Estimating Ireland's Tax Elasticities: A Policy-Adjusted Approach

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Abstract

This paper estimates tax elasticities for Ireland. We add to the existing literature on Ireland-specific tax elasticities in three key ways. First, we compile a new dataset on tax policy changes in Ireland. This allows us to use policy-adjusted revenue when estimating tax elasticities. This gives us a cleaner estimate of the relationship between government revenue and its economic drivers. Second, we estimate short-run and long-run elasticities in a dynamic setting, allowing us to compare the long-run and short-run impacts separately. Third, we estimate elasticities of Pay Related Social Insurance and Value-Added Tax, which have previously received little attention in the Irish literature. We find that income tax elasticity estimates are significantly higher when policy-adjusted revenue is used, highlighting the importance of using policy-adjusted revenue when estimating elasticities.

Keywords: Fiscal policy, Elasticity, Discretionary tax measures.

JEL No. E32, E62, H2, H30

This report and associated dataset can be downloaded at www.FiscalCouncil.ie

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1. Introduction

Tax elasticities are key to understanding and forecasting developments in government revenue. Ireland's recent economic history has seen large positive and negative swings in government revenue. Much of the variation in government revenue has been due to macroeconomic drivers. For example, greater (taxable) income leads to more income tax being paid. While economic conditions influence the amount of tax being paid, tax policy itself also plays a hugely important role. Tax rates, bands and credits are often adjusted at budget time and can have a significant impact on tax revenue collected.

Up until now, studies which have estimated tax elasticities in Ireland have focused on the role of macroeconomic drivers, without adjusting for the impact of tax policy changes. This paper is the first that comprehensively takes account of tax policy changes when empirically estimating Irish tax elasticities.

We compile a new dataset of budget day estimates of the impact of policy changes on revenue. This allows us to adjust revenue for policy changes. The "policy-adjusted revenue" variable is then used when estimating tax elasticities empirically. Stripping out the effect of tax policy changes allows us to more precisely estimate of the relationship between tax revenue and the economy.

In the Irish case, this adjustment is crucial because income tax, which accounts for more than a third of exchequer tax revenue, has frequent and often substantial policy changes which impact on receipts. We examine two other revenue sources in this paper: Pay Related Social Insurance (PRSI) and Value-Added Tax (VAT). The adjustment, while still important, has less of an impact on these revenue sources because they have had less frequent and less impactful policy changes over the time period examined.

We estimate elasticities for these three revenue headings over the years 1987 - 2017. We estimate long-run and short-run elasticities in a dynamic (error correction) framework, in line with the international literature. Our estimates suggest long-run income tax elasticities significantly above one, with short-run elasticities of a similar magnitude. We find that estimates of the long-run income tax elasticity are significantly below one when unadjusted revenue is used. The results are robust to the specification used or the macroeconomic driver chosen (including relatively new measures of activity such as domestic GVA and modified GNI (GNI*)).

For PRSI, as policy changes are not as frequent or substantial, adjusting revenue for policy changes has less of an impact on our estimates. Long-run elasticities of one are estimated for PRSI, with short-run elasticities of one or less. We find some evidence for the short-run elasticity being significantly lower than the long-run elasticity, implying a subdued initial response in PRSI to a change in income. For VAT, we find that both personal consumption and investment in the building and construction sector play significant roles in both the long and short-run. There has been less Irish specific empirical work on empirically estimating the elasticities of these two revenue sources (relative to income tax).

Our findings highlight the importance of adjusting revenue for policy changes, particularly for income tax, where policy changes are frequent and often significant. In addition, our paper also highlights the important distinction that can occur between long-run and short-run elasticities.

2. Relevant Literature

There has been a good deal of work undertaken on Irish revenue elasticities in recent years. Acheson et al (2017) derives elasticities for the Irish income tax system using both analytical and empirical methods. The analytical work is informed by statistical reports from the revenue commissioners on the distributions of taxable income. The analytical methods suggest an income tax elasticity of 2.0. When estimated empirically, the elasticity is found to be less than one.

Deli et al (2017) estimates the elasticity of Irish income tax revenue with respect to economic activity (GDP and GNP are used). Long-run elasticities are empirically estimated, with additional controls included. Using Irish data from 1983 – 2013, they find elasticities just above one. For the empirical analysis in both of the above papers, they do not adjust revenue for policy changes, so the results are not directly comparable with those in this paper.

Department of Finance (2018) documents how taxable income responds to changes to the net-of-tax rate (this is one minus the marginal tax rate). The average elasticity of taxable income they estimate is 0.168, lower than average when compared internationally.

Mourre and Princen (2015) use data on policy changes in the EU to estimate elasticities. The revenue data from 2001 – 2013 is adjusted for these policy changes. Given the short time period, they use all EU countries and conduct a panel analysis, with individual country elasticities not estimated. Elasticities are calculated for four revenue sources; consumption taxes, social security contributions, income tax and corporation tax. Both short-run and long-run elasticities are calculated using an error correction framework. The approach in our analysis is similar to that in Mourre and Princen (2015), but we focus on one country and use a longer sample of data (1987 – 2017).

While Mourre and Princen (2015) is a useful analysis, it suffers from aggregating across countries which have very different tax codes and hence are likely to have differing elasticities. This is unavoidable as the database of discretionary policy changes that is used only goes back to 2001, meaning the sample is too short to estimate country specific elasticities reliably.

Köster and Priesmeier (2017) estimate long-run and short-run elasticities for each of 18 Euro Area countries. They also employ an error correction approach, with one-stage and two-stage models estimated. Total current general government revenue and GDP are the revenue and macroeconomic drivers used. The analysis does not correct for the impact of policy changes on revenue.

For 12 countries they find that short-run elasticities are significantly different from long-run elasticities (the initial response is overshooting or undershooting relative to the equilibrium response). Ireland is one of the 6 countries where the short- and long- run elasticities estimated are not significantly different from one another. For Ireland, a long-run elasticity significantly below one is found, using data from 1985-2013. Given that total general government revenue is being modelled, rather than any specific revenue heading, these results are less relevant for this paper.

Wolswijk (2007) also estimates long-run and short-run elasticities for a number of revenue headings in the Netherlands. The revenue figures used are adjusted for the impact of policy measures; hence the analysis is similar to that presented in this paper. The results show a long-run income tax elasticity of 1.57, with an even larger short-run elasticity (2.01).

Barrios and Fargnoli (2010) discuss how discretionary tax measures may have altered elasticities in the European Union. As the time series was very short at the time, elasticities were not estimated.

Acheson et al (2018) utilise an analytical approach to generate elasticities of Value-Added Tax (VAT) receipts. They find elasticities below than one when using either household expenditure or household income as the macroeconomic driver.

A recent Tax Strategy Group report (Department of Employment Affairs and Social Protection, 2018) highlights some of the recent changes to PRSI and the associated Social Insurance Fund. An actuarial review of the Social Insurance Fund was also undertaken (KPMG, 2017), with the revenue implications of a number of policy options highlighted.

Our paper contributes to the existing literature on Ireland-specific elasticities in three key ways. First, we collect data on the impact of policy changes on revenue collected. This allows us to estimate the relationship between revenue collected and the underlying macroeconomic driver more accurately. Second, we estimate both long-run and short-run elasticities in a dynamic setting. The third contribution this paper makes is to estimate elasticities for PRSI and VAT empirically, which has not been done previously in Ireland. To the author's knowledge, there has been no previous Irish specific empirical work on the elasticities of these two revenue sources.

3. Methodology and Data

3.1 Data

We assess three headings of government revenue in this paper; income tax, PRSI and VAT. Revenue data are obtained from the Department of Finance Databank. For income tax, the figures used include the universal social charge (from 2011) and the income levy (prior to 2011).[2] While henceforth the phrase "income tax" is used, one should remember that this broader definition is being referred to. Income tax, PRSI and VAT made up two thirds of central government revenue in 2018.

This paper focuses on estimating revenue elasticities. This measures the endogenous percentage change in revenue following a one per cent change in the macroeconomic driver of that revenue source. To get a measure of the endogenous revenue response, one needs to adjust revenue for tax policy changes. With this in mind, if one is performing an analysis like this without correcting for policy changes, then it is revenue buoyancy, rather than revenue elasticities, that are being estimated.

The novel aspect of the data used in this paper is that we have compiled a dataset on the impact of policy changes on different categories of government revenue. This is done by examining historical budget day documentation which gives estimates of the impact policy changes are expected to have on government revenue. Estimates of the impact of policy changes were included in budget day documentation since 1987, so that is when our analysis starts.[3]

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[2] The health levy was abolished and merged into the Universal Social Charge in 2011. The health levy had previously not been included in the category "income tax" receipts in previous years. In 2010, the health levy raised €2.018 billion. With this in mind, €2.018 billion is added to the discretionary income tax/USC policy changes listed in the Budget documentation for 2011.
[3] One exception is the reduced (9 per cent) rate of VAT (mainly applicable to tourism related activities) introduced midway through 2011, which was not listed in *Budget 2011* documentation. The estimate of the cost of this reduction (€120 million in 2011, €350 million in a full year) is taken from the jobs initiative documentation (Department of Finance, 2011).

The policy changes given in the annual budget documentation are based on an assumed no policy change baseline. The "no policy change" baseline used by the Department assumes no automatic indexation of tax bands or credits. With this in mind, any increase in tax bands or credits would be recorded as a revenue-reducing measure. In a growing economy, keeping tax bands and credits fixed will result in more tax being paid at higher rates, resulting in higher revenue.

The estimates of the impact of tax policy changes do incorporate some assumed behavioural responses to these changes.[4] This is helpful as it means these estimates are more likely to reflect the total impact these policy changes would make. However, ex-ante estimates of the impact of policy will inevitably include errors as they are not adjusted ex-post. Despite these errors, this data source provides the best route to correcting government revenue for policy changes made. Initial year, full year and one-off impacts are all recorded.

To construct a policy-adjusted revenue variable, we utilise each of these three pieces of information. The proportional adjustment method put forward by Prest (1962) is utilised here, as is common in the literature. The policy-adjusted revenue series represents what revenue would have been in previous years if today's tax system were to apply. So in the latest year we have data (2018), policy-adjusted revenue (PAR) is equal to revenue collected ($PAR_{2018} = R_{2018}$). Policy-adjusted revenue figures for the years prior to 2018 must be calculated so that they are comparable to the tax system applying in 2018. With this in mind, the policy-adjusted series can be described mathematically as follows:

$\mathrm{PAR_t}$ represents policy-adjusted revenue in year t. $\mathrm{R_t}$ represents revenue collected in year t. $\mathrm{One\ off_t}$ represents one-off factors impacting on a

[4] An example of this is the tax on sugar sweetened beverages introduced in 2018, which assumed reformulation from producers in response to the tax.

revenue heading in year t. DM_t represents discretionary tax measures impacting on revenues collected in year t, calculated using initial year and full year impacts of policy changes as well as one-off impacts.

$DM_t = (Policy\ initial_t) + (Policy\ full\ year_{t-1} - Policy\ initial_{t-1}) + One\ off_t$

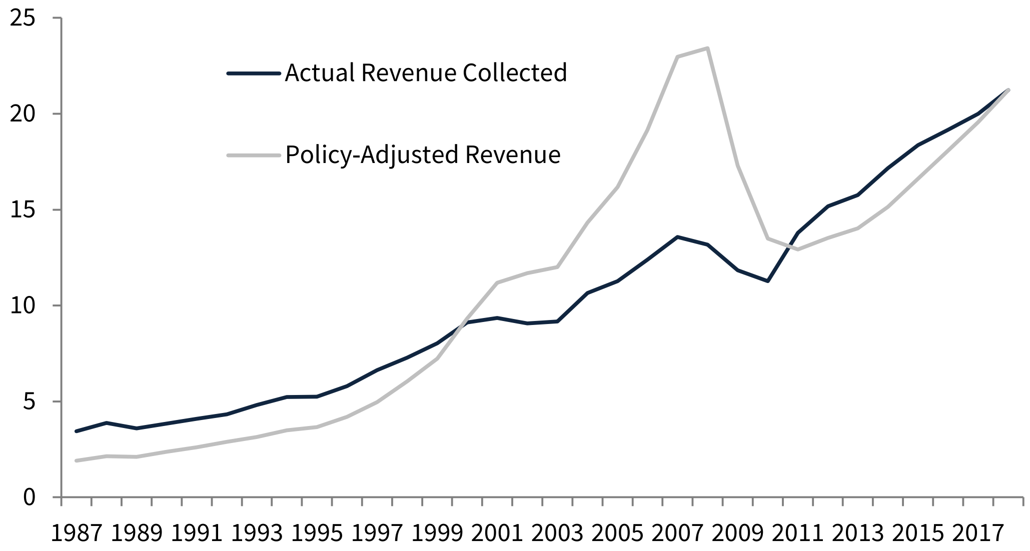
$$PAR_t = R_t * \prod_{k=t+1}^{j} \left(\frac{R_k}{R_k - DM_k} \right) \text{ for all } t < j$$

The intuition behind this method is to back-cast the series (for all the years prior to 2018) by adding/subtracting all the discretionary measures taken in subsequent years. The result is a series that is adjusted for all of the cumulative effects of discretionary measures taken over the period assessed. In effect, this converts the series to be representative of what revenue would have been collected had today's tax system applied (2018 in this case) for the entire period.

Looking at income tax, there are frequent adjustments from year to year, mainly in changing of tax bands, credits and rates. Figure 3.1 shows actual and policy-adjusted income tax revenue. It is quite striking how low policy-adjusted revenue is compared to revenue collected in the early years of the sample. However, thinking back to how the policy-adjusted series is constructed, this is less surprising. The policy-adjusted revenue series describes what level of revenue would have been collected in 1987 had today's tax system applied. If today's level of tax bands had applied in 1987, substantially fewer people would have qualified to pay tax at the higher rate of 40% for example, due to the much higher entry point into that rate which applies today.

A single person with no children could earn up to €34,550 before entering the higher rate of tax in 2018. This would have been a substantial annual income in 1987. By way of comparison, the average industrial wage in 1987 was approximately €13,100 (CSO, 2017).

Figure 3.1: Actual and Policy-Adjusted Income Tax Revenue.
€ Billions, 1987-2018



Sources: CSO, Department of Finance; and author's own calculations.
Note: Policy-adjusted revenue takes account of policy changes which impact on receipts, as outlined in the text.

In the period of strong economic and income growth preceding the crisis, income tax receipts grew robustly. However, during this period there were significant policy changes which reduced the amount of tax paid. Had these policy changes not been made, revenue would have grown even more rapidly.[5] This can be seen with the divergence of the policy-adjusted and actual revenue series in the early to mid-2000's.

From 2009 to 2012, significant income tax policy changes were made to raise additional revenue and get the government deficit under control. These changes mitigated the fall in income tax collected in 2009/10 somewhat and helped the increase in receipts in 2011/12. The policy-adjusted series gives a sense of the changes that would have occurred had policy remained fixed, with an even more dramatic revenue fall in the years 2008 to 2011. Comparing the policy-adjusted and actual revenue series also gives a sense of how procyclical income tax policy was pre-

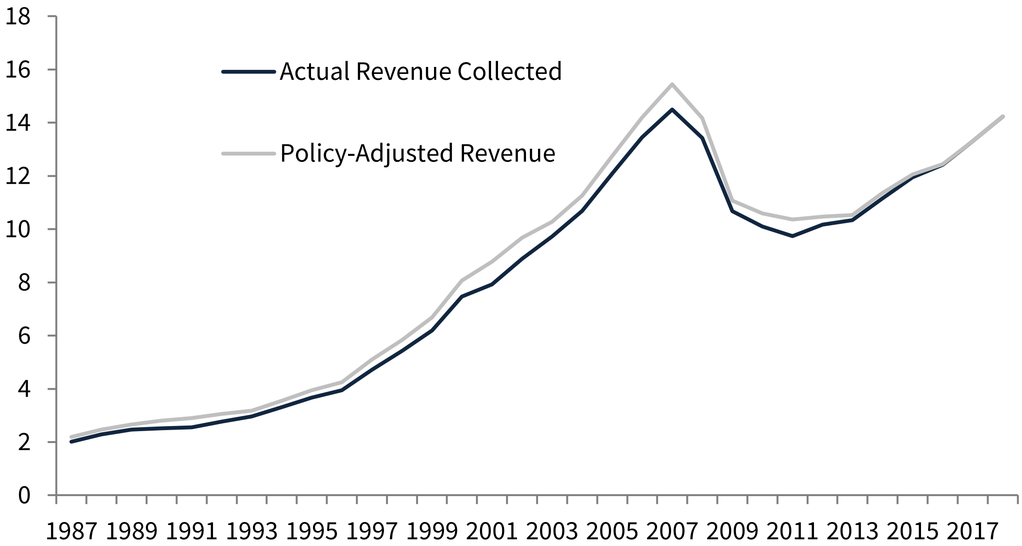
[5] This presumes that any behavioural responses to these tax cuts did not outweigh the revenue foregone by reducing rates and widening bands etc.

and post-crisis. The tax cuts in the pre-crisis phase helped fuel unsustainable economic growth, while tax rises post-crisis exacerbated the downturn.

Given the policy changes in recent history appear to have been correlated with the economic cycle, this could bias estimates of the elasticity downwards if revenue is not adjusted for these policy changes.

Value-Added Tax (VAT) and Pay Related Social Insurance (PRSI) have much smaller deviations between the actual and policy-adjusted series compared to income tax (Figure 3.2 and 3.3). With this in mind, we should expect that using policy-adjusted revenue will have less of an impact on the estimated elasticities for these revenue headings.

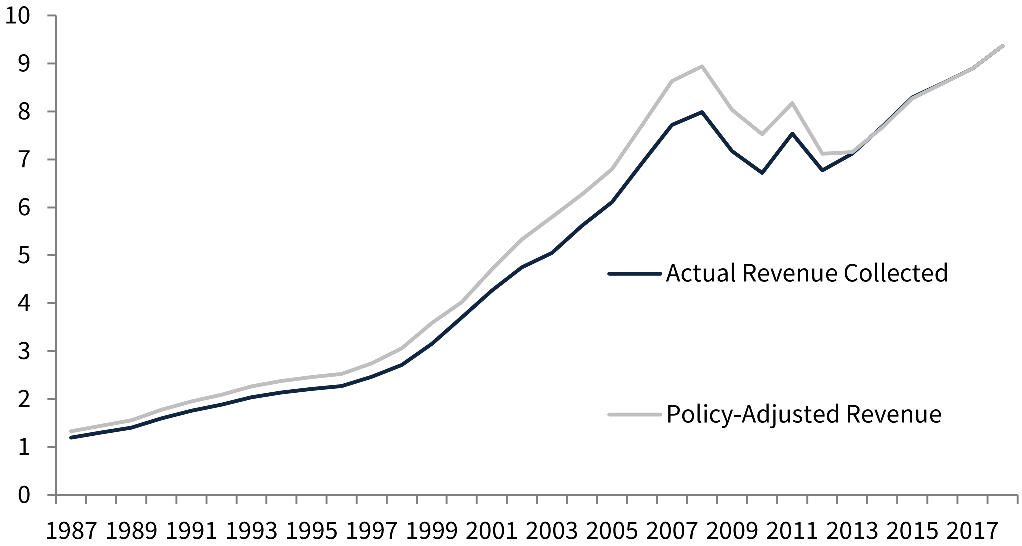
Figure 3.2: Actual and Policy-Adjusted VAT.
€ Billions, 1987-2018



Sources: CSO; Department of Finance; and author's own calculations.
Note: Policy-adjusted revenue takes account of policy changes which impact on receipts, as outlined in the text.

Turning next to macroeconomic drivers, the distortions caused by the activities of multinationals mean GDP and GNP are no longer reliable indicators of economic activity in Ireland. Alternative indicators which strip out the impact of foreign-owned multinational enterprises on the economy provide a better measure of economic activity in Ireland. With this in mind, domestic GVA and modified GNI (GNI*) may be more suitable macroeconomic drivers of income tax and PRSI. Domestic GVA describes gross value added by sectors not dominated by multinational enterprises.[6] GNI* describes Gross National Income excluding; factor income of redomiciled companies, depreciation on R&D service imports and trade in intellectual property, and depreciation on aircraft leasing.

Figure 3.3: Actual and Policy-Adjusted PRSI.
€ Billions, 1987-2018



Sources: CSO; Department of Finance; and author's own calculations.
Note: Policy-adjusted revenue takes account of policy changes which impact on receipts, as outlined in the text.

As the revenue figures are in nominal terms, the macroeconomic drivers are also taken in nominal form. We use non-agricultural income in the baseline income tax and PRSI regressions, with domestic GVA and GNI* (both in nominal terms) used as robustness checks (results shown in Appendix A).

For VAT, nominal personal consumption and nominal investment in the building and construction sector are used. Building and construction

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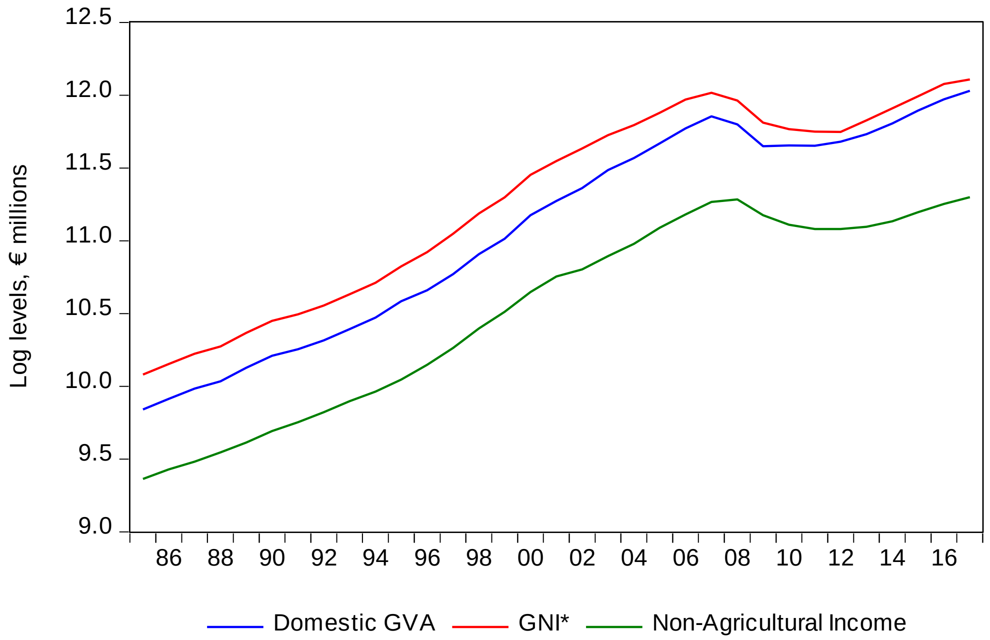
[6] This is an official measure of economic activity that is produced by the Central Statistics Office. The non-domestic sector is defined as sectors where foreign-owned multinational enterprise turnover on average exceeds 85% of the sector total.

investment is included as the housing sector yields considerable VAT receipts (Addison-Smyth and McQuinn, 2016).[7] Each of these macroeconomic drivers is taken from the quarterly and annual National Accounts published by the Central Statistics Office. The non-agricultural income variable comes from Table 1 from the annual National Income and Expenditure accounts, combining non-agricultural wages and salaries with non-agricultural self-employed earnings.

Figure 3.4 shows the log of domestic GVA, GNI* and non-agricultural income over the period 1985 to 2017. The three metrics all show a similar profile and hence it is not surprising that our results for income tax and PRSI are robust to the choice of any of the three macroeconomic indicators shown.

Figure 3.4: Measures of Income and Output in Ireland.
1985-2017



Sources: CSO; and author's own calculations.

[7] In addition, when only personal consumption is used (results in appendix A), the residuals in the long-run equations were found to be non-stationary. By contrast when both consumption and investment in the building and construction sector are used, the residuals are found to be stationary (Table B.2)

3.2 Methodology

While conceptually straightforward, a variety of approaches have been used in the literature to estimate elasticities. The approach in this paper mirrors those taken in Mourre and Princen (2015) and Wolswijk (2007).

For the estimation of the long-run elasticity, the standard approach is to estimate Ordinary Least Squares (OLS), with data transformed to logs. We test each of our revenue variables and macroeconomic drivers for unit roots using the Augmented Dickey-Fuller (ADF) test. In each case, stationarity was achieved after first differencing (Appendix B).

As suggested by Stock and Watson (1993), we add a lag and the contemporaneous change of the independent variable, giving dynamic OLS estimates, to correct the coefficient bias.[8] This is shown in equation (1) below. For the standard errors, the Newey-West correction (Newey and West, 1987) is applied.

The base two-step specification is as follows:

$$Log(PAR_t) = \alpha_1 + \alpha_2 * \mathrm{Log}(MD_t) + \alpha_3 * \mathrm{Dlog}(MD_{t-1}) + \alpha_4 * \mathrm{Dlog}(MD_t) + \varepsilon_t \quad (1)$$

$$Dlog(PAR_t) = \beta_0 + \beta_1 * Dlog(MD_t) + \beta_2 * (\mathrm{Log}(PAR_{t-1}) - (\alpha_1 + \alpha_2 * \mathrm{Log}(MD_{t-1}) + \alpha_3 * \mathrm{Dlog}(MD_{t-2}) + \alpha_4 * \mathrm{Dlog}(MD_{t-1}))) + \mu_t \quad (2)$$

Where PAR_t represents policy-adjusted revenue (income tax, PRSI or VAT), and MD_t represents the macroeconomic driver of that revenue heading (non-agricultural income, GNI*, domestic GVA, personal consumption or investment in the building and construction sector).

The long-run elasticity α_2 is estimated first in equation (1). Using those coefficients, equation (2) is then estimated, with β_1 representing the

[8] As we have only 30 observations, we limit ourselves to one lag and the contemporaneous change in the independent variable.

short-run elasticity and β_2 representing the speed of error correction. So changes in the short-run can be due to changes in the macroeconomic driver or through returning to the long-run relationship between revenue and the appropriate macroeconomic driver.

After estimating equations such as those given in (1) above, we test if these non-stationary variables are integrated. We do this by performing a stationarity test on the residuals of these long-run equations. For each of the three revenue headings we find that these errors are indeed stationary and hence the co-integrating relationship exists between revenue and their macroeconomic driver (Table B.2).

An equivalent one-step specification is also estimated:

$$Dlog(PAR_t) = \beta_0 + \beta_1 * Dlog(MD_t) + \beta_2 * (\text{Log}(PAR_{t-1}) - \beta_3 * (\text{Log}(MD_{t-1}) - \beta_4 * \text{Dlog}(MD_{t-2}) - \beta_5 * \text{Dlog}(MD_{t-1})) + \mu_t \qquad (3)$$

We experimented with variations of the one- and two-step models described above. Firstly, we investigated if the speed of error correction was symmetric. This was done by estimating separate error correction coefficients when the revenue level is above/below its long-run level. We found no significant evidence of an asymmetric speed of error correction.

On a similar theme, we tried interacting the speed of error correction with a dummy for instances of a positive output gap.[9] No significant difference was detected. We also tried interacting this output gap dummy with the long-run impact of the macroeconomic driver. In some instances we found a statistically significant coefficient, but even when these impacts were statistically significant, they were not economically significant.[10]

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[9] Using estimates from Casey (2018) based on domestic GVA.
[10] For example, for income tax we estimated that the long-run elasticity was 1.39 with a negative output gap and 1.41 with a positive output gap.

After these various different specifications were tried, we decided to stick with the simplest and most parsimonious models, those given in equations (1) to (3) above, particularly given that we have only thirty observations.

Any revenue elasticity can be thought of as the ratio of the marginal tax rate to the average tax rate. With this in mind, for income tax or PRSI, it gives an insight into the progressivity of a tax for a given level of income (Creedy and Gemmell, 2011). An elasticity above one indicates a progressive tax structure. A one per cent increase in income leads to a greater than one per cent increase in revenue, as the marginal tax rate is greater than the average tax rate. Conversely, an elasticity below one would indicate a regressive tax structure.

4. Results

In this section, we first present the results of the elasticities estimated for the three revenue headings examined.

4.1 Income tax

Four versions of the results are presented in Table 4.1. To see the impact of adjusting revenue for policy changes, we estimate models using policy-adjusted revenue and unadjusted revenue. The preferred estimates are those which adjust for policy changes, given in columns (1) and (2). The estimates in columns (3) and (4) correspond to revenue buoyancy. We estimate the one-step and two step models, as outlined by equations (1), (2) and (3) above. The models below use non-agricultural income as the macroeconomic driver. As a robustness check, models were also estimated with domestic GVA and GNI* as the macroeconomic driver and the results are presented in Appendix A. The results are very similar to those shown in Table 4.1.

Table 4.1: Income Tax Results
Estimated coefficients, 1987 – 2017.

	(1)	(2)	(3)	(4)
Estimation Method:	**One-step**	**Two-step**	**One-step**	**Two-step**
Policy-Adjusted?	**Adjusted**	**Adjusted**	**Unadjusted**	**Unadjusted**
Long-Run Elasticity				
Log(Income(-1))	1.40^{+**}	1.34^{+**}	0.83^{-**}	0.81^{-**}
	(0.08)	(0.02)	(0.06)	(0.04)
Short-Run Elasticity				
Dlog(Income)	1.51**	1.54**	0.98**	0.80**
	(0.33)	(0.13)	(0.18)	(0.11)
ECM	-0.27	-0.27	-0.19**	-0.18
	(0.19)	(0.21)	(0.09)	(0.12)
N	30	30	30	30

Sources: CSO, Department of Finance and author's calculations.
Note: +/- indicates that the long-run elasticity estimated is significantly greater/less than one. ** and * indicate significance at 5% and 10% levels respectively, standard errors are in parenthesis.

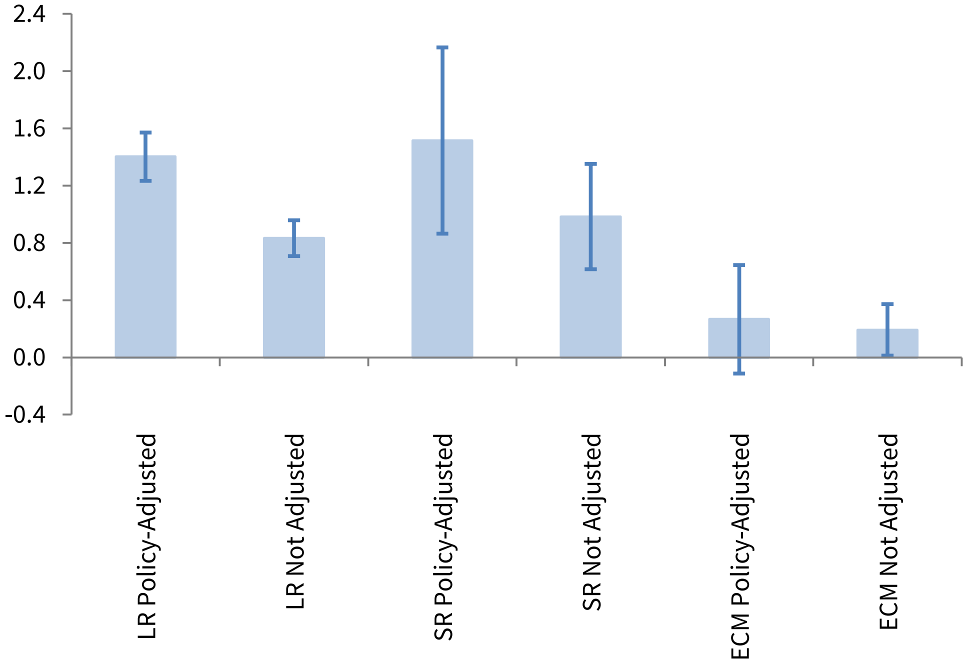
Looking across the four columns, we can see that the results are heavily influenced by whether or not the revenue data is adjusted for policy changes. Looking at the long-run elasticity, we can see that when adjustments for policy changes are made, estimates significantly above one are found. This would point towards the progressivity of the Irish income tax system (i.e., the marginal tax rate is higher than the average tax rate). Conversely, if no adjustment is made for policy changes (as previous studies have done), much lower estimates of the long-run elasticity are found, which are significantly below one in this case. Given that policy changes appear to have been negatively correlated with the economic cycle (Figure 3.1), it is unsurprising to find that elasticities estimated with policy-adjusted revenue are much higher than when not correcting for policy changes.

Figure 4.1 below shows the different coefficients estimated using policy-adjusted revenue or unadjusted revenue. The "whiskers" in this chart represent plus or minus two standard errors of the coefficients estimated. We can see that the long-run estimates are significantly different depending on whether or not policy-adjusted revenue is used. This highlights the importance of using policy-adjusted revenue when estimating elasticities.

Looking next at the short–run elasticities, adjusting for policy changes can also increase the elasticity estimated. Formally testing the short-run estimates in column (1) against (3) does not yield significant differences, but testing column (2) against (4) does indicate that there is a significant difference between them.

Comparing the short–run and long-run elasticities, in each of the four sets of estimates the difference between them is not statistically significant. Comparing the results from the one-step and two-step models, we can see that these are very similar and in no case are the coefficients significantly different (comparing column (1) v (2) and (3) v (4)).

Figure 4.1: Coefficients Estimated Using Policy-Adjusted and Unadjusted Income Tax Revenue.



Sources: CSO, Department of Finance and author's calculations.
Note: Absolute values of the ECM coefficients are shown. +/- two standard errors are shown. LR refers to the long-run elasticity, SR refers to the short-run elasticity and ECM refers to the error correction coefficient estimated (in absolute terms). Estimates in each case are using the one-step estimator, corresponding to columns (1) and (3) in Table 4.1.

Examining the error correction coefficient, this appears to be stronger when policy-adjusted revenue is used. This makes some intuitive sense. Consider the case where large policy changes are made: unadjusted revenue would deviate from what macroeconomic drivers would suggest. It would be unlikely that revenue would quickly correct back to the level suggested by the macroeconomic driver alone. While not always statistically significant, the range of estimates (between 18 and 27 per cent correction per annum) are in line with those found elsewhere in the literature.

As a robustness check, the equations are also estimated over different time periods. For income tax, we find that the results are reasonably robust to the sample period used. In particular, estimates of the long-run elasticity and the speed of error correction seem stable over time. The estimated short-run elasticity does show some evidence of increasing when later years are included in the sample (either with an expanding or moving sample window).

4.2 PRSI

Four versions of the results are presented in Table 4.2. As was the case with income tax, models were also estimated with domestic GVA and GNI* as the macroeconomic driver as opposed to non-agricultural income. These results are shown in Appendix A, and are very similar to those presented below.

Table 4.2: PRSI Results
Estimated coefficients, 1987 – 2017

	(1)	(2)	(3)	(4)
Estimation Method:	**One-step**	**Two-step**	**One-step**	**Two-step**
Policy-Adjusted?	**Adjusted**	**Adjusted**	**Unadjusted**	**Unadjusted**
Long-Run Elasticity				
Log(Income(-1))	1.00**	1.01**	1.03**	1.03**
	(0.03)	(0.02)	(0.04)	(0.03)
Short-Run Elasticity				
Dlog(Income)	0.48*	0.97**	0.59**	0.98**
	(0.25)	(0.10)	(0.24)	(0.10)
ECM	-0.48**	-0.42**	-0.34**	-0.32**
	(0.23)	(0.16)	(0.15)	(0.12)
N	30	30	30	30

Sources: CSO, Department of Finance and author's calculations.
Note: **, * indicate significance at 5% and 10% levels respectively, standard errors are in parenthesis.

There is far less variation across the results for PRSI compared to income tax. This is mainly because policy changes have been much less substantial for PRSI, particularly compared to income tax. Given the limited policy changes, it is not surprising that the differences between column (1) v (3) and (2) v (4) are quite small.

Looking at the long-run elasticity, estimates of one or just above one are found consistently across specifications. In each case, the estimates are not significantly different to one. This would indicate that PRSI is neither a progressive nor regressive revenue heading.

Estimates of the short–run elasticity vary somewhat depending on what estimation strategy is used. Using the two-step estimation strategy, a short-run elasticity of close to one is found. When using the one-step estimator, a much lower elasticity is found (0.48 – 0.59). The speed of error correction estimated varies somewhat depending on whether or not revenue is adjusted for policy measures. As was the case for income tax, the speed of error correction is faster when policy-adjusted PRSI is used.

For PRSI, we find that the results are reasonably robust to the sample period used. In particular, estimates of the long-run elasticity seem very stable over time. The speed of error correction and the short-run elasticity show some evidence of increasing when later years are included in the sample (with either an expanding or moving sample window).

4.3 VAT

Four versions of the results are presented in Table 4.3. Personal consumption and investment in the building and construction sector are used as the macroeconomic drivers in this case. Appendix A shows estimates when only personal consumption is used as the macroeconomic driver.

Like PRSI, policy changes impacting on VAT receipts have been relatively limited in the years examined (particularly when compared with income tax). Despite the relatively small differences between adjusted and unadjusted revenue, there are some differences in the elasticities estimated using the different series.

Table 4.3: VAT Results
Estimated coefficients, 1987 – 2017

	(1)	(2)	(3)	(4)
Estimation Method:	**One-step**	**Two-step**	**One-step**	**Two-step**
Policy-Adjusted?	**Adjusted**	**Adjusted**	**Unadjusted**	**Unadjusted**
Long-Run Elasticity				
Log(Consumption(-1))	0.80**	0.82**	0.88**	0.90**
	(0.04)	(0.03)	(0.06)	(0.03)
Log (B&C)	0.21**	0.20**	0.18**	0.17**
	(0.03)	(0.02)	(0.04)	(0.02)
Short-Run Elasticity				
Dlog(Consumption)	1.42**	0.95**	1.32**	0.94**
	(0.12)	(0.10)	(0.24)	(0.11)
Dlog(B&C)	0.13**	0.15**	0.17**	0.17**
	(0.04)	(0.04)	(0.06)	(0.04)
ECM	-0.73**	-0.75**	-0.68**	-0.62**
	(0.19)	(0.23)	(0.19)	(0.22)
N	30	30	30	30

Sources: CSO, Department of Finance and author's calculations.
Note: **, * indicate significance at a 5% and 10% level respectively, standard errors are in parenthesis. B&C represents investment in the building and construction sector as defined in the National Accounts.

Adjusting for policy changes yields slightly higher coefficient estimates for building and construction investment, and lower coefficient estimates for consumption. In all four sets of estimations we find that the sum of the two long-run elasticities are not significantly different to one. The speed of error correction is very consistent and fast across the four specifications.

The estimated short-run elasticities vary somewhat also. The short-run consumption elasticities exceed the long-run relationship and imply significant overshooting in response to a change in consumption. The short-run responses to building and construction investment are much closer to the estimated long-run building and construction elasticity.

For VAT, we find that the results are robust to the sample period used. All of the coefficients of interest appear to be unaffected by changing the sample period (either with an expanding or moving sample window).

As a robustness check, the same equations were estimated using only personal consumption in the long-run and short-run. With this specification, we find a consistent long-run elasticity with respect to consumption, just above one. We also find some evidence of an overshooting short-run response to changes in consumption. These results are shown in Table A.5 in Appendix A.

4.4 Summary of Results

Table 4.4 provides a summary of various estimates of the long-run Irish elasticity of income tax. Looking at other empirical studies of Irish data, estimates just above/below one have been found. Interestingly, analytical work from Acheson et al (2017) and Price et al (2014) suggested a much higher elasticity. In explaining the difference between their empirical and analytical results, Acheson et al (2017) notes that not correcting for policy changes may be biasing their empirical estimates downwards.

This paper provides some supportive evidence for this hypothesis, as our empirical estimates when adjusting for policy changes (1.40) are indeed much higher than when not adjusting for policy changes (0.83). The estimates we find when not adjusting for policy changes is in the range of estimates from other papers which used unadjusted revenue. When we adjust for policy changes, our estimates of the long-run elasticity are higher than previous empirical work which used unadjusted revenue.

Wolswijk (2007) performed a similar exercise to this paper, using policy-adjusted revenue to estimate long-run and short-run elasticities for a number of tax heads for a single country (the Netherlands). Interestingly, Wolswijk (2007) finds a long-run income tax elasticity of a similar magnitude to this paper.

Table 4.4: Estimates of Income Tax Elasticities
Long-run elasticity

	Method	Macro Driver	Policy-Adjusted Revenue?	Estimate
Deli et al (2017)	Empirical	GNP	No	1.17
Acheson et al (2017)	Empirical	Income	No	0.83
Acheson et al (2017)	Analytical	Income	No	2.0[1]
Acheson et al (2017)	Analytical	Income	No	1.2[2]
Price et al (2014)	Analytical	Income	No	2.11
Köster and Priesmeier (2017)	Empirical	GDP	No	0.88[3]
Wolswijk (2007)	Empirical	Income	Yes	1.57[4]
Conroy (2019)	Empirical	Income	Yes	1.40

Sources: Various.
Note: 1 Refers to estimate based on income tax only, not including USC.
2 Estimate based on USC only.
3 Total current government revenue, rather than income tax is the dependent variable.
4 Wolswijk (2007) is an analysis on the Netherlands. As it uses a very similar approach to this paper, adjusting for policy measures and estimating short- and long-run elasticities, the results are shown.

Table 4.5 provides a summary of estimates of the long-run elasticity of PRSI in Ireland. There have not been many studies examining the elasticity of PRSI receipts. Analytical work suggests an elasticity well above one, while previous empirical work found an elasticity close to one when examining social security contributions in the EU as a whole. Estimates from this paper suggest an elasticity of one, implying that PRSI is neither progressive nor regressive.

Table 4.5: Estimates of PRSI Elasticities
Long-run elasticity

	Method	Macro Driver	Policy-Adjusted Revenue?	Estimate
Mourre and Princen (2015)	Empirical	Income	Yes	0.98[1]
Price et al (2014)	Analytical	Income	No	1.51
Conroy (2019)	Empirical	Income	Yes	1.00

Sources: Various.
Note: 1 Panel analysis of the EU, no individual country elasticities are estimated.

Table 4.6 provides a summary of estimates of the long-run elasticity of VAT receipts. Morre and Princen (2015) find a long-run elasticity of consumption taxes for the EU to be just above one. In some respects our estimates from Table 4.3 are not comparable to other estimates as building and construction investment is also included in the regressions. Using only consumption as an explanatory variable (as shown in Table A.5) gives a long-run elasticity of 1.09, in line with previous empirical estimates. Wolswijk (2007) performs a similar exercise to this paper, examining Value-Added Tax in the Netherlands. A long-run elasticity of just below one is found for the Netherlands.

Lyons et al (2009) estimate price and income elasticities for a number of categories of consumption in Ireland. They find that most categories of expenditure have income elasticities above one (the exceptions being food, beverages and tobacco and miscellaneous goods and services). In formulating VAT forecasts, the Department of Finance assumes an elasticity of one with respect to nominal consumption (TFMRG, 2008). The results in this paper would also suggest that building and construction investment may also play a significant role. When only consumption is used as a predictor, an elasticity just above one would appear appropriate.

Table 4.6: Estimates of VAT Elasticities

Long-run elasticity

	Method	Macro Driver	Policy-Adjusted Revenue?	Estimate
Acheson et al (2018)	Analytical	Taxable income	No	0.6
Acheson et al (2018)	Analytical	Consumption	No	0.7
Price et al (2014)	Analytical	Consumption	No	1.18
Mourre and Princen (2015)	Empirical	Consumption	Yes	1.08[1]
Wolswijk (2007)	Empirical	Consumption	Yes	0.90[2]
Conroy (2019)	Empirical	Consumption	Yes	1.09[3]
Conroy (2019)	Empirical	Consumption	Yes	0.80[4]

Sources: Various.

Note: 1 Panel analysis of the EU, no individual country elasticities are estimated.

2 Wolswijk (2007) focuses only on the Netherlands. As it uses a very similar approach to this paper, adjusting for policy measures, the results are shown.

3 This refers to estimates where only consumption is used as an explanatory variable (Table A.5).

4 This refers to where consumption and investment in the building and construction sector are used as explanatory variables (Table 4.3).

A number of analytical studies of the elasticity of VAT receipts have also been completed. Acheson et al (2018) derived an elasticity well below one, while Price et al (2014) found an elasticity significantly above one, both with respect to consumption.

5. Conclusions

This paper contributes to the literature of empirical studies on Irish tax elasticities. We make three major contributions. First, we compile a new dataset on the impact of tax policy changes on different headings of government revenue. This allows us to use policy-adjusted revenue when estimating elasticities. We find that using policy-adjusted revenue has a significant impact on the elasticities estimated. Second, we estimate both long-run and short-run elasticities in a dynamic setting. Third, we estimate elasticities for PRSI and VAT, which have largely been ignored in the Irish empirical literature.

Our results suggest a long-run income tax elasticity significantly above one and higher than previous empirical studies for Ireland. We find that correcting for tax policy changes has a large impact on the estimates of this elasticity. Our estimates of an elasticity significantly above one implies that income tax is progressive. Estimates produced where policy changes are not taken account of are significantly lower and below one. This highlights the need for recognising the role played by tax policy on revenue collected when trying to assess the link between changes in the tax base and revenue raised.

For VAT and PRSI, we find that adjusting for policy changes has a less significant impact due to the typically smaller and less frequent policy changes in these areas. For PRSI we find a long-run elasticity of one, suggesting a structure which is neither progressive nor regressive. For VAT, we find that a significant role is played both by personal consumption and investment in the building and construction sector. For all three of the revenue sources examined, our results are robust to varying the estimation strategy and/or the macroeconomic driver used.

In distinguishing between long-run and short-run elasticities, some interesting results emerge. For income tax, we find that the short-run elasticity is similar to the long-run elasticity. For PRSI, we find some evidence that the short-run elasticity is smaller than the long-run estimate, implying undershooting in response to a change in income. Conversely, for VAT we find an unusually strong short-run elasticity, implying overshooting in response to a change in consumption.

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Appendix A: Results using Alternative Macroeconomic Drivers

Table A.1: Income Tax Results using GNI*

Estimated coefficients, 1987-2017

	(1)	(2)	(3)	(4)
Estimation Method:	**One-step**	**Two-step**	**One-step**	**Two-step**
Policy-Adjusted?	**Adjusted**	**Adjusted**	**Unadjusted**	**Unadjusted**
Long-Run Elasticity				
Log(GNI*(-1))	1.34^{+**}	1.29^{+**}	0.80^{-**}	0.80^{-**}
	(0.13)	(0.03)	(0.06)	(0.04)
Short-Run Elasticity				
Dlog(GNI*)	0.53*	1.37**	0.40**	0.72**
	(0.27)	(0.15)	(0.19)	(0.11)
ECM	-0.19	0.02	-0.21**	-0.23
	(0.23)	(0.21)	(0.08)	(0.12)
N	30	30	30	30

Sources: CSO, Department of Finance and author's calculations.
Note: +/- indicates that the long-run elasticity estimated is significantly greater/ less than one. ** and * indicate significance at 5% and 10% levels respectively, standard errors are in parenthesis.

Table A.2: Income Tax Results using Domestic GVA

Estimated coefficients, 1987-2017

	(1)	(2)	(3)	(4)
Estimation Method:	**One-step**	**Two-step**	**One-step**	**Two-step**
Policy-Adjusted?	**Adjusted**	**Adjusted**	**Unadjusted**	**Unadjusted**
Long-Run Elasticity				
Log(Domestic GVA(-1))	1.22^{+}**	1.22^{+}**	0.75^{-}**	0.75^{-}**
	(0.09)	(0.05)	(0.04)	(0.02)
Short-Run Elasticity				
Dlog(Domestic GVA)	0.67**	1.30**	0.49**	0.72**
	(0.20)	(0.16)	(0.17)	(0.10)
ECM	-0.15	-0.09	-0.29**	-0.34**
	(0.12)	(0.14)	(0.10)	(0.15)
N	30	30	30	30

Sources: CSO, Department of Finance and author's calculations.
Note: +/- indicates that the long-run elasticity estimated is significantly greater/ less than one.
** and * indicate significance at 5% and 10% levels respectively, standard errors are in parenthesis.

Table A.3: PRSI Results using GNI*

Estimated coefficients, 1987-2017

	(1)	(2)	(3)	(4)
Estimation Method:	**One-step**	**Two-step**	**One-step**	**Two-step**
Policy-Adjusted?	**Adjusted**	**Adjusted**	**Unadjusted**	**Unadjusted**
Long-Run Elasticity				
Log(GNI*(-1))	0.97**	0.98**	1.00**	1.01**
	(0.03)	(0.02)	(0.04)	(0.03)
Short-Run Elasticity				
Dlog(GNI*)	0.06	0.85**	0.25**	0.87**
	(0.10)	(0.10)	(0.11)	(0.10)
ECM	-0.55**	-0.41**	-0.35**	-0.31**
	(0.19)	(0.17)	(0.11)	(0.12)
N	30	30	30	30

Sources: CSO, Department of Finance and author's calculations.
Note: ** and * indicate significance at 5% and 10% levels respectively, standard errors are in parenthesis.

Table A.4: PRSI results using Domestic GVA

Estimated coefficients, 1987-2017

	(1)	(2)	(3)	(4)
Estimation Method:	**One-step**	**Two-step**	**One-step**	**Two-step**
Policy-Adjusted?	**Adjusted**	**Adjusted**	**Unadjusted**	**Unadjusted**
Long-Run Elasticity				
Log(Domestic GVA(-1))	0.90^{-}**	0.93**	0.95^{-}**	0.97**
	(0.04)	(0.02)	(0.02)	(0.02)
Short-Run Elasticity				
Dlog(Domestic GVA)	0.18*	0.84**	0.24**	0.86**
	(0.10)	(0.11)	(0.08)	(0.10)
ECM	-0.37*	-0.22*	-0.51**	-0.42*
	(0.21)	(0.21)	(0.18)	(0.19)
N	30	30	30	30

Sources: CSO, Department of Finance and author's calculations.
Note: - indicates that the long-run elasticity estimated is significantly less than one.
** and * indicate significance at 5% and 10% levels respectively, standard errors are in parenthesis.

Table A.5: VAT Results using Personal Consumption

Estimated coefficients, 1987-2017

	(1)	(2)	(3)	(4)
Estimation Method:	**One-step**	**Two-step**	**One-step**	**Two-step**
Policy-Adjusted?	**Adjusted**	**Adjusted**	**Unadjusted**	**Unadjusted**
Long-Run Elasticity				
Log(Consumption(-1))	1.09^{+}**	1.10^{+}**	1.14^{+}**	1.14^{+}**
	(0.03)	(0.03)	(0.03)	(0.02)
Short-Run Elasticity				
Dlog(Consumption)	1.82**	1.27**	1.81**	1.27**
	(0.12)	(0.09)	(0.12)	(0.09)
ECM	-0.27**	-0.25**	-0.36**	-0.30**
	(0.11)	(0.13)	(0.14)	(0.15)
N	30	30	30	30

Sources: CSO, Department of Finance and author's calculations.
Note: + indicates that the long-run elasticity estimated is significantly greater than one.
**, * indicate significance at 5% and 10% levels respectively, standard errors are in parenthesis.

Table A.6: VAT Results using Income and Building and Construction Investment

Estimated coefficients, 1987-2017

	(1)	(2)	(3)	(4)
Estimation Method:	**One step**	**Two step**	**One step**	**Two step**
Policy-Adjusted?	**Adjusted**	**Adjusted**	**Unadjusted**	**Unadjusted**
Long-Run Elasticity				
Log(Income)	0.75**	0.79**	0.88**	0.89**
	(0.05)	(0.03)	(0.05)	(0.04)
Log (B&C)	0.21**	0.19**	0.15**	0.14**
	(0.04)	(0.02)	(0.04)	(0.02)
Short-Run Elasticity				
Dlog(Income)	1.19**	0.82**	1.22**	0.85**
	(0.36)	(0.12)	(0.37)	(0.13)
Dlog(B&C)	0.18**	0.16**	0.18*	0.16**
	(0.07)	(0.05)	(0.09)	(0.05)
ECM	-0.58**	-0.59**	-0.60**	-0.56**
	(0.11)	(0.21)	(0.20)	(0.21)
N	30	30	30	30

Sources: CSO, Department of Finance and author's calculations.
Note: B&C represents investment in the building and construction sector as defined in the National Accounts. **, * indicate significance at a 5% and 10% level respectively, standard errors are in parenthesis.

Appendix B: Unit Root Test Results

Table B.1 shows the results using the Augmented Dickey-Fuller (ADF) test on unit roots. As policy-adjusted revenue is what is used in the regression analysis, policy-adjusted revenue is used in the stationarity tests.[11] We find that each of the three revenue sources is stationary after first differencing. For the macroeconomic drivers, we find similar results, with all of the variables showing evidence of stationarity after taking first differences. Modified GNI (GNI*) is the only variable which shows any evidence of stationarity before differencing.

Table B.1: Augmented Dickey Fuller Test, 1987-2017

	(1) Level	(2) Level with trend	(3) First Difference
Income Tax	-0.43	-2.87	-4.58**
VAT	-1.25	-2.40	-2.67*
PRSI	-0.45	-1.92	-3.88**
Income	-0.55	-3.14	-2.93*
Consumption	-0.56	-2.31	-2.96*
B&C Investment	-1.55	-1.86	-3.65**
GNI*	-0.62	-3.35*	-3.06**
Domestic GVA	-0.11	-3.07	-2.63*

Sources: CSO, Department of Finance and author's calculations.
Note: T-statistics are shown, ** and * indicate significance at 5% and 10% levels respectively.

The residuals from the long-run equations are also tested for stationarity using the ADF test (these equations are described in column 2 of Table 4.1, 4.2 and 4.3). This yields satisfactory results of stationary residuals in each case (Table B.2).

[11] Similar results are found if unadjusted revenue is used.

Table B.2: Augmented Dickey-Fuller Tests on Residuals from Long-Run Dynamic OLS Equations, 1987-2017

	(1)
	Level
Income Tax	-3.05**
VAT	-3.58**
PRSI	-6.05**

Sources: CSO, Department of Finance and author's calculations.
Note: ** and * indicate significance at 5% and 10% levels respectively.

Appendix C: Cointegration Test Results

Table C.1 shows the results of cointegration tests of the three revenue sources examined and their macroeconomic drivers. The tests are performed using both the policy-adjusted revenue series and the unadjusted series. For income tax and VAT, we find significant evidence of a long-run relationship between revenue and the macroeconomic driver. For PRSI, we find the trace statistic is slightly below a statistically significant level. However, one has to keep in mind the relatively small sample for these tests.

It is also interesting to examine the differences here in using the unadjusted revenue series and the policy-adjusted revenue series. Using the unadjusted series, we do not find evidence of a stable long–run relationship between revenue and the macroeconomic driver in any of the three cases.

Table C.1: Johansen System Cointegration Test (rank test)

	Null: None	Null: at most one
Income Tax (policy-adjusted)	25.7**	0.6
Income tax	3.7	0.2
PRSI (policy- adjusted)	12.7	1.0
PRSI	5.6	0.05
VAT (policy-adjusted)	13.7*	0.07
VAT	11.1	0.02

Sources: CSO, Department of Finance and author's calculations.
Note: In each case tests are performed with one lag. The macroeconomic drivers for Income tax, PRSI and VAT are non-agricultural income, non-agricultural income and personal consumption respectively. 29 observations are used (1989 – 2017). ** and * indicate significance at 5% and 10% levels respectively.

Looking at the Granger-causality tests, for income tax and VAT we find evidence for causality running in both directions. For PRSI there is a more conclusive result, with income Granger-causing PRSI and PRSI not Granger-causing income.

When using the unadjusted revenue series for income tax, we find no evidence of Granger-causality in either direction.

Table C.2: Granger-Causality Tests

	Null: Macro driver does not cause revenue	Null: Revenue does not cause macro driver
Income Tax (policy-adjusted)	18.3**	12.3**
Income tax	0.1	2.3
PRSI (policy-adjusted)	12.7**	0.3
PRSI	6.2**	0.1
VAT (policy-adjusted)	6.0**	12.1**
VAT	6.2**	15.6**

Sources: CSO, Department of Finance and author's calculations.
Note: In each case tests are performed with two lags. The macroeconomic drivers for Income tax, PRSI and VAT are non-agricultural income, non-agricultural income and private consumption respectively. 29 observations are used (1989 – 2017). ** and * indicate significance at 5% and 10% levels respectively.

Appendix D: Dataset on Tax Policy Changes

This appendix describes the new dataset which underlies much of the analysis in the paper. Hazel Ahern-Flynn was a summer intern for IFAC in the summer of 2017 and did excellent work in constructing much of this dataset, for which the author is very grateful. The dataset is available online at https://www.FiscalCouncil.ie/

Since *Budget 1987*, part of the budgetary documentation published includes estimates of the costs or yields arising from changes to the tax system.[12] These estimates include the estimated yield or cost in the initial year as well as for a full year. One-off items are typically highlighted in this section also. Estimates of these costs or yields are broken out between the different tax heads. What is recorded in our dataset is the aggregate impact of all policy changes on a particular tax heading. This is done for the initial year, full year and any one-off impacts. Policy changes impacting on the following revenue headings are recorded: income tax, VAT, PRSI, corporation tax, capital acquisitions tax, capital gains tax, stamp duties, excise duties and other.

Budgetary documentation (including estimated impacts of tax policy changes) is available online from *Budget 2000* to the present (the document used to compile this dataset is typically described as "tax policy changes" or "summary of taxation measures").[13] For the years 1987 – 1999, budget day estimates of the costs/yields of tax policy changes are contained in budget documentation. Physical copies of these budget books were obtained on loan from the Department of Finance. The estimates of tax policy changes were then scanned, transcribed and saved in excel format.

[12] Prior to *Budget 1987*, there is no systematic recording of the costs/yield of tax policy changes in budget documentation.
[13] In addition, the budget day speeches of the various Ministers for Finance are available online for *Budget 1996* and later. See http://budget.gov.ie/

There is one instance where a significant tax policy measure we are aware of was not announced in a budget but we have estimates of the cost. This relates to the reduced (9 per cent) VAT rate applied to tourism related activities. This was implemented from July 2011. Estimates of the initial year cost (€120 million) and full year cost (€350 million) are taken from the Jobs Initiative documentation, where the policy change was officially recorded.[14]

An important classification issue that arose relates to income tax and the USC. The USC was introduced in 2011, replacing the health levy and income levy. It was claimed that this change would be revenue neutral in 2011, with an increase in receipts of €420 million in a full year. This means that USC receipts were expected to be the same in 2011 as what would have been collected by the income levy and health levy, had they still been in place. In subsequent years, the USC would collect €420 million more than would otherwise have been the case.

Prior to this policy change, income levy receipts were counted as part of income tax, while health levy receipts were a departmental receipt (Department of Health).

With this in mind, if one takes assumes that the USC raised the same level of receipts as the income levy and health levy combined would have, then this policy change would increase income tax/USC receipts (as health levy receipts were not previously included in income tax). Health levy receipts in 2010 were €2,018 million, so we assume that the impact of this policy change on income tax/USC receipts in 2011 is €2,018 million, while the full year impact is €2,438 million (€2,018 million plus €420 million).[15]

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[14] See https://merrionstreet.ie/en/wp-content/uploads/2011/05/Jobs_Initiative_Booklet_10_May_2011.pdf

[15] No forecasts had been made for health levy receipts in 2011, so for simplicity we assume zero growth.