.7
Cointegration					
Engle-Granger	–5.399	–9.651			–3.37

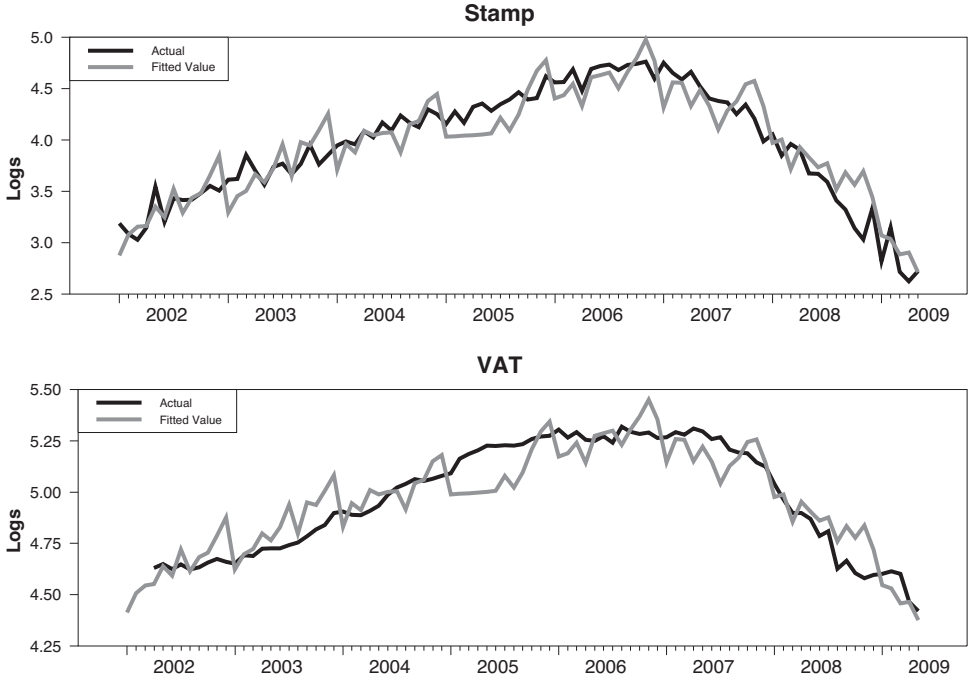
Note: s_t is the log of stamp duty levels, v_t is the log of vat receipts, p_t is the log of house prices and h_t is the log of housing supply. The cointegration test is conducted on the residuals from the regression of the individual tax item on both house prices and supply levels. The sample period is monthly and runs from 2002:1–2009:6.

In modelling the two long-run relationships, given by (10) and (11), we use a variety of long-run estimators. Along with the OLS estimator, 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 (2008).

[5] For details of this procedure in RATS see page 571 of the *Users Manual*.

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.[6] 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.[7] In addition to DOLS estimates, we also estimate the long-run cointegrating relationship using Philips and Hansen's (1990) fully modified ordinary least squares estimator (FM-OLS). This method corrects OLS for possible serial correlation and endogenity in the regressors that results from the existence of a cointegrating relationship.

Figure 3: *Model Results for Stamp and VAT Receipts 2002-2009 (June)*



[6] The error terms in equations (10) and (11) are 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.

[7] 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.

The results from the long run estimation are presented in Table 6. In the case of both taxes, all three estimators report similar coefficients for the house price and housing supply variables. This consistency of estimates is reassuring. As the estimation is in logs, all coefficients can be interpreted as elasticities. Both variables are highly significant for both taxes, with the house price variable having a marginally larger effect. In Figure 3, we plot the actual tax level with the fitted value based on the OLS estimates. From the graph, the fitted values can be seen to track the actual levels quite well. It is also evident from the graph that tax revenues, in both cases, peaked in late 2006/ early 2007 and fell significantly from the latter part of 2007 onwards.

Given the cointegrating relationship, we also estimate two short-run models based on the long-run estimates in Table 6. The results in Table 7, reveal significant error correction in both cases, but with two different speeds of adjustment. In the case of VAT receipts, any disequilibrium is corrected almost instantaneously, while for stamp duty, the period of adjustment takes approximately five months.

Table 6: *Long-Run Estimates of Stamp and VAT Models*

		Estimator	
Dependent Variable s_t	*OLS*	*DOLS*	*FM-OLS*
p_t	1.500	1.694	1.608
	(0.159)	(0.304)	(0.370)
h_t	1.241	1.345	1.407
	(0.078)	(0.146)	(0.213)
Dependent Variable v_t	*OLS*	*DOLS*	*FM-OLS*
p_t	0.815	0.929	1.056
	(0.131)	(0.148)	(0.429)
h_t	0.573	0.601	0.584
	(0.064)	(0.071)	(0.247)

Note: Standard errors are in parenthesis, sample period is monthly and runs from 2002:1–2009:6.

4.1 *Quantifying Windfalls*

Using the long-run OLS results presented in Table 6, we solve for what the level of taxation receipts compatible with fundamental housing activity levels would be over the period 2002-2009. The results for stamp duty are presented in Figure 4, while those for VAT receipts are in Figure 5. In both instances, we label the fundamental tax level as the "scenario" level. The pattern is similar in both cases. By 2005 a significant difference had emerged between the two

Table 7: *Short-Run Estimates of Stamp and VAT Models*

Dependent Variable	Δs_t	Δv_t
ECT_{t-1}	–0.196	–0.967
	(0.073)	(0.104)
Δq_{t-10}	0.296	0.561
	(0.137)	(0.160)
Δq_{t-11}	0.411	0.752
	(0.137)	(0.165)
Δp_{t-2}	3.591	
	(1.840)	
Δs_t		0.870
		(0.151)
Δs_{t-12}		–0.513
		(0.147)
$\bar{R}^2$	0.20	0.63

Note: q is the dependent variable, ECT = error correction term and standard errors are in parenthesis. Sample period is monthly and runs from 2002:1–2009:6.

Figure 4: *Stamp Duty Actual and Scenario Level*

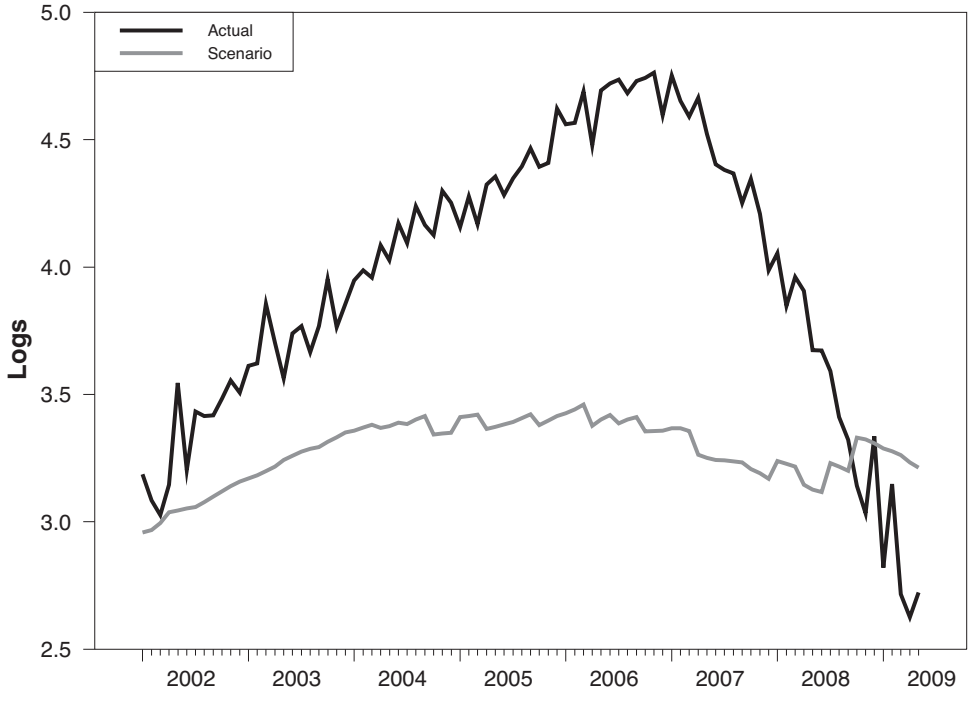
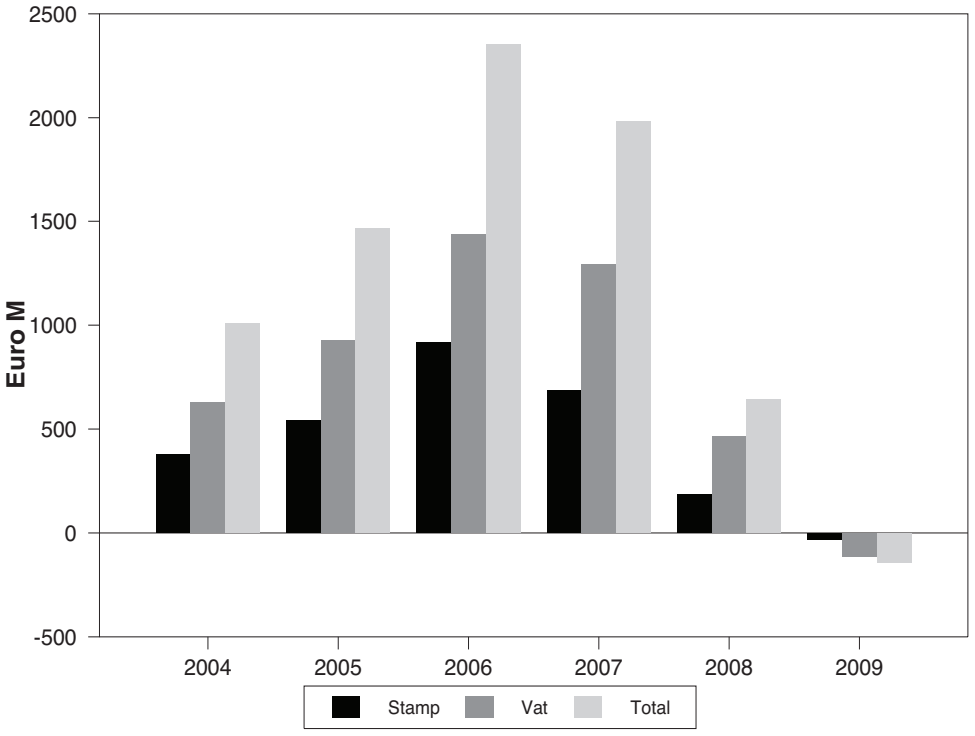


Figure 5: *VAT Actual and Scenario Level*

tax levels and the associated fundamental levels. This difference, which can be interpreted as the "windfall component" reached a peak in early 2007. Thereafter, actual and fundamental levels have become more closely aligned as activity levels in the housing sector more closely resemble what fundamental variables suggest they should be. It is worth noting that by 2009, such has been the correction in the housing market, that present activity levels would appear to be below what the fundamental level is.

In Figure 6 we summarise the annual levels of the windfall amounts for both tax categories and for the combined total. In 2006, our estimates suggest that nearly €1.5 billion of total VAT receipts were a revenue windfall, while the figure in 2007 was approximately €1.3 billion. Similarly, for stamp duty returns, revenue windfalls in 2006 were nearly €1 billion. In 2008, the windfall figures for VAT and stamp were, €462 million and €183 million respectively. In contrast, as of June 2009 it can be seen, that if housing activity were at a (higher) fundamental level compared to where it actually is, then tax receipts from VAT and stamp duty would be €150 million higher than was the case in June 2009.

Figure 6: *Annual Stamp Duty and VAT Windfalls Due to Residential Construction*



The estimates of the windfall amounts are, of course, sensitive to the underlying assumptions concerning the equilibrium house price and supply levels. We examine the sensitivity of our results, particularly to the assumptions concerning equilibrium housing supply. As stated earlier, our estimate of long-run housing supply at 45,000 units may be somewhat below comparable estimates from other agencies. Therefore, we solve equations (10) and (11) with the alternative supply levels of 55,000 units per annum and 65,000 units. In Table 8 we list the amount associated with the 45,000 units and the two alternative supply levels. It can be seen that given a higher level of equilibrium housing supply, the windfall tax revenue amount is smaller. For example in 2006, the total windfall amount for an equilibrium housing level of 45,000 units is €2.3 billion, whereas, for 55,000 units it is €2 billion and for 65,000 units, the amount is €1.8 billion. Thus, the model would suggest that an increase in the assumed housing equilibrium level of 10,000 housing units results in a decline in windfall tax levels by approximately €240 million.

Table 8: *Windfall Tax Levels Euros (m) – Supply Scenarios*

	Number of Annual Housing Units		
Year	45,000	55,000	65,000
2004	1,007	751	502
2005	1,467	1,206	953
2006	2,353	2,092	1,838
2007	1,980	1,743	1,514
2008	645	415	192
2009	–144	–242	–337

4.2 *Windfall Taxes and the Role of Mortgage Credit*

The housing model equation (8), which is used to generate the fundamental price is in terms of income and interest rates. However, a recent model by Addison-Smyth, McQuinn and O'Reilly (2009) seeks to capture the contribution to Irish house price increases of innovation in the financial sector. In particular, the model seeks to quantify the impact on average mortgage levels and house prices of Irish credit institutions access to inter-bank funding from abroad. The model can be briefly summarised as the following:

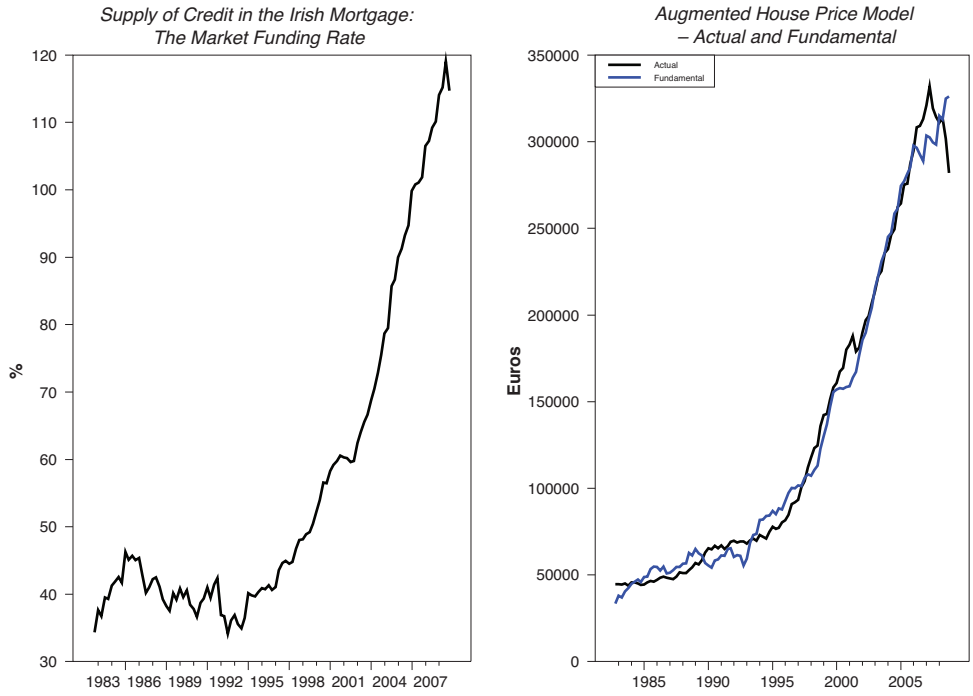
$$p_t = \rho_0 + \rho_1 x_t + \rho_2 f_t - \rho_2 k_t, \tag{12}$$

where p_t, x_t are defined previously, k_t is the stock of Irish housing and f_t is a funding rate variable. This latter variable captures the ability of Irish credit institutions to raise funds from abroad, which increased considerably in magnitude from 2001 onwards. Historically, 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. We use the funding rate variable as a means of approximating this development. This source of funding was negligible before the mid-1990s but has grown exponentially since then.[8] See Addison-Smyth, McQuinn and O'Reilly (2009) p.382 for a full discussion of the role played by financial market innovation on Irish house prices.

[8] 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.

In Figure 7 we include a graph of this funding rate and also the fundamental house price based on equation (12), i.e. with the funding rate variable included. Compared with the house price graph in Figure 2, it is apparent that almost all of the gap between actual house prices and fundamental prices based on equation (8) is now bridged due to the inclusion of the funding rate variable. Therefore, one can say that a considerable amount of the windfall taxes, which are due to the disequilibrium in prices in equations (10) and (11) are due to this large increase in credit provision brought about by financial innovation.

Figure 7: *Credit and the Irish Housing Market*



V CONCLUSIONS

While most western economies have witnessed a significant deterioration in their budgetary positions over the past two years, the Irish case has been particularly severe. The Celtic tiger's buoyant days of budgetary surpluses have quickly given way to deficits of a substantial nature. Inevitably, this deterioration has gone hand in hand with the substantial "correction", which has taken place in the Irish housing sector over the same period.

The aim of this paper, has been to determine what component of Irish stamp duty and VAT taxation receipts, over the period 2002–2009, were due to disequilibrium in the housing market. By disequilibrium, we mean where activity levels were substantially in excess of those warranted by the prevalent levels of macroeconomic variables such as interest rates and income in the economy. Stamp duty and VAT taxation receipts are explicitly modelled as a function of activity levels. Drawing on previous work done on the housing market, we are able to determine what the fundamental level of housing activity is and consequently, the associated level of taxation revenue.

Over the period 2002 to 2009, the analysis confirms that a sizable gap emerged between actual stamp duty and VAT taxation revenues and that warranted by fundamental variables. This peaked, on an annual basis, in 2006 where, we estimate the revenue windfall component to be €2.4 billion or, 1.2 per cent of GDP. In 2007, the windfall component was €2 billion. This meant, that even abstracting from the economic cycle, the actual General Government Balance in those years was artificially inflated, thus painting a misleadingly optimistic picture of the sustainability of Irish public finances. Furthermore, in light of consistently robust increases in government spending in these years and tax cuts, it fostered an over reliance on asset based tax revenues.

In terms of policy implications, the recent experience in Ireland highlights the volatile nature of asset taxes and the need to allocate these revenues in a prudent manner. Furthermore, empirical evidence shows that the volatility of government revenue is typically higher than both expenditure and the economic cycle itself. This point coupled with the difficulty in predicting turning points, which was raised recently by the ECB (2009), points to the need for windfall gains to be used to reduce deficits and debt as opposed to increasing expenditures. At a minimum, during periods in which the receipts from such taxes are increasing rapidly, they should be saved for periods in which they underperform. With this in mind, expenditure programmes and budgetary policy should be linked more closely to developments in more stable tax categories.

REFERENCES

ADDISON-SMYTH, D., K. McQUINN and G. O'REILLY, 2009. "Modelling Credit in the Irish Mortgage Market", *The Economic and Social Review*, Vol. 40, No. 4, pp. 371-392.

DEPARTMENT OF FINANCE, 2008. Report of the Tax Forecasting Methodology Review Group, February 2008, http://www.finance.gov.ie/

ELLIOTT, G., T. J. ROTHENBERG and J. H. STOCK, 1996. "Efficient Tests for an Autoregressive Unit Root", *Econometrica*, Vol. 64, pp. 813-836.

ENGLE, R. and C. GRANGER, 1987. "Cointegration and Error-Correction: Representation, Estimation and Testing", *Econometrica*, Vol. 55, pp. 251-276.

EUROPEAN CENTRAL BANK, 2009. *Annual Report 2008*, Available online at http://www.ecb.int

EUROPEAN COMMISSION, 2009. *Public Finances in EMU*. European Economy 5.

FITZPATRICK, T. and K. McQUINN, 2007. "House Prices and Mortgage Credit: Empirical Evidence for Ireland", *The Manchester School*, Vol. 75, No. 1, pp.82-103.

GOMEZ, V. and A. MARAVALL, 1996. Programs TRAMO ("Time Series Regression with Arima Noise, Missing Observations and Outliers") and SEATS "(Signal Extraction in Arima Time Series"). Instructions for the user. Working Paper 9628 (with updates), Bank of Spain: Research Department.

JOUMARD, I. and C. ANDRE, 2008. "Revenue Buoyancy and its Fiscal Policy Implications", OECD Working Paper No. 598, ECO/WKP(2008)6.

LUTZ, B., 2008. "The Connection Between House Price Appreciation and Property Tax Revenues", *Finance and Economics Discussion Series*, Division of Research and Statistics and Monetary Affairs, Washington D.C.: Federal Reserve Board.

McGUIRE, M. and D. SMYTH, 2005. "The Implications of a 'Correction' in the Residential Construction Sector", *Financial Stability Report 2005*, pp. 153-162. Central Bank and Financial Services Authority of Ireland.

McQUINN, K. and G. O'REILLY, 2007. "A Model of Cross-country House Prices", Research Technical Paper 5/RT/07, Dublin: Central Bank and Financial Services Authority of Ireland.

McQUINN, K. and G. O'REILLY, 2008. "Assessing the Role of Income and Interest Rates in Determining House Prices", *Empirical Modelling*, Vol. 25 pp. 377-390.

MORRIS, R. and L. SCHUKNECHT, 2007. "Structural Balances and Revenue Windfalls", Working Paper Series No. 737, March, European Central Bank.

MORRIS, R., F. DE CASTRO FERNÁNDEZ, S. JONK, J. KREMER, S. LINEHAN, R. M. MARINO, C. SCHALCK and O. TKACEVS, 2009. "Explaining Government Revenue Windfalls and Shortfalls: An Analysis for Selected EU Countries, Working Paper Series, No 1114, European Central Bank.

MUELLBAUER, J. and A. MURPHY, 1997. "Booms and Busts in the UK Housing Market," *Economic Journal*, Vol. 107, pp. 1701-1727.

PHILLPS, P. C. B. and B. E. HANSEN, 1990, "Statistical Inference in Instrumental Variables Regression with I(1) Processes", *Review of Economic Studies*, Vol. 57, No. 1 (January), pp. 99-125.

SIMS, C. A., 1974. "Seasonality in a Regression", *Journal of the American Statistical Association*, Vol. 69, pp. 618-626.

STOCK, J. and M. WATSON, 1993. "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems", *Econometrica*, Vol. 61, pp. 783-820.