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Simulating the impact of austerity on the Irish economy using a Stock-Flow Consistent model

Abstract:

This paper uses an empirically grounded stock-flow consistent macroeconomic model to assess the impact of a sudden drop in government expenditures in the Irish economy. We are able to use the model to trace the development of the shock through the economy. We show that a sharp, one period reduction in public expenditure by 11.5% would lead to a decrease in the liabilities of Irish government securities other than shares of about 14%, with other effects like a decrease in household income, reductions in consumption and a slowdown of growth.

Keywords: *Ireland, Macroeconomic modelling, Stock-flow consistent models, Euro zone crisis, Austerity.*

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This work was supported by a grant from the Institute for New Economic Thinking, INET. Helpful comments from Gennaro Zezza, Dirk Bezemer, Antoine Godin, Vela Velupillai, Paul Martin, and participants in seminars at NUI, Galway, University College, Dublin, and the INET Money-Finance group, are gratefully acknowledged.

Introduction

The Irish economy has experienced a severe recession that began in the summer of 2007. The growth rate declined sharply. The country's savings rate fell from 21.9% in 2007 to 10.8% in 2010. Investment conditions deteriorated as a result of the downturn in the property market. The unemployment rate rose rapidly from 4.6 in 2007 and reached its highest level in 2011 to 14.5% (Tables 9, 10).

Before 2007, a favourable international economic environment contributed to the indebtedness of non-financial corporations, financial corporations, and households, with real interest rates at historic lows, even negative at times.

In addition to most sectors experiencing a large increase in debt, the bursting of the property bubble has left a large fiscal deficit, a series of banks with damaged balance sheets, and a sovereign borrowing crisis. Since 2010 Ireland has been in a programme of adjustment with the EU and IMF. It is not hard to see why. From 2008, the debt to GDP ratio increased rapidly from 44.3% to 121% in 2012 due to a significant increase in government expenditures coming mainly from welfare enhancing automatic stabilisers.

As part of the strategy of deficit correction, the Irish government initiated a significant reduction in public expenditure and an increase in taxation, or more colloquially, an austerity policy.

This paper examines the consequences of such austerity policies on the economy using a stock-flow consistent (SFC) model for a small open economy.

The first section provides an explanation of the choice of the model and describes the model structure. The second section focuses on the *Dynamic Empirical Simulation* approach that was used for the model simulation and its comparison with previous approaches. The third section presents our data sources, and the fifth section shows the results of front loading a shock of increased austerity through reduced government expenditure, and describes the impact of the shock on real activity, focusing on the Irish Financial Balance Sheet. Section 6 concludes with a discussion and a roadmap for further work.

Model

Why build a SFC model for Ireland?

Macroeconomic models did not cause the collapse of the Irish economy. Nor, however, did they prevent or raise an alarm when they should have. Three separate reports into the Irish banking and fiscal crisis have established that macro prudential regulation was lax, that fiscal policy, and in particular Ireland's fiscal stance, was inappropriate given our membership of the Euro zone, and finally that Ireland's political elite was enmeshed with property developers, whose interests were served before those of the national interest.

Each report also noted with dismay the failure of macroeconomic models used by Ireland's Department of Finance and the European Central Bank to accurately predict the crisis (Honohan, 2010; Regling and Watson, 2010; Nyberg, 2011). In particular, the lack of a detailed treatment of the financial side of the economy was identified as a serious modelling issue that needed to be addressed.

In this paper we argue that the shortcomings of modern models used for policy evaluation in taking account of financial flows may be addressed, or at the very least complemented, using a stock-flow consistent approach.

What are SFC models?

Stock-flow consistent modelling emphasizes the connections between classes (or sectors) of economic agents (Godley and Lavoie, 2007). Stock-flow consistent models do not have a representative agent maximizing their utility subject to constraints over time, nor are production functions used to describe the behaviour of the system.

The economy is treated as a set of sectors interacting with one another, for example: Non-financial corporations (NFC's), private banks and central bank aggregated in Financial corporations (FC's), General government (GG), Households (HH's) and the Rest of the World (ROW). In this sense stock-flow models occupy a middle ground between microeconomic models of individual behaviour and large-scale macroeconomic models of economies as a whole.

In stock-flow consistent models, for example, households buy from firms; the firms sell to the households, netting out to zero at any moment in time. The sectors are tied together within a balance sheet for the economy, and their transactions recorded within transactions flow matrices and revaluation matrices for capital gains.

Every flow and stock variables are logically integrated into the accounting so that the value of any one item is implied by the values of all the others taken together; in other words the system of accounts for each economy is stock-flow consistent.

The models can normally be solved for their steady state, and the behaviour of the entire system can be simulated. Choosing stock-flow norms, which must be stable, is a serious concern at this stage—the models require attention to their initial conditions that must give any modeller cause for concern.

The simulated system is then shocked, via a drop in investment, say, or a change in wages or a change in inflation, and the behaviour of the system can be analyzed and discussed. Stock-flow consistent models can also naturally model the distinction between wage earners and the recipients of capital income (van Treek, 2009), financial imbalances (Godley and Lavoie, 2007), contagion effects, (Kinsella and Khalil, 2011) and as well as income distribution effects (Dos Santos, 2005).

Every modelling choice has positive and negative implications. On the positive side, stock-flow models capture several important Keynesian and post-Keynesian insights. They are monetary economies that evolve in historical time; there is no representative agent or production function (there is a production function, it's not explicit), households and firms are assumed to have a crude procedural rationality, in that they don't really form expectations about the future in a rational manner, relying on past trends to guide future performance. It is natural to model the income distribution within these models. The flows between each part of the model can be traced out explicitly.

The ability to model flows into and out of financial sectors like banks and central banks, and explicitly see the effects across the macro-economy of a change in interbank lending, say, that leads to a credit crunch (Kinsella and Khalil, 2011), is for us the main benefit of stock-flow modelling.

In fact, the only limit to the inclusion of economic variables of interest is the time, patience, and sanity of the individual modeller. There is, more or less, unlimited scope to model the macro-economy using this framework. So far comparatively few of these models, with the honourable exception of the Levy model run by the Levy Institute at Bard College, and models written to estimate the UK and Danish economies, have been estimated (Zezza, 2009, Davis, 1987).

The major proponent of stock-flow modelling, Wynne Godley, in his treatise on the subject with Marc Lavoie wrote that simulating macro-economies in layers of increasing complicatedness allowed one to “build up knowledge, or ‘informed intuition’, as to the way

monetary economies must and do function” (Godley and Lavoie, 2007, pg. 9). There is much to be said for informed intuition at the personal level. But at the level of policy formation and evaluation, we need estimation and extrapolation based on aggregate statistics generated by the economy and collected through the national accounts.

Model description

The model in this paper describes a simple open economy structure in accordance with the Financial Balance Sheet of Ireland data combined with those of aggregate demand in the real economy. The Irish economy is divided into four major sectors: the Non-financial corporations (NFC's), which include all private firms, but also other corporate bodies, the Financial corporations (FC's) include all financial institutions and the Central Bank of Ireland, General government (GG) and Households (HH's) are standard, while the Rest of the World describes the economy’s interactions with non-residents. Assets of the rest of the world represent Irish liabilities to non-residents. Similarly, liabilities of the Rest of the World represent Irish non-residents assets. The domestic economy exchanges with the Rest of the World (ROW) which represents the fifth sector.

Diagram1 The model structure, a schematic overview (For Financial Balance Sheet instruments in the diagram, the dots on line for the deposits, the securities other than shares, the equity and the loans mean that the sectors are respectively depositors, equity owners, bondholders and borrower).

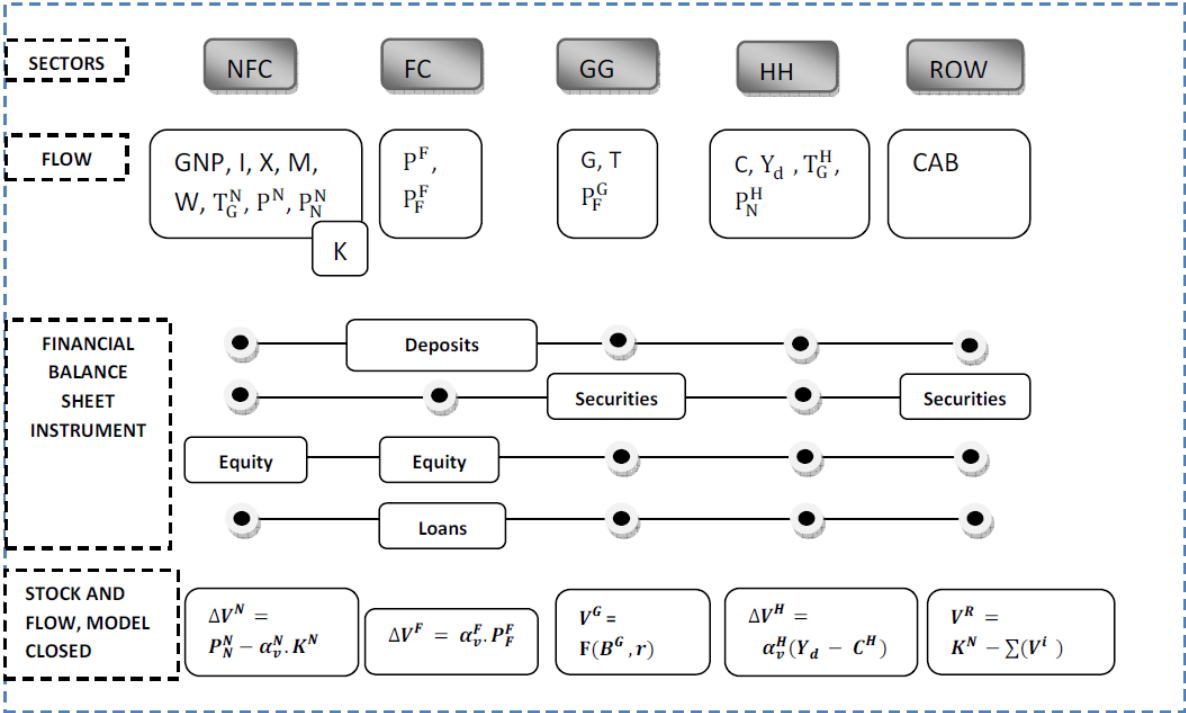


Table 1
Stock matrix based on Irish economy Financial Balance Sheet

FINANCIAL BALANCE SHEET		IRISH ECONOMY								ROW		Sum
		INSTITUTIONAL SECTORS										
		NFC's		FC's		GG		HH's		A	L	
		A	L	A	L	A	L	A	L			
Physical capital												
FINANCIAL INSTRUMENT	Deposits										0	
											0	
	Loans										0	
	Equities										0	
Wealth (A-L)												
Sum (A-L)		0	0	0	0	0	0	0	0	0	0	

Assets and liabilities are aggregated according to the methods used in the Irish Quarterly Financial Accounts issued by the Central Bank of Ireland. There are basically the deposits, the securities other than shares, the loans and the equities. Financial Balance Sheet instruments as the deposits, the loans, the securities other than shares and the equities are the net assets or net liabilities. Only the NFC's sector accumulates capital stock. The FC's sector that aggregates central bank and commercial banks holds deposits provided by other sectors, and. The FC's grant loans which are required by all other sectors, and. The general government and the rest of the world are net issuers of securities other than shares and held by other sectors, and. NFC's and FC's sectors are net issuers of equities and held by the other sectors and. The bondholders and equity owners have a portfolio composed by two assets that cannot be clearly distinguished in the Financial Balance Sheet. These assets are written in the form of hook in the model structure and in matrix in the appendix where the parameters of portfolio allocation could eventually allow refereeing in the assets holding by sectors. Each sector wealth is obtained by difference between assets and liabilities which can be positive or negative but it is always recorded as a liability so that the balance sheet of each sector is in equilibrium and is zero when we calculate the difference in column between assets and liabilities. On line, the zeros can be explained that all assets of the Ireland counterpart all liabilities of its bilateral partners identified under the rest of the world sector and vice versa.

Institutional sectors not only use financial instruments but they have income and profits distribution operations, as well as productive activities.

Indeed, the NFC sector produces goods and services and accumulates the capital stock. This sector also distributes wages, pays taxes to the general government and provides a share of its profits to households. It is also the main sector of exchange of goods and services produced with the rest of the world. The NFC's sector flow is connected to Financial Balance Sheet in stock by the wealth accumulation equation of NFC's sector. The NFC's sector wealth accumulation depends on its past wealth plus the NFC's sector profits which not distributed to households minus a share of capital stock.

The main activities of the FC's are based on the deposits that they hold in other sectors, government and the rest of the world securities other than shares that they purchase, they issue equity and provide loans to other sectors. All these operations will enable this sector to reap profits whose the central bank as central bank revenue surplus is repaid to general government - counted as non-tax revenue - and the other share is maintained in the accounts of commercial banks. The wealth accumulation by the FC's sector depends therefore on its past wealth plus a profit share undistributed.

The general government receives tax revenues from NFC's and households sectors, and non-tax revenue composed by the central bank surplus, interests on deposits and dividends.

The current general government expenditures are exogenous in the model. The general government wealth accumulation depends in the securities other than shares issues and their dividend yield, in the interest rates on deposits, dividend yield on the equities purchased and in the interest rates on loans received from FC's.

Households receive wages W , consume C , pay taxes and receive a share of profits from NFC's sector. The household's wealth accumulation is equalled to the wealth of the previous period plus a savings share obtained by the difference between personal disposable income and consumption C .

The rest of the world 'sector' realizes its financial transactions through the Financial Balance Sheet of other sectors and conducts traded exchange with the domestic economy. Increasing the rest of the world's wealth is a loss of the Irish economy's wealth, and vice versa.

Methodological approach

Theoretical approach

The theoretical approach to stock-flow consistent model emerges from research conducted separately at the New School for Social Research and the Levy Economics Institute, Yale University and the Department of Applied Economics at Cambridge University and rejuvenated in 1980 following the conference on Keynes in Cambridge. More recently most of this work was published by Godley and Lavoie (2007). Cripps and Godley (1976) and Godley and Cripps (1983) had also published pioneering work. The theoretical approach was further developed by several other authors in terms of simulated models (Table 13). Other authors are interested by macro-econometric modelling particularly Clévenot and al. (2009), Davis (1987), Godley and Zezza (1992) and Zezza (2009).

Static Empirical Simulation

The static pure calibration is the method most often used to simulate SFC models (for example Table 13). The method allows the modeler to calibrate or simulate a theoretical model with values having constraints that generate consistent ratios, or what Godley and Lavoie refer to as 'stock-flow norms'. This calibration does not specify a period of the Financial Balance Sheet but relies on the trends underlying the economy's Financial Balance Sheet. The method could evolve into three approaches (Table 13) that we classify as *Dynamic Pure Simulation*, the *Static Empirical Simulation* and the *Dynamic Empirical Simulation*.

Table 13
Calibration and simulation approaches

	Calibration	Simulation	Parameters	Calibration period	Approach
1	Static pure calibration	Pure simulation	Static	One period	<i>Static Pure Simulation</i>
Static parameters, parameters sensitivity test, macro ratio consistent, no empirical data, no estimation and no country balance sheet. <i>Examples in the literature</i> Chatelain (2010); Dallery and Van Treeck (2011); Dos Santos and Zezza (2008); Godley (1999); Kinsella and Khalil (2011); Lavoie and Daigle (2011); Lavoie and Zhao (2010); Duwicquet and Mazier (2011); Godley and Lavoie (2007); Mazier and Tiou-Tagba Aliti (2012).					
2	Dynamic pure calibration	Shock simulation	Dynamic	Several periods	<i>Dynamic Pure Simulation</i>
Dynamic parameters, not need parameters test, simulation test, macro ratio consistent, not need much empirical data, no estimation and no country balance sheet.					
3	Static empirical calibration	Empirical simulation	Static	One period	<i>Static Empirical Simulation</i>
Tables 14a and 14b					
4	Dynamic empirical calibration	Shock simulation	Dynamic	Several periods	<i>Dynamic Empirical Simulation</i>
Dynamic parameters, no need parameters test, current macro ratio consistent and empirical data and country balance sheet.					

The *Dynamic Pure Simulation* is the first proposed improvement. In contrast to the *Static Pure simulation*, this approach could be used when a series of empirical data has missing values. These series may be completed as in the case of a pure calibration, but as the series are evolving over several periods, the modeler is forced to modify these parameters at each period to coincide with each period value, hence the dynamic calibration.

The second proposal is the *Static Empirical Simulation*. The *Static Empirical Simulation* helps to improve the static pure and the dynamic pure calibrations because it imposes a constraint of using empirical data in the model calibrating without any possible change in the original data. The approach provides more constraints in the calibration method because it is designed to relate the simulation to the empirical Financial Balance Sheet at a known period of time of the economy.

The last approach, which we call *Dynamic Empirical Simulation*, is similar to the static empirical calibration but rather it is a calibration over several periods which justify a parameter change in each period. For illustration, Table 14a below shows a convergence stability test of each quarterly static empirical calibration, then, is linked to get the dynamic empirical calibration under *Dynamic Empirical Simulation* approach developed in the next section.

Table 14a
Static Empirical Simulation convergence test

Convergence <u>Data period</u> 2002Q2 to 2011Q1 <u>Simulation periods</u> 20 or 150 periods	Each quarterly empirical calibration converge		
	36 empirical calibrations (EC) based on the stock matrices for each period		
Baseline Consumption as % of GNP adjusted	Behaviour of convergence expected (stable)		Misbehaviour of convergence (unstable)
	28 or 20 empirical calibrations (EC)		8 or 16 empirical calibrations (EC)
Shock Cut in government spending	Impact expected	Weakly impact expected	Unexpected impact
	20 or 8 (EC)	2 or 5 (EC)	6 or 7 (EC)
Conclusion	The model should be simulated by static empirical calibration approach		The model should be simulated only by an improvement of exogenous values or parameters which are not provided by database.
General conclusion	The test is done with the consumption variable.		

Dynamic Empirical Simulation

Using the data raises additional constraints on the model calibration. The balance sheet provides data in stocks. In fact in the transaction matrix, the flows are obtained through the interest rate and the dividend yield applied on stocks and changes in financial instruments. Build a model with the *Dynamic Empirical Simulation* method in contrast to *Static Pure Simulation* involves either using the stocks, flows, interest rates and dividend yields or using the stocks and flows to determine by calculating interest rates and dividend yields or still using the empirical data in stock in Financial Balance Sheet, interest rates and dividend yields to calculate flows. The first method appears to be difficult to implement because of the difficulty to have really, for example, bank deposits rates applied on deposits of each household's in assets and on deposits of each FC's in liabilities. The drawback to apply this method is a systematic disconnection between the calculated flows and flows generated by the real economy that should be exactly the same. The second method seems to pose magnitude and sign problems in the determination of interest rates or dividend yields.

The model we build in this paper chooses the third method, which involves taking the balance sheet of the country in stocks per quarter, and finding interest rates and dividend yields, etc., to calculate flows. The dynamic empirical calibration is able to reflect the real evolution of the economy.

All flows related to Financial Balance Sheet instruments like deposits, securities other than shares, equities and loans are calculated in the model. We also calculate the values of some endogenous variables, such as profit and desired capital holdings.

Disposable income is adjusted relative to households' portfolio income flows and the current account is also adjusted relative to net factor income and transfers from rest of the world (Table 11).

All other endogenous variables and main exogenous variables are empirical data taken from the Irish Financial Balance Sheet (*Table 15*). In terms of methodology, Dynamic Empirical Simulation approach is clearly distinct from the Static Pure Simulation approach and offers several other advantages to building a model that makes full use of the country Financial Balance Sheet and, the same time, considers all the behavioural and accounting equations from the Financial Balance Sheet.

Empirical data

Data

Quarterly data over 2002 to 2011 are from the Central Bank of Ireland (CBI), the Central Statistics Office (CSO) and the OECD. All instruments from the Irish economy Financial Balance Sheet were used except net equity of households in life insurance reserves and pension fund reserves, prepayment of insurance premiums and reserves for outstanding claims, other account receivable/payable and monetary gold and special drawing rights (Tables 2, 3).

For each sector and in each period this can be accounted as a loss or a gain of wealth depending on whether the instruments are removed as assets or liabilities (Tables 4, 5).

Instruments removed in the first quarter 2011 are important in households Financial Balance Sheet, 42.62% of total assets and only 2.92% of total liabilities. Deleting data represents 39.7% loss of wealth in the household's Financial Balance Sheet. For the case of other sectors, such as NFC's, GG and ROW, deleting scales respectively 4.99%, 6.10% and 10.21% of their wealth. FC's sector liabilities which is largely the counterpart of the instruments eliminated in the households financial balance sheet assets has 18.47% a gain of wealth. The work incorporates these cuts in the balance sheet of each sector to give the proportional interpretation in the change of each sector balance sheet towards the shock.

Data limitations

There are several measurement issues with the data we must be aware of when modelling the Irish economy.

First, these data are quarterly, while other data are lower and higher frequency. This may seem trivial, but when attempting to model, say, securities other than shares yields; to be consistent one must use a quarterly estimate of the yield on Irish securities other than shares. Given the fluctuations we have seen recently, different aggregations will lead to different securities other than shares figure.

Second, the data for Non-financial corporations have serious measurement issues. Irish subsidiaries of foreign companies and the Irish branches of foreign companies operating in Ireland on a branch basis are included, while the foreign subsidiaries of Irish companies and the foreign branches of Irish companies operating abroad are excluded (they form part of the Rest of the world sector).

Third, the Rest of the World figures represent the Irish economy's transactions with financial claims and liabilities to non-residents. The conceptual definition is the same as in the balance of payments (BOP) and international investment position (IIP) statistics. In particular, non-residents include foreign subsidiaries of Irish companies, the foreign branches of Irish

companies that operate abroad on a branch basis, and the head offices of foreign companies that operate in Ireland on a branch basis.

Fourth, In general, balance sheet positions are reported at end-year market value where they are available or can be estimated, and transactions are reported at the actual value of the transaction. This applies in particular to marketable securities on both the assets and liabilities sides. However, unquoted equity assets and liabilities are in general reported at book value.

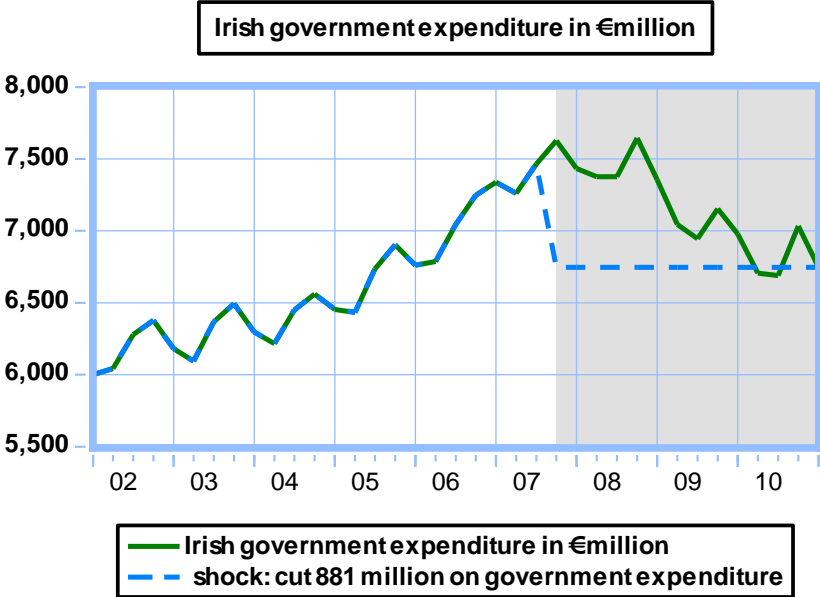
Empirical simulation results

Austerity measures shock: 11,5% cut in government expenditures from 2007 to 2011

In the periods preceding the crisis, the government significantly reduced its sovereign debt (General government gross debt in 2006 was a mere 24% of GDP). After the crisis began, government expenditures rose significantly to support economic activity (Table 10), mainly by bailing out the banking sector and also supporting social expenditures including unemployment spending.

The paper examines government expenditures cut at the end of 2007 that seems to appear as the start of an austerity demanded by the IMF and EU.

Figure 1 Irish government expenditure in €million, and a shock of 881 million at the start of the Crisis (dotted line).



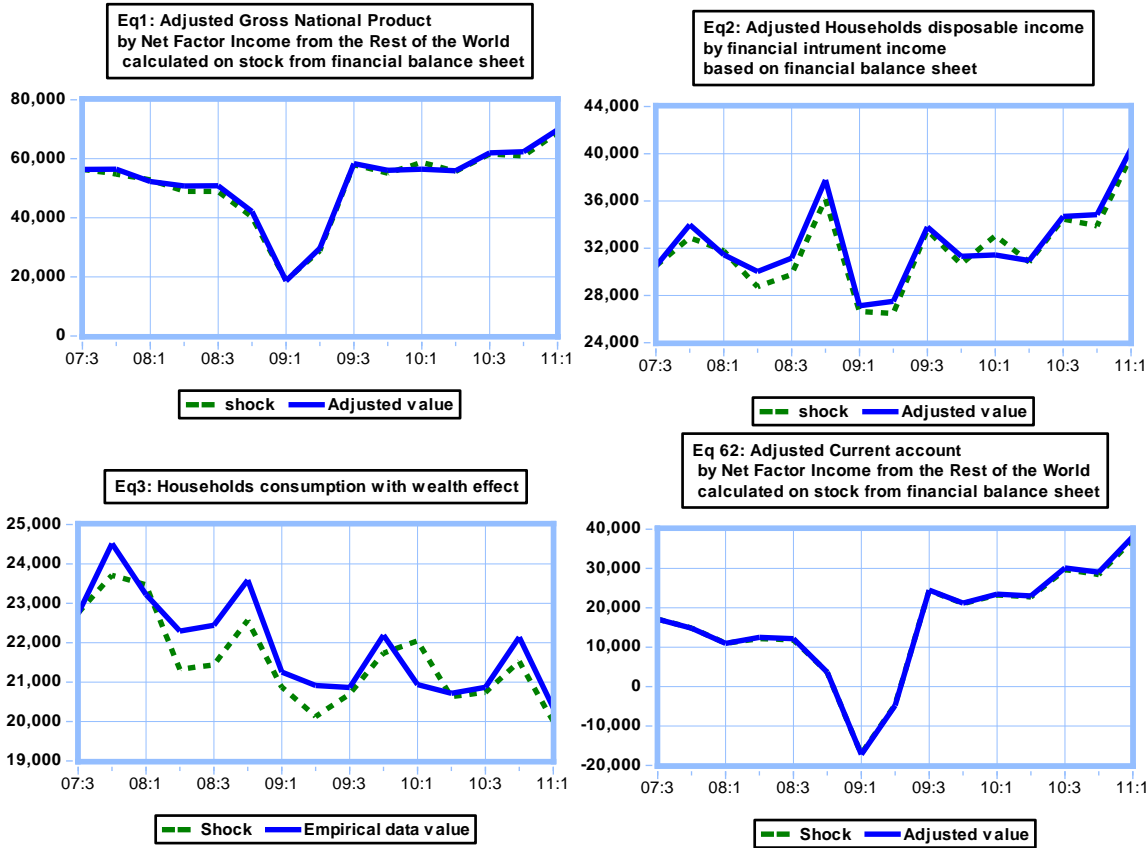
Source: Central Statistics Office (Ireland) data

Despite a significant increase in public expenditure, the economy experienced a recession in 2009 and suffered a crisis in its sovereign debt which locked Ireland out of international markets for debt.

As the model uses empirical quarterly data from 2002 to 2011 including public expenditure of this period, it seems interesting to evaluate the impacts of the austerity phase from late 2007 to early 2011 on the Irish economy. Indeed, government expenditure has increased since 2002 until 2007 in the fourth quarter to €7.627 billion and then suffering a

fiscal tightening to reach €7.376 billion in the third quarter of 2008. In the fourth quarter 2008, while government expenditures reach €7.645 billion, began a long period of fiscal austerity that reduced government expenditure in 2011 to 6.747 in the first quarter. From the fourth quarter 2007 to the first quarter 2011, €1.702 billion have been cut from government expenditure, and €821 million have been raised in taxation revenues. The shock is thus to reduce 7.627 billion public expenditures of 881 million in the fourth quarter of 2007. This represents 11.5% cut in government expenditures in the fourth quarter 2007 to first quarter 2011.

Figure 2 Shock impact on GNP, personal disposable income, consumption and current account



The shock of government expenditures decrease (11.5%) leads an activity slowdown which can be explained by a decline in disposable income and consumer spending. The model does not propose a structure of the labour market but it is probably through layoffs businesses which fear a downturn following the decline in wages, disposable income and consumption through government expenditures decrease. The impact of the shock on the current account is weak because of the exogenous feature of exports and imports.

The large drop in adjusted GNP in the first quarter 2009 was due to the large interest payments on securities other than shares and large withdrawals of capital from investors creating a deep deterioration of the activity. The real economy of production is connected with financial instruments in the balance sheet. Therefore, the impact of the shock in the real sector will be transmitted to the financial balance sheet. The diffusion of the shock will be analyzed by focusing on the financial balance sheet of each sector.

Impact on Irish institutional sectors Financial Balance Sheet

- *Impact on General government and Households Financial Balance Sheet*

To cope with the crisis, the public accounts have deteriorated greatly. Government securities other than equity issues have continued to increase since the fourth quarter of 2007.

After the crisis began in 2007, the Irish government assets in deposits increased until the first quarter of 2009. The government received external help from the International Monetary Fund and the European Union which could explain these increases in deposits. In 2008 and 2009 Ireland suffered two years of severe recessions. These recessions combined with the austerity policies could lead to a reduction on the government assets in deposits. It is what shows the impact of the shock through a decrease on the government assets in deposits following a decline in public spending.

The government had net assets of loans on the financial corporations sector until the fourth quarter of 2009 when the government assets in loans changed to liabilities. The shock reduced the government liabilities in loans. The government assets in equity declined and the securities other than shares rose until 2010 before experiencing a downturn due to the effects of recession including austerity policies. The impact of the shock reflected a reduction of government securities other than shares and the acquisition less and less of shares.

The reduction in public expenditure reduces securities other than shares issues, so the government debt in counterpart a slowdown growth, a decline of household disposable income and consumption. Indeed, the household sector has been affected more by the crisis.

The households are affected by two years of severe economic recession. For the household assets in deposits, the first figure shows an upward phase that is explained by precautionary savings by households and then a phase of decline when households' savings is reduced following effects related to the recession. The impact of the shock reflects a decline in the households' assets in deposits. This is consistent with changes observed on the chart in the second phase. The households' liabilities in loans continue to grow in the Irish economy through the fourth quarter of 2009 in a first phase and a second phase where the loans will begin a decline. The impact of the shock causes a decrease in loans granted to households by the financial corporations. It is consistent with observations of empirical data in the Irish economy.

Households sold equities in assets and acquired more and more securities other than equity. The impact of the shock on the securities shows a decline in household portfolios from the first quarter of 2009. These results show that we observed with the empirical data in the households balance sheet concerning the evolution of household deposits, loans and securities during the second phase of the crisis in the late fourth quarter 2009 and early 2010.

Figure 3 Impact on General government Financial Balance Sheet in €million

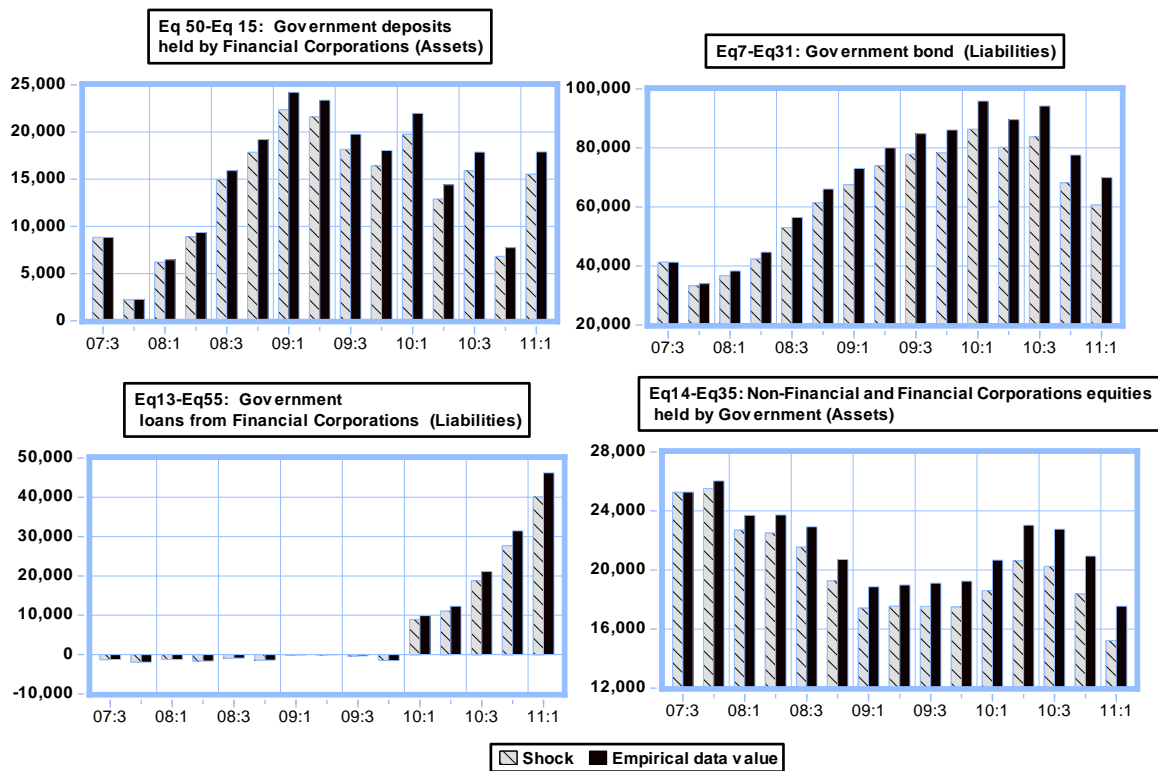
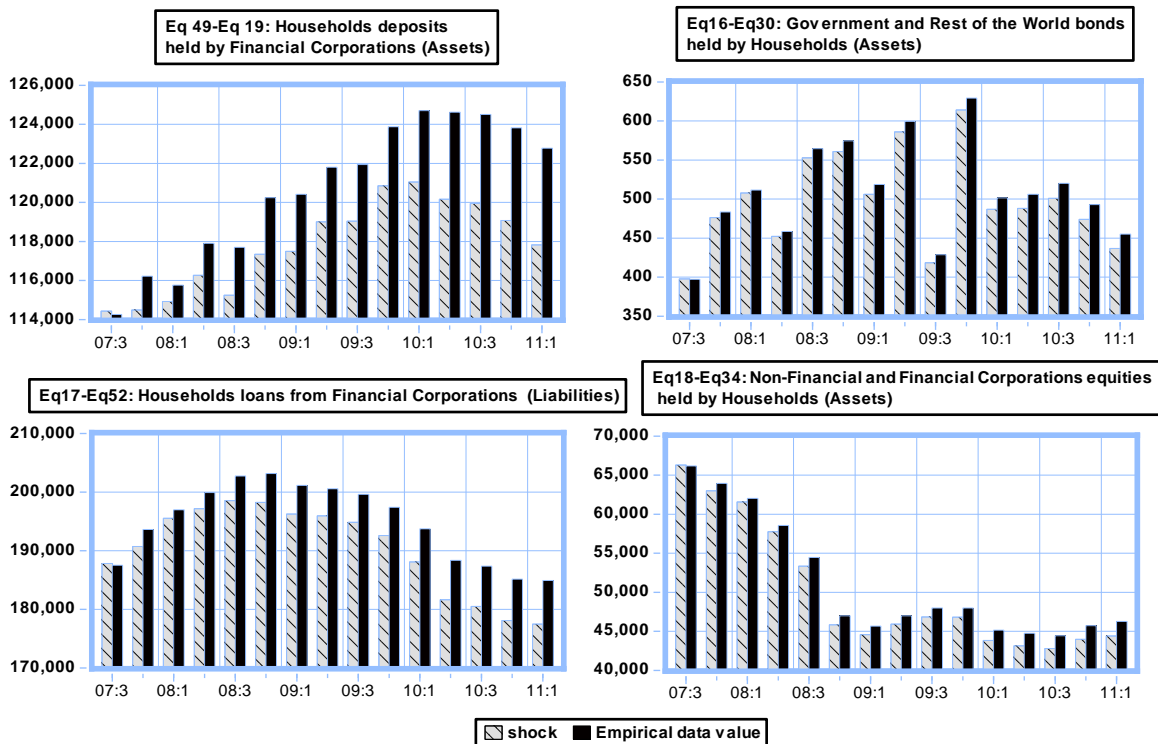


Figure 4 Impact on Households Financial Balance Sheet in €million



- *Impact on Non-Financial Corporations Financial Balance Sheet*

NFC's after the crisis have increased their deposits until the third quarter of 2009 then beginning a decline that is due to loan repayments of NFC's. Indeed, NFC's sector loans declined sharply since the first quarter of 2008. NFC's increase their issuing in equity during the crisis period. This is explained by a low level of deposits and borrowing. NFC's compensate the need in liquidity through sales of securities other than shares that they hold on the ROW. The impact of government expenditures reduction has pushed NFC's to have more deposits because they expect a decline in economic activity. The lower level of activity weighs more on their level of debt from FC's. NFC's issue more equity following the reduction of government expenditure because they would need more liquidity but they would hold more government securities other than shares which improves public finance.

- *Impact on Financial corporations Financial Balance Sheet*

The balance sheet of FC's has been changed during the crisis. Of 2009, deposits from other sectors in FC's liabilities have been reduced. Indeed, in 2009, the economy is in recession and the housing market is rapidly declining, loan institutions restrict their supply. The low level of loans and deposits shows that the FC's need additional liquidity and issues new equities. They hold more government and the rest of the world securities other than shares. The shock shows that if government expenditure had been lowered, the restrictions on loan and deposit levels were much higher than the actual level. The FC's have issued less equity and hold less than government and the ROW securities other than shares. This situation has probably compounded the difficulty of NFC's and worsened the employment.

Irish Financial Balance Sheet facing crisis

The Irish economy Financial Balance Sheet shows a negative net financial wealth continuously increasing since 2002. This degradation from the national wealth is tied largely to the increased of NFC's sector negative net financial wealth. The FC's and general government also have a negative net financial wealth but much less huge than the NFC's. We can distinguish in the overall transaction movements mainly two periods. The first phase is up to the eve of the 2007 crisis where the FC's and the general government sectors have net financial lending while households net financial borrowing grew. The FC's net financial lending sector is due to financing activities and supports the construction sector, and the income that they generate. In contrast, household's debts are increasing because of the loans provide by the banking sector. Until the eve of the crisis, the government is a net financial lending reflecting growth from the construction sector, a low unemployment rate and government budget surpluses. When crisis strikes, flow movements on the each sector account shows that, in 2007, when the FC's become a net financial borrowing sector, the general government acts as last resort for the commercial banks. The public accounts are deteriorating and general government sector becomes net financial borrowing while the FC's become a net financial lending. It's the bank bailout by the government to avoid a general contagion of the banking system and the difficulties of the whole economy. The need for government funding is increasing - 13 billion in 2008 to - 48 billion in 2010. NFC's sector conducts much of its adjustments by layoffs. At the time of crisis, household's debts suddenly stop and then they become a net financial lending sector from 2009. The impact of adjustment on the real economy is difficult to observe in the each sector balance sheet. The model attempts to understand what were the consequences on the real and financial economy following the government's austerity policy dictated by donors.

Conclusion

On the one hand, austerity policies conducted by the Irish government since the fourth quarter of 2007 reduced government expenditures by 11.5% between the fourth quarter 2007 and first quarter 2011. Economic activity is penalized in the foreground households experiencing largely adjustment policies by NFC's sector contraction job creation and FC's sector by the hugely costs of loan repayment. The effects of the impact on the wealth of sectors show that the NFC's sector wealth is penalized by a reduction in government expenditure while the government increases its wealth. Household's wealth also increases slightly in response to adjustments in their portfolios to build precautionary savings. The wealth of FC's remained unchanged. Finally, the austerity policy has reduced about 14% of liabilities in government securities other than shares.

On the other hand, at a time when the European Union is preparing to adopt the fiscal treaty that promotes stability for euro zone members and much more austerity measures for countries with large sovereign debt and not enough measures to sustain growth in the euro zone and in each countries. The countries would be forced to make huge cuts to comply with the rules defined by the Stability Treaty. The consequences would slow growth with a dramatic impact on the situation of households such as the results of this model using Irish Financial Balance Sheet have shown.

This paper briefly sets out a more realistic macroeconomic model empirical simulation for Ireland. We are now at the stage before where this model can be estimated, and a set of forecasts made. The model is in its 'alpha' stage and so while we can simulate simplest model of Irish economy. Nevertheless, many problems remain.

First, the model does not distinguish central bank and commercial bank. The Irish Central Bank is subsumed into 'Financial Corporations'. Second, the valuation issues with equities, bonds and treasury bills have not been adequately addressed (Table 11 and 12). Third, pricing and revaluation effects in the real economy have not been considered. Fourth, several assumptions in the current model need to be relaxed, for example, as it stands, the yield on international securities other than shares is equal to the yield on national securities other than shares. The interest rate is currently exogenous, and we would like to make it endogenous. The dividend yield is the same for financial corporations and non-financial corporations. The model can't deal sensibly with inventories. Clearly, these are the improvements that we will near future bring to the model.

We would like to solve this simplest model, and refine and extend the model. We would like to disaggregate the financial corporate sector, include more details of equities, model special drawing rights, gold, and insurance markets (as well as the dreaded 'other') and include a more realistic version of the trade balance. We can begin distinguishing between trade in goods and trade in services by sector, and have a much more detailed treatment of the revaluation effects of Ireland's assets and liabilities by sector.

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APPENDIX A

Structure of the model

<i>Gross National Product</i>					(1)
<i>Households disposable income</i>					(2)
<i>Households’ consumption with wealth effect</i>					(3)
<i>Taxes</i>					(4-6)
=		—		—	
<i>Government budget</i>					(7)

Equation 7 can be explained in detail by Equation 7 twice that shows the components of the general government (GG) budget in the central government (CG) budget and local government (LG) budget. The central government is responsible to occupy its traditional activities which are collecting taxes, government expenditure, interest payments on securities other than shares issued and transfer exceptional profits from the central bank. Operations of local government are in the model through loan repayments and interest that they have obtained from the FC’s sector, deposits and remuneration they have made and equities purchased by them with dividends

paid. The distinction between central government and local government budgets is not very clear. In a small economy like Ireland, the local government budget is low because many of the activities are centralized in Dublin. However for economies such as France and the United States where local authorities, departments regions and States (for US), local governments have huge weights in the general government budget by loans or negative equities that they obtain from FC's.

	<i>(7 bis)</i>
<i>Non-financial corporations portfolio</i>	<i>(8-11)</i>
Government portfolio	<i>(12-15)</i>
Households portfolio	<i>(16-19)</i>
ROW portfolio	<i>(20-23)</i>
<i>Assets in deposits by each sector</i>	<i>(11-bis)</i> <i>(15-bis)</i> <i>(19-bis)</i> <i>(23-bis)</i>
<i>Financial corporations profit</i>	<i>(24-26)</i>
	*
<i>Supply-demand in securities other than shares</i>	<i>(27-32)</i>
<i>Supply-demand in equities</i>	<i>(33-38)</i>

Wage (39)

Profit (40-42)

Investment and capital stock (43-45)

Liabilities in deposits by Financial corporations sector (46)

Assets and liabilities in deposits by each sector equivalence in supply and demand (47-51)

Supply-demand equality in loans (52-57)

Wealth accumulation (58)

(59)

(60)

is determined by equation (12)

(61)

Current account (62)

APPENDIX B Variables definition

Interests on securities other than shares portfolios held by non-financial corporations, financial corporations and households

Portfolio distribution parameters

Dividends on equities portfolios held by general government, households and rest of the world

Equity portfolios

$$=$$

$$=$$

Portfolio deal parameters

Subscript and superscript	Non-financial corporations (), financial corporations (), government (), households (), rest of the world (), supply () and demand ()
Aggregate demand	Gross National Product (), Gross Domestic Product (), consumption (), government expenditure (), investment (), exports (), imports (), current account ()
Taxes and tax rates (,)	Government taxes () paid by both sectors (,)
Households disposable income	
Wealth of each sector	, , , ,
Profit	Sector <i>F</i> profit () deal to <i>G</i> and <i>F</i> (, Sector <i>N</i> profit () deal to <i>H</i> and <i>N</i> (,
Wage, capital stock and desired capital stock	,
Securities other than shares issued by each sector and dividend yield	, , and ,
Equities issued by each sector and dividend yield	, and
Securities other than shares portfolios held by <i>N</i> , <i>H</i> and <i>F</i> sectors with <i>G</i> , <i>R</i> sectors dividend yield on securities other than shares	, , , , , ,
Equities portfolios held by <i>R</i> , <i>G</i> , <i>H</i> with <i>N</i> , <i>F</i> sectors dividend yield	
Loans with rate of interest on loans ()	, , , , , , , , ,
Deposits and rate of interest on deposits ()	, , , , , , , , ,
Other parameters	Propensity to consume income (), propensity to consume wealth or wealth effect (), share of sector <i>F</i> profit transfer to sector <i>G</i> (), share of sector <i>N</i> profit transfer to sector <i>H</i> (), rate of depreciation on fixed capital (), reaction parameters in the portfolio choice of sectors (), wage share (), capital income ratio (), capital stock adjustment parameter (), wealth accumulation parameters

Figure 5 Impact on Non-Financial Corporations Balance Sheet in €million

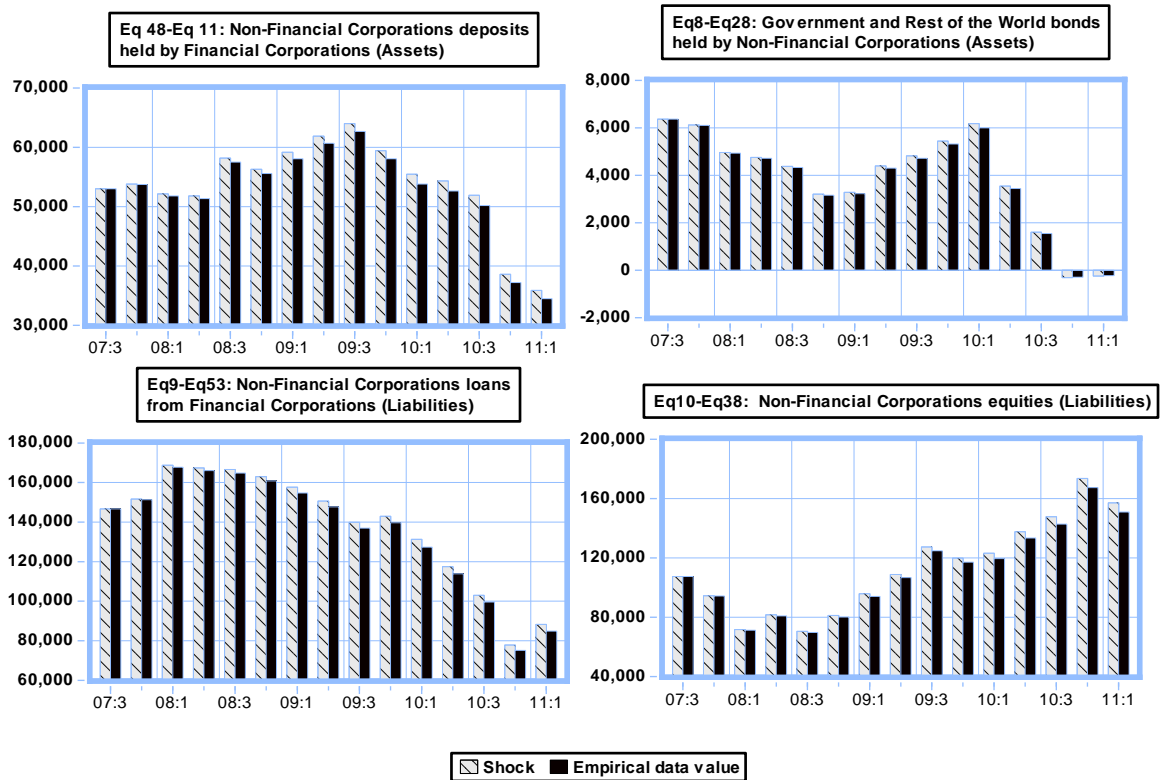


Figure 6 Impact on Financial corporation Balance Sheet in €million

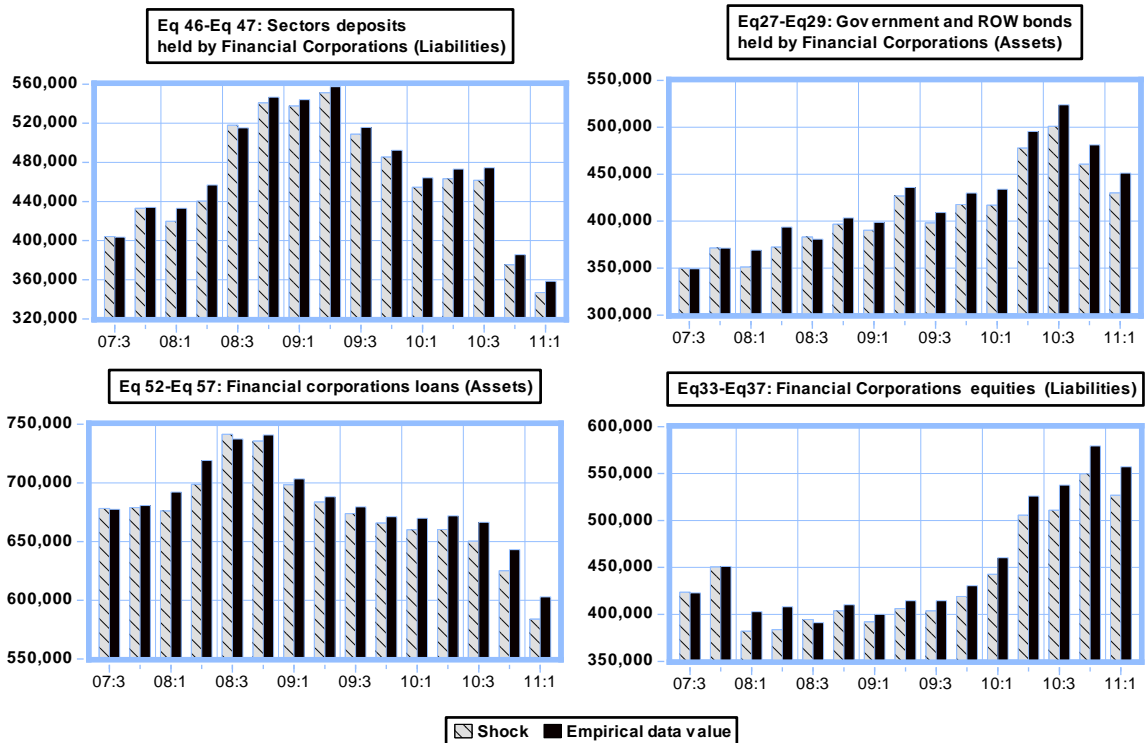


Figure 7 Impact on the Rest of the World Balance Sheet in €million

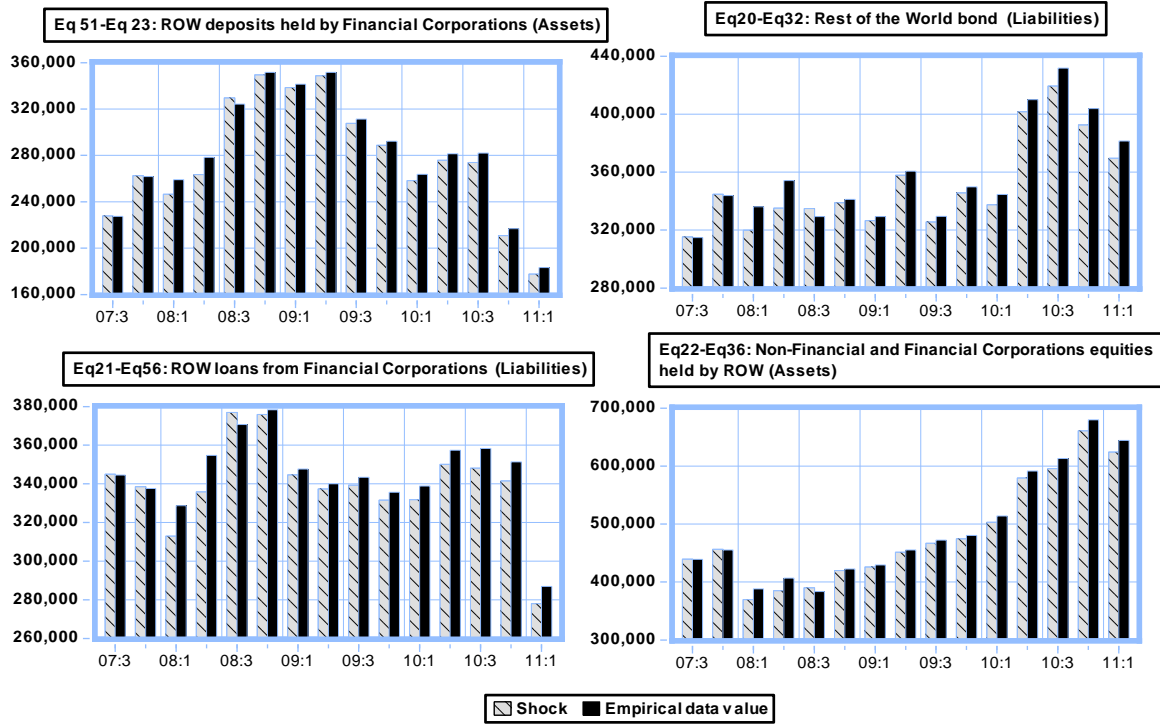


Figure 8 Impact on wealth of each sector Balance Sheet in e million

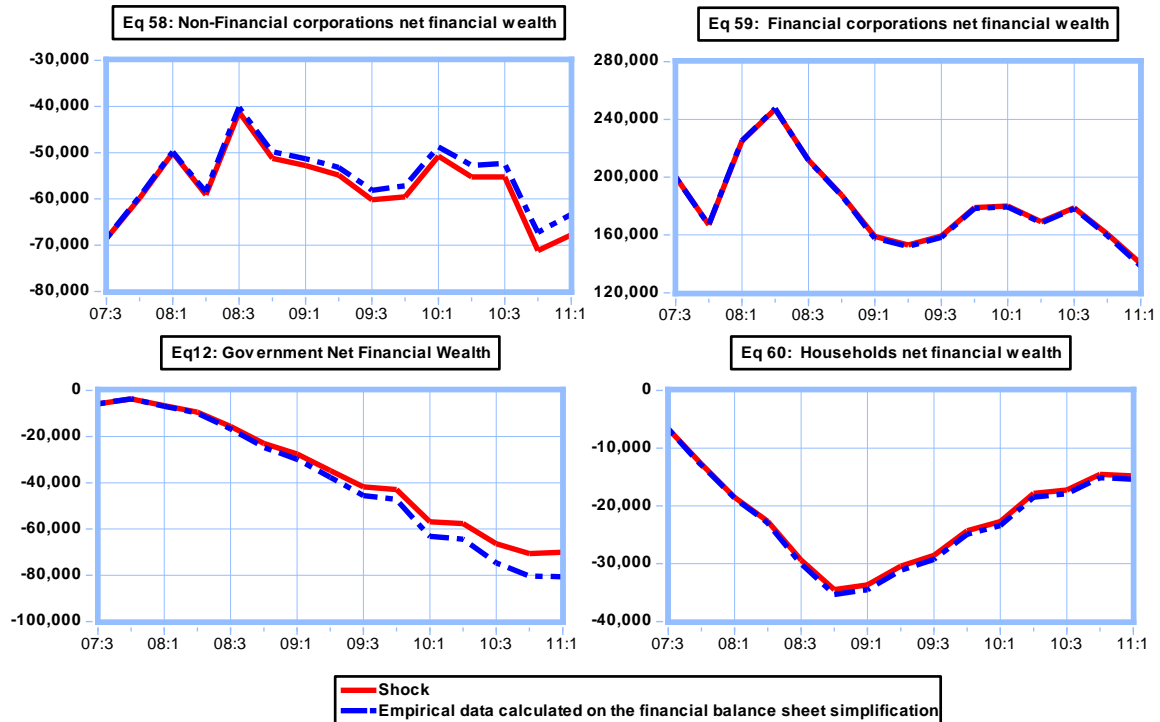


Table 2
Irish economy financial balance sheet, first quarter 2011, €million

FINANCIAL BALANCE SHEET FIRST QUARTER 2011 € MILLION	IRISH ECONOMY								ROW		Sum
	INSTITUTIONAL SECTORS										
	NFCs		FCs		GG		HHs		A	L	
	A	L	A	L	A	L	A	L			
Gold & SDRs			841								841
Currency & Deposits	34461			358423	17907		122776		183280		1
Securities other than shares		233	451093			69945	455			381371	-1
Loans		84852	602826			46207		184912		286855	0
Shares and other equity		150940		557115	17539		46 261		644255		0
Insurance technical reserves	3 511			208755			125895		79 349		0
Other accounts receivable/ payable		10 489		1 045	2 304			5 553	14 783		0
Wealth (A-L)		-208542		-70578		-78402		104922		253441	-841
Sum (A-L)		0		0		0		0		0	0

Table 3
Simplification of table 2

FINANCIAL BALANCE SHEET FIRST QUARTER 2011 € MILLION	IRISH ECONOMY								ROW		Sum
	INSTITUTIONAL SECTORS										
	NFCs		FCs		GG		HHs		A	L	
	A	L	A	L	A	L	A	L			
Currency & Deposits	34461			358423	17907		122776		183280		1
Securities other than shares		233	451093			69945	455			381371	-1
Loans		84852	602826			46207		184912		286855	0
Shares and other equity		150940		557115	17539		46 261		644255		0
Wealth (A-L)		-201564		138 381		-80706		-15420		159309	0
Sum (A-L)		0		0		0		0		0	0
In % of each sector total A or L											
Currency & Deposits	100%			39,15%	50,52%		72,44%		22,15%		
Securities other than shares		0,1%	42,8%			60,22%	0,27%			57,07%	
Loans		35,95%	57,2%			39,78%		100%		42,93%	
Shares and other equity		63,95%		60,85%	49,48%		27,29%		77,85%		
Total A and L	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Table 4
Data cut in % based on Table 2

FINANCIAL BALANCE SHEET FIRST QUARTER 2011 IN % OF EACH SECTOR TOTAL A OR L	IRISH ECONOMY								ROW	
	INSTITUTIONAL SECTORS									
	NFCs		FCs		GG		HHs		A	L
	A	L	A	L	A	L	A	L		
Gold & SDRs			0,08%							
Currency & Deposits	90,75%			31,85%	47,44%		41,56%		19,89%	
Securities other than shares		0,09%	42,77%			60,22%	0,15%			57,07%
Loans		34,42%	57,15%			39,78%		97,08%		42,93%
Shares and other equity		61,23%		49,51%	46,46%		15,66%		69,90%	
Insurance technical reserves	9,25%			18,55%			42,62%		8,61%	
Other accounts receivable/ payable		4,25%			6,10%			2,92%	1,60%	
GAIN OR LOSS IN WEALTH IN %		4,99%		-18,47%		6,10%		39,7%		10,21%

Table 5

Simplification of financial balance sheet (table2) in % of all sectors A or L by each financial instrument

FINANCIAL BALANCE SHEET FIRST QUARTER 2011 IN % OF ALL SECTORS A OR L	IRISH ECONOMY								ROW		Total	
	INSTITUTIONAL SECTORS											
	NFCs		FCs		GG		HHs					
	A	L	A	L	A	L	A	L	A	L		
Currency & Deposits	9,61%			100%	5%		34,25%		51,14%		100%	100%
Securities other than shares		0,05%	99,9%			15,49%	0,1%			84,46%	100%	100%
Loans		14,08%	100%			7,67%		30,67%		47,59%	100%	100%
Shares and other equity		21,32%		78,68%	2,48%		6,53%		90,99%		100%	100%

Table 9
Irish economy indicators before crisis

BEFORE CRISIS	2001	2002	2003	2004	2005	2006	2007
Current account balance, % of GDP	-0,646	-0,993	-0,001	-0,581	-3,506	-3,555	-5,346
Government revenue, % of GDP	33,375	32,371	32,782	34,137	34,578	36,29	35,83
Government structural balance, % of potential GDP	-1,8	-2,757	-3,167	-2,75	-3,756	-4,006	-7,313
Government total expenditure, % of GDP	32,445	32,683	32,369	32,725	32,932	33,357	35,779
Government net lending/borrowing, % of GDP	0,93	-0,311	0,413	1,412	1,646	2,933	0,051
Government gross debt, % of GDP	35,494	32,125	30,943	29,366	27,248	24,844	25,035
Government net debt, % of GDP	27,304	25,131	22,703	19,938	15,915	12,155	12,175
Unemployment rate	3,865	4,402	4,653	4,5	4,375	4,425	4,575
GDP growth	5,702	6,546	4,411	4,598	6,016	5,322	5,626
Gross national savings, % of GDP	22,096	21,104	23,364	24,141	23,657	24,466	21,948
Investment, % of GDP	22,742	22,097	23,366	24,721	27,163	28,02	27,294
Inflation, consumer prices, Chg Y/Y	3,986	4,725	3,995	2,3	2,18	2,7	2,873

Source: IFS

Table 10
Irish economy indicators after crisis

AFTER CRISIS	2008	2009	2010	2011	2012	2013	2014
Current account balance, % of GDP	-5,65	-3,04	-0,723	0,186	0,59	0,237	0,162
Government revenue, % of GDP	34,326	34,212	35,447	36,101	36,654	37,334	37,696
Government structural balance, % of potential GDP	-11,261	-9,552	-8,048	-5,908	-5,694	-4,808	-2,904
Government total expenditure, % of GDP	41,665	48,574	67,651	46,92	45,524	44,698	42,484
Government net lending/borrowing, % of GDP	-7,338	-14,362	-32,204	-10,82	-8,869	-7,364	-4,788
Government gross debt, % of GDP	44,369	65,496	96,149	114,072	121,511	125,765	124,959
Government net debt, % of GDP	23,037	38,039	69,385	95,213	104,317	110,34	108,667
Unemployment rate	6,325	11,825	13,625	14,5	13,3	12,8	11,9
GDP growth	-3,548	-7,58	-1,041	0,547	1,908	2,409	2,981
Gross national savings, % of GDP	16,617	11,021	10,086	11,15	11,613	11,485	11,854
Investment, % of GDP	22,266	14,061	10,809	10,964	11,023	11,249	11,692
Inflation, consumer prices, Chg Y/Y	3,108	-1,706	-1,557	0,541	0,523	1,401	1,338

Source: IFS

Table 6
Transaction matrix

	<i>NFC's</i>		<i>FC's</i>		<i>GG</i>		<i>HH's</i>		<i>ROW</i>		
	<i>Current</i>	<i>Capital</i>									
<i>G&S</i>		-			-		-				0
<i>IM</i>											0
<i>X</i>											
<i>Wages</i>	-										0
<i>Tax</i>	-						-				0
<i>Deposits</i>			-	*							0
<i>Securities OTS</i>					-				-		0
<i>Loans</i>	-				-		-		-		0
<i>Equities</i>	-		-								0
<i>NFC profits</i>	-										0
<i>FC profits</i>			-								0
<i>Change in</i>											
<i>Deposits</i>		-				-		-		-	0
<i>Securities OTS¹</i>		-		-				-			0
<i>Loans</i>				-							0
<i>Equities</i>						-		-		-	0
<i>Sum</i>	0	0	0	0	0	0	0	0	0	0	0

¹ OTS= Other than shares

Table 11
Stock matrix deepening based on table1

<i>FINANCIAL BALANCE SHEET</i>		<i>IRISH ECONOMY</i>								<i>ROW</i>		<i>Sum</i>
		<i>INSTITUTIONAL SECTORS</i>										
		<i>NFC's</i>		<i>FC's</i>		<i>GG</i>		<i>HH's</i>		<i>A</i>	<i>L</i>	
<i>A</i>	<i>L</i>	<i>A</i>	<i>L</i>	<i>A</i>	<i>L</i>	<i>A</i>	<i>L</i>	<i>A</i>	<i>L</i>			
<i>Physical capital</i>												
<i>FINANCIAL INSTRUMENT</i>	<i>Deposits</i>										<i>0</i>	
	<i>Bills</i>										<i>0</i>	
											<i>0</i>	
	<i>Loans</i>										<i>0</i>	
	<i>Equities</i>										<i>0</i>	
<i>Wealth (A-L)</i>												
<i>Sum (A-L)</i>		<i>0</i>		<i>0</i>		<i>0</i>		<i>0</i>		<i>0</i>	<i>0</i>	

Table 12
Transaction matrix deepening based on table 6

	NFC's		FC's		GG		HH's		ROW		
	Current	Capital									
G&S		-			-		-				0
IM											
X											
Wages	-										0
Tax	-						-				0
Deposits			-	*							0
Bills					-				-		0
Securities OTS					-				-		0
Loans	-				-		-		-		0
Equities	-		-								0
NFC profits	-										0
FC profits			-								0
Change in											
Deposits		-				-		-		-	0
Bills		-		-				-			0
Securities OTS		-		-				-			0
Loans				-							0
Equities						-		-		-	0
Sum	0	0	0	0	0	0	0	0	0	0	0

APPENDIX C

Deepening variables definition

Interests on treasury bills held by non-financial corporation, financial corporate and households

|

Portfolio distribution parameters

|

Bond portfolios held by non-financial corporation, financial corporate and households

|

Portfolio distribution parameters

|

Equity portfolios

=

=

=

Portfolio distribution parameters

|

Table 14b
Static Empirical Simulation convergence test

Static Empirical Calibration convergence test									
Simulation periods	20		150		Simulation periods	20		150	
Calibration periods	Behaviour of convergence expected	Impact expected	Behaviour of convergence expected	Impact expected	Calibration periods	Behaviour of convergence expected	Impact expected	Behaviour of convergence expected	Impact expected
2002Q2	stable	weakly	stable	weakly	2006Q4	stable	normal	unstable	
2002Q3	stable	normal	stable	normal	2007Q1	unstable		unstable	
2002Q4	stable	abnormal	unstable		2007Q2	stable	normal	unstable	
2003Q1	stable	abnormal	stable	abnormal	2007Q3	unstable		unstable	
2003Q2	stable	normal	stable	weakly	2007Q4	stable	normal	unstable	
2003Q3	stable	weakly	stable	weakly	2008Q1	stable	abnormal	stable	abnormal
2003Q4	stable	normal	unstable		2008Q2	stable	normal	stable	normal
2004Q1	stable	abnormal	stable	abnormal	2008Q3	unstable		unstable	
2004Q2	stable	normal	stable	weakly	2008Q4	unstable		unstable	
2004Q3	stable	normal	stable	weakly	2009Q1	unstable		unstable	
2004Q4	stable	normal	unstable		2009Q2	unstable		unstable	
2005Q1	stable	abnormal	stable	abnormal	2009Q3	stable	normal	stable	abnormal
2005Q2	stable	normal	stable	normal	2009Q4	stable	normal	stable	abnormal
2005Q3	stable	normal	stable	normal	2010Q1	stable	abnormal	stable	normal
2005Q4	stable	normal	stable	abnormal	2010Q2	stable	normal	stable	normal
2006Q1	unstable		unstable		2010Q3	stable	normal	unstable	
2006Q2	unstable		unstable		2010Q4	stable	normal	unstable	
2006Q3	stable	normal	stable	normal	2011Q1	stable	normal	stable	normal

