



# ESRI Research Note

## *Irish Quarterly Macroeconomic Data: A Volatility Analysis*

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Niall Conroy



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\*Niall Conroy<sup>1</sup>

## 1. Introduction

This Note presents an updated assessment of the volatility of Irish quarterly macroeconomic data from 1997 Q1 to 2014 Q3. This Note follows McCarthy (2003) in highlighting the volatility of Irish quarterly macroeconomic data in an international context. The quarter-to-quarter volatility in real macroeconomic aggregates, including gross output (GDP) and gross income (GNP), remain extremely high for the Irish data. The volatility in the Irish data is greater than that displayed by all other OECD countries, except Iceland. This highlights the caution required when interpreting quarterly changes in annualised growth rates. This high level of volatility, combined with large revisions poses challenges for forecasters and policymakers.

Volatility in macroeconomic data comes from two main sources. Firstly, actual volatility in the Irish economy which is picked up in the quarterly data and secondly, measurement error which may also arise. The fact that this is a small open economy with a large financial sector can impact on both of these sources of volatility. So “data volatility” in the Note, refers to both actual volatility in the economy and also possible measurement error in the data.

## 2. Macroeconomic Indicators

When examining Irish macroeconomic data one must choose whether to focus on GDP or GNP. While internationally the differences between the two are often trivial, the same can not be said for Ireland. Figure 1 highlights how unusual Ireland is in having such a large gap between GNP and GDP. This large gap has been previously highlighted by McCarthy (2003) amongst others, and it remains the case. With this in mind we use both GDP and GNP to compare Ireland to other OECD countries.

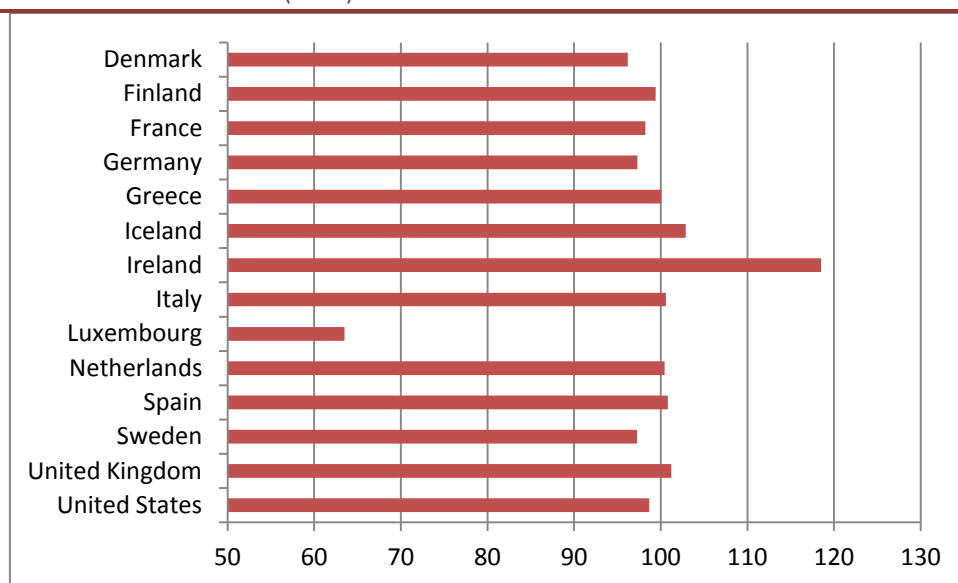
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<sup>1</sup> Thanks to Alan Barrett, Dawn Holland, Niall McNerney and Michael Connolly (CSO) for comments on a previous draft. Any remaining errors are the responsibility of the author.

As has been highlighted in recent *Quarterly Economic Commentaries*, GNP is considered a better indicator of Irish domestic activity, mainly due to the activities of multi-national corporations (MNCs) distorting GDP figures. It has also been noted that recent movements in GNP have been more consistent with data from Quarterly National Household Surveys and income tax receipts.

Recent issues surrounding the patent cliff, as highlighted by FitzGerald (2013a), have shown the impact MNCs can have on GDP while leaving GNP unchanged. While GNP may be considered a better measure of domestic economic activity, it is also not immune from accounting issues. FitzGerald (2013b) highlights the impact of redomiciled PLCs on Irish statistics, distorting GNP but having no impact on GDP.

**FIGURE 1** GDP as a Per Cent of GNP (2013)

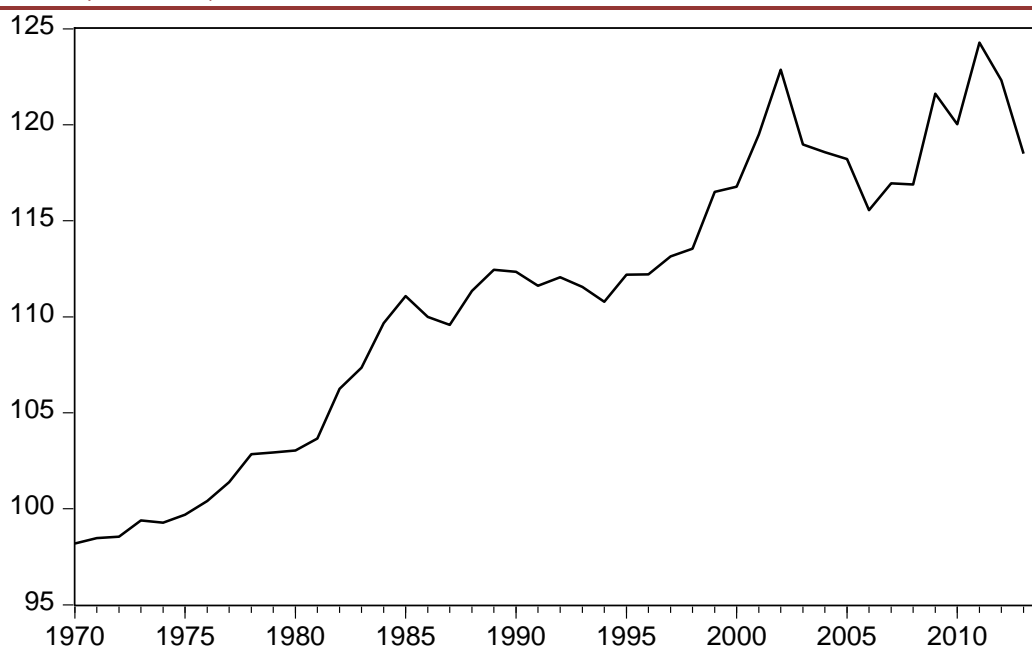


Source: Eurostat, CSO, World Bank and FRED.

In Figure 2 we can see the evolution of the GDP/GNP ratio in Ireland through time. We can also see that from the mid 1980s onwards there has been a gap in excess of 10 per cent between GDP and GNP. The ongoing presence of a large MNC sector in Ireland means that a large gap is likely to remain over the medium term.

Due to international convention, GDP is generally used for international comparison. However, given the large differences in the two measures in an Irish context, one can get quite different estimates of government debt or deficits to GDP/GNP. Growth accounting and productivity estimates may also yield different results in an Irish context if either GDP or GNP is used.

**FIGURE 2** GDP/GNP Ratio, 1970-2013



Source: CSO National Income and Expenditure Accounts 2013 and National Accounts Historical Series.

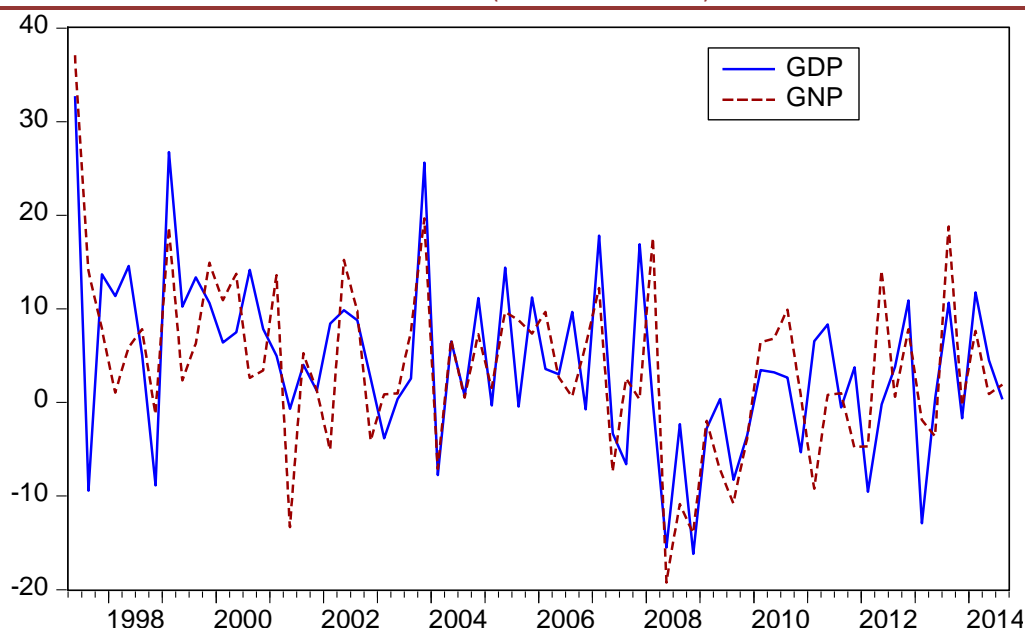
### 3. Irish Macroeconomic Data in an International Context

Since the CSO's Quarterly National Accounts (QNA) data run from 1997 Q1, we can assess the volatility of Irish data over a number of different periods. The data used are seasonally adjusted by the CSO and are expressed in constant (2012) prices. In following McCarthy (2003), the implied annualised growth rates of GDP and GNP is examined. These annualised growth rates show us what the growth would be if the present quarterly growth rate were maintained for a year. To do this, the following formula is used:  $100 * [(1 + g/100)^4 - 1]$ , where  $g$  is the quarter-on-quarter growth rate of national output or income.

The volatility of Irish quarterly macroeconomic data is evident in Figure 3, which plots the annualised growth rates of both GDP and GNP.

While volatility is an important aspect of macroeconomic data, revisions are also important in an Irish context. Revisions to the Irish Annual National Accounts have been analysed by Ruane (1975). More recently, revisions to the QNA have been assessed by Casey and Smyth (2015) Quill (2008) and Bermingham (2006). Quill finds that revisions to the levels of GDP are not statistically significant, while Bermingham finds that revisions to the growth rates of GDP can be predicted by using the initial estimate of GDP and equity prices. Casey and Smyth find that while revisions are not predictable, they are large relative to other OECD economies even after controlling for cross-country differences in growth rates. This highlights the caution with which forecasters and policymakers should treat initial QNA releases.

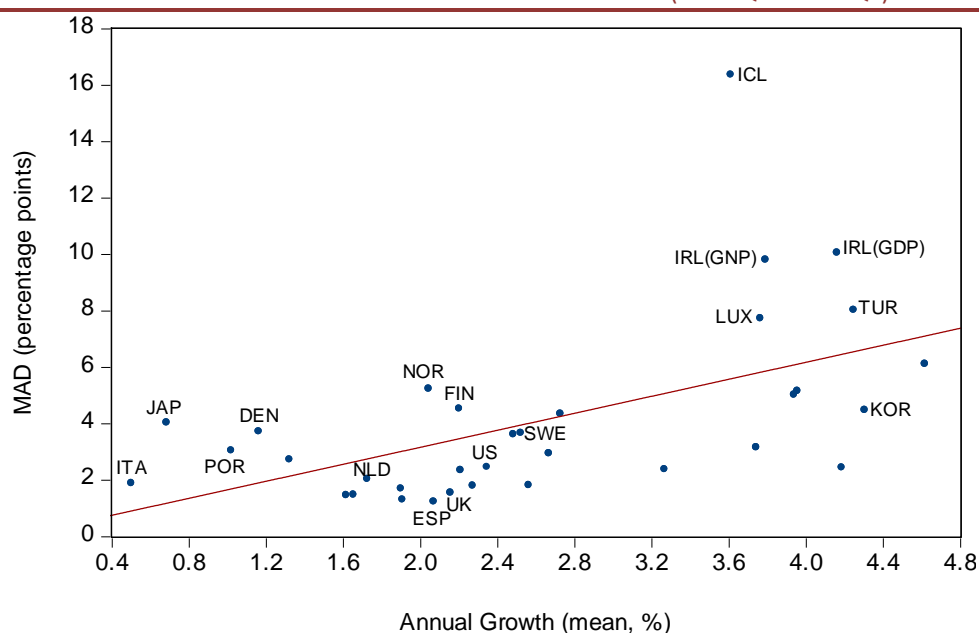
**FIGURE 3** Annualised Growth Rates of GDP and GNP (1997 Q1 - 2014 Q3)



Source: CSO Quarterly National Accounts and author's calculations.

Following McCarthy (2003), the mean absolute deviation (MAD) is used to analyse the volatility of the Irish and international data. The MAD takes the average absolute change in the quarterly annualised growth rates (as described earlier) from one quarter to another. For example, a country which had an annualised growth rate of 3 per cent last quarter and now has an annualised growth rate of minus 1 per cent has a MAD of four percentage points. We may expect that countries with higher average growth rates may have more volatile data. With this in mind we plot (in Figure 4) the MAD against the average growth rate<sup>2</sup> for each of the OECD countries.<sup>3</sup>

**FIGURE 4** Mean Absolute Deviation and Growth Rates. OECD Countries (1997 Q1 - 2014 Q2)



<sup>2</sup> A possible extension to this work would be to attempt to model the cross country variation in the MAD.

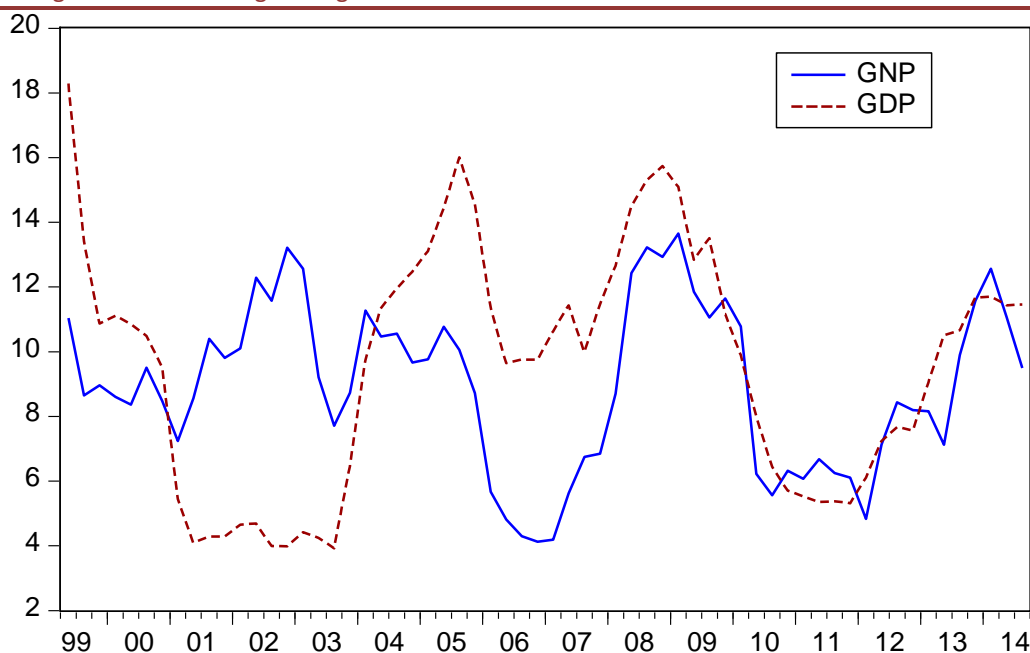
<sup>3</sup> Reliable quarterly data for Greece is no longer available hence it is excluded.

Firstly, we can see that there is a positive correlation between average growth rates and the MAD in the data. Even given Ireland's above average growth rate for this period, the volatility of macroeconomic aggregates is quite high. We can also see that Iceland appears to be something of an outlier, with a mean absolute deviation of over 16 percentage points. Excluding Iceland, Ireland has the most volatile macroeconomic data in the OECD. We can see that Luxembourg, another small open economy with a large financial sector, also has a high level of data volatility.

The mean absolute deviation of growth rates in Ireland are 10.06 percentage points (GDP) and 9.82 percentage points (GNP). This means that from quarter to quarter, the average absolute swing in the annualised rate of growth is ten percentage points. While this is high, it is slightly lower than the 11 to 13 percentage point range found in McCarthy (2003).

Given the dramatic turns in Ireland's economic fortunes in the last decade, it is worth considering if our data volatility is driven mainly by recent events. With this in mind we present an eight quarter moving average of the MAD of GDP and GNP data in Ireland.

**FIGURE 5** Eight Quarter Moving Averages of the Mean Absolute Deviation



We can see that there does seem to be an elevated level of volatility around possible turning points in the business cycle. However, these instances alone do

not explain Ireland’s highly volatile quarterly data. It is worth noting that the minimum levels of volatility presented here (4 to 6 per cent) are still well above many OECD countries volatility levels. This, coupled with the high levels of revisions found by Casey and Smyth (2015), shows the difficulty faced by policymakers and forecasters when examining the QNA. Models that use a range of indicators, such as nowcasting methodologies (see Byrne *et al.*, 2014), may be less sensitive to these issues. This is because factor models that take common factors from a range of sources give a better indication of the underlying movements in the economy.

#### 4. Sources of Volatility

Broad sectoral estimates of GDP are provided by the CSO and these can be used to identify sectors that may be driving this high level of volatility. These are shown in Table 1 below.

It is apparent that all sectors except “other services” and “public administration and defence” have quite high levels of volatility. The high levels of volatility in agriculture and construction sectors may be ignored as they make up a small share of GDP. This leaves other industrial sectors and the distribution sector as the principal sources of volatility. While McCarthy (2003) highlighted the issues in some manufacturing industries, we can see that the volatility in the national accounts is no longer solely due to activities in the manufacturing sector. It is noticeable however, that the two sectors most responsible for the high levels of volatility have a significant MNC presence.

**TABLE 1** Sectoral MADs and Shares of GDP (1997 Q1 - 2014 Q3)

Sector	MAD (%)	Average Share of GDP (%)
Agriculture Forestry and Fishing	27.293	3.0
Industry - Building and Construction.	14.679	3.2
Industry - All other industry.	31.320	26.0
Distribution, Transport, Software and Communication	19.889	25.9
Public Administration and Defence	4.825	4.4
Other Services (including Rent)	7.093	37.7
Net factor income	64.717	N/A

Source: CSO Quarterly National Accounts, December 2014, Table 1.

We have seen that there is little difference in the average level of volatility of the GDP and GNP data for Ireland, with both being well above other OECD countries. However, the difference between the two (net factor income from abroad) is extremely volatile itself, with a mean absolute deviation of 73 percentage points. This shows how the magnitude of the once-off measures can impact on GDP or GNP.



While attention has been given to sectors on the supply side that might be responsible for the elevated levels of volatility, focus now turns to the demand side. In Table 3 of the QNA we have a breakdown of seasonally-adjusted real GDP into the expenditure items shown below.

**TABLE 2** Expenditure Items MADs and Shares of GDP (1997 Q1 - 2014 Q3)

Sector	MAD (%)	Average share of GDP (%)
Personal Expenditure on Consumer Goods and Services	7.187	49.4
Net Expenditure by Central and Local Government	10.470	17.0
Investment	45.942	21.3
Imports	17.257	-82.0
Exports	13.060	93.7

*Note:* Averages do not sum to 100 due to value changes in stocks.

*Source:* CSO Quarterly National Accounts, December 2014, Table 3.

We can see that both consumption and net government expenditure exhibit lower levels of volatility than investment, imports and exports. This should be kept in mind when seeking reliable indicators of turning points in the business cycle. It should be kept in mind that both investment and imports/exports are heavily influenced by the activities of MNC. Casey and Smyth (2015) previously highlighted that the investment and net exports items were the most heavily revised in Irish Quarterly National Accounts.

One additional factor that may be driving the volatility of Irish macroeconomic data is credit levels. Ireland recently experienced, even by international standards, a large credit boom (see Kelly, 2009). In this context, it is worth considering possible spillover effects from this credit boom to the volatility of Irish macroeconomic aggregates.

The impacts of credit markets on business cycle fluctuations have been previously documented. Mendicino (2007) claims that better developed credit markets (proxied by size) lead to reduced business cycle volatility. However, large increases in credit may indicate an increased probability of tight credit conditions ahead and hence a more volatile business cycle. Further work on the relationship between credit and output volatility is needed to establish potential directions of causality and possible non-linearities in these effects.

## 5. Conclusion

This Note finds that Ireland still has highly volatile quarterly macroeconomic data. It again highlights both the caution required when interpreting quarter-on-quarter changes in growth rates and the difficulty in identifying turning points in the Irish economy. While we find that both GDP and GNP are quite volatile, the difference between the two (net factor income from abroad) is also extremely volatile. This highlights both the importance of choosing the macro indicator and the impact MNCs have on national accounting aggregates.

While we also find that there are elevated levels of volatility around recent turning points in the business cycle, these alone do not explain Ireland's elevated levels of volatility.

These estimates are comparable with those found by McCarthy (2003). However the results show that the sources of volatility are now not just due to developments in the manufacturing sector, but are also apparent in the distribution, transport, software and communication sector. Similarly on the expenditure side, investment, imports and exports are found to be highly volatile, with consumption and government expenditure less so. The increasing number of sectors displaying volatility may be due to the greater presence of MNC's throughout the Irish economy.

The high levels of volatility and often large revisions to the Quarterly National Accounts highlight the difficulties faced by policymakers and forecasters. With such a degree of uncertainty around the state of the economy at any moment in time, forecasters are challenged to present a coherent picture of the economy.

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