



**Irish Fiscal
Advisory Council**

Working paper series

Free State to Tax state: A century of taxation in Ireland

Killian Carroll

Working Paper No. 16

April 2022

Suggested reference:

Carroll, K. (2022). "Free State to tax state: A century of taxation in Ireland"
Irish Fiscal Advisory Council Working Paper Series No. 16. Dublin.

Free State to tax state: A century of taxation in Ireland

Killian Carroll¹

Version: April 2022

Abstract

Over the last century, there has been a dramatic change in both the composition and the structure of the Irish tax system. In this paper, we construct a new dataset of tax rates and tax bands for the main tax headings in Ireland, from 1920-2019. We document these changes and trends in tax policy in the aggregate and using the main tax headings. One striking regularity, however, is that Irish tax policy has been persistently procyclical. While tax revenues are naturally expected to vary with the cycle, we show that changes in tax rates have been conducted procyclically. Most notably, we find strong evidence that governments have tended to adjust the rates of income tax in a procyclical manner over the past century. Using an additional tax policy changes dataset, we show that discretionary tax measures—which incorporate all tax policy instruments (rates, bands, credits, exemptions, etc.)—have been largely procyclical manner over the period 1987-2019. These findings are in contrast with other developed countries, where tax policy has tended to be acyclical.

Keywords: Fiscal Policy, Taxation, Business Cycle, Ireland, Economic History.

JEL No. E32, E62, H20, N14, N44.

© Irish Fiscal Advisory Council 2022

This report can be downloaded at www.FiscalCouncil.ie

¹ The author is a Research Assistant at the Irish Fiscal Advisory Council and a PhD student at University College Dublin. Email Killian.carroll@fiscalcouncil.ie. The opinions expressed and arguments employed in this paper do not necessarily reflect the official views of the Irish Fiscal Advisory Council. The tax rate and tax band dataset that accompanies this paper is available online at <https://www.fiscalcouncil.ie/datasets/>. The author would like to acknowledge the kind assistance from members of the Council and Secretariat of the Irish Fiscal Advisory Council, in particular Eddie Casey and Sebastian Barnes. The author would like to also acknowledge the valuable comments received from Kieran McQuinn (ESRI) and John Fitzgerald (TCD).

1. Introduction

The Irish economy has changed dramatically since the Irish Free State was first established almost a century ago in 1922. How it has changed and what role government policy has played in changing the structure of the economy are important questions.

The Irish economy has changed dramatically since the Irish Free State was first established almost a century ago in 1922. Throughout this period, Ireland has experienced large swings in economic activity. As a small open economy, Ireland is exposed to global shocks. As such, it is important that domestic macroeconomic policy is conducted with a view to stabilising the economy. Given that Ireland is now a member of a monetary union, and does not have control over monetary policy, the use of fiscal policy in stabilising the business cycle is especially important. The impact that fiscal policy has had in terms of mitigating/exacerbating these fluctuations warrants close scrutiny and lessons can be drawn from it to better inform future policy decisions.

In this paper, we construct a new dataset to document how tax policy in Ireland has evolved from 1920 to 2019. We focus on the changes in composition and the trends in taxation over the past century. In addition, we show that tax policy has been persistently procyclical over the past century. A major contribution of this paper is that we isolate the discretionary changes to tax policy (changes to tax rates and tax bands) in our analysis. This sets our work apart from previous studies that have focused primarily on tax revenues. The distinction is critical as tax revenue is endogenous to the business cycle. That is, changes in tax revenues may not always reflect changes in policy, but instead, may reflect changes in the business cycle or other non-policy factors.

Using a new dataset on tax rates and tax bands, we show that income tax rates have been changed procyclically over the period 1920-2019. In addition, we construct a “tax rate index” as a measure of the overall tax system, which is a weighted average of changes in the rates of a number of key tax headings, and show that this too has exhibited signs of procyclicality over the period 1975-2019.

We use an additional dataset on the estimated yield/cost of all budgetary tax measures introduced from 1987-2019 to investigate how tax policy—as a whole—was conducted over this period. We find that changes to income taxes and the tax system as a whole have been taken procyclically over this period. Changes to VAT has been broadly acyclical over this period. There is evidence that changes to other tax heads were either acyclical or procyclical over this period. We do not find evidence of countercyclical changes.

In the past century Ireland has transitioned from a protectionist economy to a small open economy. The size of the state in the economy has increased significantly over this period, with the share of Exchequer taxation in the economy (GNI*) almost doubling from 1960 to the mid-1980s. While this partly reflects a more centralised form of taxation, i.e., a shift from local government taxes and charges to central government, it also reflects a more prominent role of government in the economy. In the early part of the foundation of the state, the main sources of tax revenue were from customs taxes, excise taxes and income tax. A century later, the state is now mostly reliant on income tax, value added tax (VAT), and corporation tax.

Perhaps the most significant changes to the taxation system in Ireland occurred in the 1970s. Joining the EEC in 1973 fundamentally changed the composition of Ireland's tax revenue. First, the share of customs tax in Exchequer revenue fell by 19 percentage points following the accession to the EEC. Secondly, wholesale and turnover tax were replaced by VAT. Another significant change that happened in the 1970s was the Corporation Tax Act (1976), which introduced an entirely new taxation system for companies. Under the old corporation profits tax, the precursor to the current system, taxes on companies were levied on both income and profits.² Finally, in the 1970s, there were also major reforms in how capital and wealth was taxed.

Broadly speaking, the Keynesian view of fiscal policy suggests that the optimal fiscal policy should be countercyclical, with taxes being cut and government spending being raised in recessionary periods in order to stimulate growth and increase aggregate demand, while the converse should happen during boom periods. Were

² The bases for these two taxes were not the same. Corporations profit tax applied to the profits of a company before income tax was applied. The amount due in corporations profit tax was then a deductible from the income tax bill.

policy makers to follow the Keynesian view of fiscal policy, tax rates and expenditure should be countercyclical, with a positive correlation between tax rates and the economic cycle and a negative correlation between expenditure and the cycle.

On the other hand, the “tax smoothing” theory of Barro (1979) suggests that tax rates, and fiscal policy more generally, should be kept constant over the cycle and only respond to unanticipated changes to fiscal sustainability. If policymakers followed Barro (1979), tax rates would be acyclical and there would be no correlation between tax rates and the economic cycle.

Numerous studies have empirically estimated the relationship between the cycle and fiscal policy, both in a domestic setting and an international setting. International evidence from Lane (2003) suggests that total government expenditure is acyclical, with current government expenditure being mildly countercyclical in 22 OECD countries. Other studies have found that, broadly speaking, fiscal policy has been countercyclical in developed countries and procyclical in developing countries (Kaminsky et al., 2004; Tavli and Vegh, 2005; Woo, 2009).

On the domestic side, Lane (1998) rejects the notion that fiscal policy was conducted countercyclically in Ireland over the 1980s and 1990s. Government spending has not been conducted on a countercyclical basis and, depending on how the cycle is measured, government tax revenue is either acyclical or countercyclical (Lane, 1998). Kearney et al. (2000) uses three methods of estimating the fiscal stance and find that the fiscal stance was in general procyclical in Ireland over the 25 years from 1976–2000. Hunt (2005) finds that “feasible discretionary government investment” was procyclical over the period 1969–2003. Bénétrix and Lane (2012) find similar results when looking at a period from 1970–2007. Over this period, the headline government balance, the underlying government balance, government revenues, and the discretionary element of government expenditure moved procyclically. Consistent with these findings, Cronin and McQuinn (2018) have found that Irish fiscal policy in terms of government consumption was procyclical both ex-ante (plans laid out in budgetary documents, i.e., the intended fiscal stance) and ex-post (execution of these plans, including overruns and underruns, i.e., the actual fiscal stance) from 1989–2013. These findings all point to the conduct of fiscal policy

in Ireland as being largely procyclical. It suggests that, in terms of its budgetary stance, Ireland is closer to developing economies than it is to developed economies.

While these papers contribute to the literature on how Irish fiscal policy—as a whole, and in terms of revenue and expenditure components—has been conducted over the business cycle in Ireland, they say relatively little on the cyclical conduct of tax policy, as opposed to tax revenue. The distinction between tax revenue and tax policy is crucial. In contrast to most items of government expenditure, tax revenue is not directly controllable by a policymaker. Tax revenue reflects a policy outcome and not a policy instrument. Tax revenue is endogenous to the business cycle and changes in tax revenues may not reflect changes in tax policy but instead reflect changes in the business cycle or other non-policy factors. As argued by Vegh and Vuletin (2015), focusing on the cyclical behaviour of tax revenue may lead one to draw incorrect conclusions as to the cyclical behaviour of tax policy. For instance, tax revenues may fall in a recession even if tax rates increase. This arises if the higher taxes are dominated by the effect from a reduction in the size of the tax base i.e., the lower consumption/income. If one were to use tax revenues as the appropriate measure of tax policy in this instance, one would quite possibly conclude that tax policy has been countercyclical when the exact opposite has been the case. A perfect illustration of this is what transpired in 2009 and 2010 in Ireland. In the midst of the banking crisis, Ireland introduced the income levy at the beginning of 2009 (the rate of the levy was subsequently increased mid-way through the year), and yet income tax revenue fell in 2009, and continued to fall in 2010, even as the rate was increased further. Focusing on tax revenue in this instance—as opposed to the appropriate policy variable—would lead one to incorrectly conclude that tax policy in 2009 and 2010 was countercyclical.

This paper fills a gap in the literature of Irish fiscal policy by examining the cyclicity of tax policy—as opposed to tax revenues. We take two approaches to investigate the cyclicity of taxation.

First, we take the approach of Vegh and Vuletin (2015), who use tax rates as the appropriate policy instrument on the revenue side and examine how these rates change across the business cycle. To do so, we compile a new dataset of tax rates and tax bands for key tax headings in Ireland, from 1920-2019. We cover the main tax headings in Ireland, including income tax, the Universal Social Charge (USC),

corporation tax and value added tax (VAT). Using this dataset, we show that income tax rates have been changed procyclically over the period 1920-2019. In addition, we construct a “tax rate index” as a measure of the overall tax system, which is a weighted average of changes in the rates of a number of key tax headings, and show that this too has exhibited signs of procyclicality over the period 1975-2019. This stands in contrast to Vegh and Vuletin (2015), who find that tax policy is acyclical in developed countries and places Ireland among developing countries, who tend to run procyclical tax policy.³

However, there is an important caveat to bear in mind when considering the cyclicity of tax policy solely based on tax rate changes. Tax rates are only one policy instrument available in the conduct of tax policy. A more holistic assessment would need to account for changes in other tax policy instruments, like tax credits or tax bands. For instance, it is possible that the impact, in terms of revenue, of a change in the tax rates may be wholly or partially offset by parallel changes in tax bands.

Our second approach to investigate the cyclicity of taxation addresses this shortcoming. We use estimates of the costs/yields in revenue from all discretionary changes to the tax system—changes in bands, rates, credits, exemptions, etc.—to see how tax policy, as a whole, is conducted over the business cycle. This is the approach taken by Barrios and Fagnoli (2010), who find that, for eight EU countries over the period 2001–2007, discretionary tax changes were taken in a procyclical manner.⁴ We carry out the same exercise for Ireland using a dataset on the expected yields/costs from discretionary tax policy changes included in each budget from 1987–2019 to investigate how the tax system has been changed over the business cycle.⁵ Our findings suggest that the overall tax system and income tax have been changed procyclically. While evidence suggests that other parts of the tax system were changed either procyclically or acyclically. We do not find evidence of countercyclical tax changes.

³ Their analysis was based on more than 60 countries. However, Ireland was not included in their analysis.

⁴ Ireland was not one of the eight countries included in this analysis.

⁵ Since 1987, the budgetary documents have included the expected yield/cost, in nominal terms, of a tax policy change. These estimates were not easily available prior to this.

The paper proceeds as follows, Section 2 outlines how the tax rate and tax band data were collected, as well as the sources of other data used in the paper. Section 3 outlines the historical trends, and changes in taxation over the past century both on an aggregate level, and with a focus on certain individual tax headings (income tax, VAT, corporation tax, etc.). The approach to Section 3 is to mainly provide a quantitative overview of the historical trends in taxation, while providing a brief historical background. For a richer historical context of the evolution of the Irish tax system see Clarke (2017), Hardiman (2002) and Hardiman (2004), amongst others. Section 4 investigates the cyclicity of tax policy over the last century using both the tax rate data and the data on discretionary tax measures. Finally, Section 5 concludes.

2. Data description

This paper draws on several different sources of data relevant to the Irish tax system and the macroeconomy. A summary of the data used in this paper is outlined in Table 1.

In terms of tax revenue, long-run Exchequer revenue data (and interest expenditure data) is available from the Irish Fiscal Advisory Council (Fiscal Council) from 1938-2018.⁶ This was supplemented with additional data from the Finance Accounts to extend back the dataset to 1922. The tax revenue data in this dataset only relates to Exchequer revenue (central government). Exchequer data is available on a financial year basis. From 1922-1973, the financial year ran from 1st of April to 31st of March. In 1974 there was a nine-month financial year running from the 1st of April to the 31st of December. Thereafter the financial year coincided with the calendar year. For the most part, the revenue data presented here is on a financial year basis, with data for 1974 presented as a linear interpolation between 1973 and 1975. It is important to note that significant revenue is generated from taxes and charges outside of the Exchequer and is not included in this dataset. For instance, significant revenue is raised by way of social security contributions, Pay Related Social Insurance (PRSI), which is classified as appropriations in aid and is not paid into the Exchequer. Historically, the health contribution and the national training levy are also not included in Exchequer tax revenue.⁷ However, data on PRSI, the health contribution and the national training levy are available from the Department of Finance databank from 1982-2016. This has been supplemented with data from the Fiscal Monitor for years 2017-2019.

⁶ Exchequer revenue data is available here: <https://www.fiscalcouncil.ie/datasets/>

⁷ Likewise, property tax, which was paid into the Exchequer from 2013-2017, is from 2018 onwards, paid directly into the local government fund. Motor tax had been paid into the Exchequer up until 1998, when it was then paid directly into the local government fund. However, since 2018, motor tax is again paid directly into the Exchequer.

Table 1. Description of data

Data	Description	Source	Coverage	Frequency
Exchequer tax revenue	Data covers the exchequer tax revenue receipts for all the main tax headings included in the Finance Accounts. Data relates to the government financial year, which from 1922-1973 ran from 1 st April to the 31 st of March. In 1974 the financial year ran from the 1 st April to the 31 st December. Thereafter, the financial year coincided with the calendar year.	Irish Fiscal Advisory Council, and Finance Accounts.	1922-2019	Annual
Total exchequer revenue	Includes all exchequer tax revenue, with the addition of Post office revenue and miscellaneous receipts. Miscellaneous receipts include items like the central bank surplus payments, fees for licences etc. Data relates to the financial year.	Irish Fiscal Advisory Council, and Finance Accounts.	1922-2019	Annual
Exchequer interest	Exchequer interest expenditure is taken from the Finance Accounts. Data relates to a financial year.	Irish Fiscal Advisory Council, and Finance Accounts.	1922-2019	Annual
PRSI, Health Contribution, National training levy revenue	Revenue from PRSI, the health contribution, and the National training levy are available from the Department of Finance. Data relates to a calendar year.	Department of Finance databank	1982-2019	Annual
Tax rates and tax bands	Data on tax rates, tax bands and the implementation dates are obtained from primary legislation. Data covers the main tax headings. Income tax bands are those for a single person. If more than one tax rate applied in a calendar year, the tax rate that was in place for the majority of the calendar year is used in this paper.	Finance Acts, Income tax acts, Tax consolidation acts, and Corporation tax acts, Wealth tax acts, Social Welfare Acts, Capital Gains tax acts, Capital Acquisition tax acts, Stamp Duty Acts and Health Contribution Acts as well as data from the Revenue Commissioners and the European Commission.	1920-2019	Annual
National debt	Data on the national debt is taken from the NTMA for years 1996-2019. Data prior to 1996 is taken from Fitzgerald and Kenny (2018), which was compiled from the Finance Accounts.	NTMA and Fitzgerald and Kenny (2018).	1922-2019	Annual
Consumer price index	The consumer price index with December 2016 as the base month is used. Data with December 2016 as the base month is available back until 1976. This is then extended back until 1922 using the consumer price index with base month of July 1914.	Central Statistics Office.	1922-2019	Annual
Employment cycle	Estimates of the length of economic contractions are obtained using the Bry and Boschan dating algorithm. For further details see Box A of Fiscal Council (2018) for details.	Irish Fiscal Advisory Council.	1960-2019	Annual
Discretionary tax measures	Discretionary tax measures include the estimates revenue yield/cost of all tax policy changes include in the budget documents. Only implemented tax changes are included. Data is at a quarterly frequency. If a tax measure is implemented after the middle of the current quarter, it is assigned an implementation date of the following quarter. Measures that merely alter the timing of payments, but not the ultimate tax liability are not included. Full year estimates of the tax revenue yield/cost have been used. As the full year estimate is used, these are scaled by an annual estimate of nominal GNI*.	Financial Statements/Budget documents from the Department of Finance.	1987-2019	Quarterly
Output gap	The output gap is estimated using a "suite of models" approach based on domestic GVA.	Casey (2019).	1975-2019	Annual and quarterly
Nominal and real GNI*	Nominal and Real modified gross national income (GNI*) are obtained from the CSO for the years 1995-2019. Data is then extended back to 1922 using the nominal and real GDP growth rates from Gerlach and Stuart (2015).	Central Statistics Office, and Gerlach and Stuart (2015).	1922-2019	Annual
Real domestic GVA	Data on real domestic GVA is taken from the CSO for 1995 Q1 - 2019 Q4. This data excludes sectors that are dominated by foreign-owned multinational enterprises. Data from 1989 Q1 - 1994 Q4 is from the Irish Fiscal advisory Council. The data is extended back to 1987 Q1 using the historical relationship between domestic demand and domestic GVA. A local quadratic interpolation is used to convert the series into a quarterly series over this period.	Central Statistics Office, and Irish Fiscal Advisory Council.	1987-2019	Quarterly

For tax rate and tax band data, a new dataset was compiled.⁸ These data draw on several different sources. The main source of data for the tax rates and tax bands is various Finance Acts from 1920-2019.^{9,10} Data from the Finance Acts are supplemented with data in Income tax acts, Tax consolidation acts, and Corporation tax acts, Wealth tax acts, Social Welfare Acts, Capital Gains tax acts, Capital Acquisition tax acts, Stamp Duty Acts and Health Contribution Acts as well as data from the Revenue Commissioners. For VAT, data is available from the European Commission.¹¹

A second new tax policy changes dataset is also used here. This dataset consists of the expected full year yield or cost of discretionary revenue measures taken in each budget.¹² The data is constructed on a quarterly basis covering 1987 Q1- 2019 Q4 and contains all implemented tax changes for the main tax headings.^{13,14} If a tax measure is implemented in the first half of a quarter, it is assigned to that quarter. If a tax measure is implemented in the second half of a quarter, it is assigned an implementation date of the following quarter.

⁸ The new tax rate and band dataset is available here: <https://www.fiscalcouncil.ie/datasets/>.

⁹ In the event that two different tax rates applied in the one year, as was the case for the income levy in 2009 with a lower rate for the first four months and a higher rate for the final eight months, the rate that is shown in figures and used in the empirical analysis is that which applies for the majority of the calendar year.

¹⁰ Corporation profits tax was the precursor to the current corporation tax system and lasted until 1974. The Corporation Tax Act 1976 introduced the new corporation tax system (which, it is important to note, set corporation tax rates for the 1974-1975 financial year and subsequent years).

¹¹ VAT rate data is available from the European Commission here: https://ec.europa.eu/taxation_customs/sites/taxation/files/resources/documents/taxation/vat/how_vat_works/rates/vat_rates_en.pdf.

¹² This dataset is similar to the dataset used in Conroy (2019). Both datasets capture discretionary tax measures. However, the dataset in Conroy (2019) is at an annual frequency.

¹³ There was no systematic recording of the yield from discretionary revenue measures in budget documentation prior to 1987.

¹⁴ Tax measures that merely change the timing of payments, but not the ultimate tax liability are not included.

Data on Ireland’s historical national debt is taken from the NTMA for 1996-2018, and from Fitzgerald and Kenny (2018).¹⁵

Turning to the macroeconomic variables used: consumer price index (CPI) data from the Central Statistics Office (CSO) is used. For the years 1976-2019 the CPI with December 2016 as the base is used. This is then backcasted to 1922 using the consumer price index with July 1914 as the base. For our measures of nominal and real output, nominal GNI* and real GNI* from the CSO is used from 1995-2019.¹⁶ This data is then backcasted to 1922 using the nominal and real GDP growth rates of Gerlach and Stuart (2015).¹⁷ As data for real GNI* is only available at an annual frequency, data on quarterly real domestic GVA from the CSO is also used here.¹⁸ This data is available from the CSO from 1995 Q1 – 2019 Q4. This is extended back to 1987 Q1 using the historical relationship between domestic demand and domestic GVA.¹⁹

Data on the “Employment cycle”, which show periods of contraction in the Irish economy, are taken from Fiscal Council (2018).²⁰ This data is available for the period from 1960-2018.

Irish output gap estimates from 1975-2019 are taken from the Irish Fiscal Advisory Council, as estimated in Casey (2019). This is available on both an annual and a

¹⁵ Historical national debt data is available here: <https://www.ntma.ie/business-areas/funding-and-debt-management/statistics/debt-projections>

¹⁶ Ireland’s national account data is distorted due to the globalisation activities of a few large multinational corporations in Ireland. As a result, the Irish statistics office, the Central statistics Office (CSO), produces a measure of domestic income called Modified Gross National Income (GNI*), which adjusts for the disproportional affect that these multinationals have on Ireland’s national accounts. This estimate is a more relevant measure of the underlying Irish economy—particularly in a fiscal capacity context—than GDP or GNP.

¹⁷ Data for historical nominal and real GDP for Ireland are located here: https://rebeccastuart.net/historical_macroeconomic_data/.

¹⁸ Domestic GVA excludes GVA from sectors that are dominated by foreign-owned multinational enterprises.

¹⁹ A local quadratic interpolation is used to convert this data to a quarterly frequency over this period.

²⁰ Estimates of the lengths of contractions are obtained using the Bry and Boschan (1971) dating algorithm, which is commonly used in business cycle dating.

quarterly frequency. This is supplemented with output gap estimates that are derived using a HP filter and a Hamilton filter on the real GNI* series.²¹

²¹ For the HP filter a value of $\lambda = 6.25$ is used, as in Ravn and Uhlig (2002), and for the Hamilton filter, $h=2$, and $p=2$. Due to the filtering techniques involved, the output gap series using the HP filter begins in 1922, and the output gap series using the Hamilton filter begins in 1925.

3. Trends in taxation over the past century

The structure of the Irish economy has changed significantly over the past century and with it, so too has the composition of tax revenue. Figure 1 shows the composition of Exchequer tax revenue from 1922-2019. In the last century Ireland has transitioned from a protectionist economy, to a small open economy. This is reflected in the changing composition of tax revenue over the same period. While excise taxes and income taxes have remained key pillars of the tax system in Ireland over the past century, customs tax, which from 1924-1967 (with the sole exception of 1944) was the largest tax heading, has significantly declined in importance as a revenue source. Customs tax averaged 35 per cent of total tax revenue in each year up to 1972 and peaked at 46 per cent of tax revenue in 1958. As Ireland gradually liberalised its trade policies, customs tax's importance as a tax source decline persistently from 1959-1975.

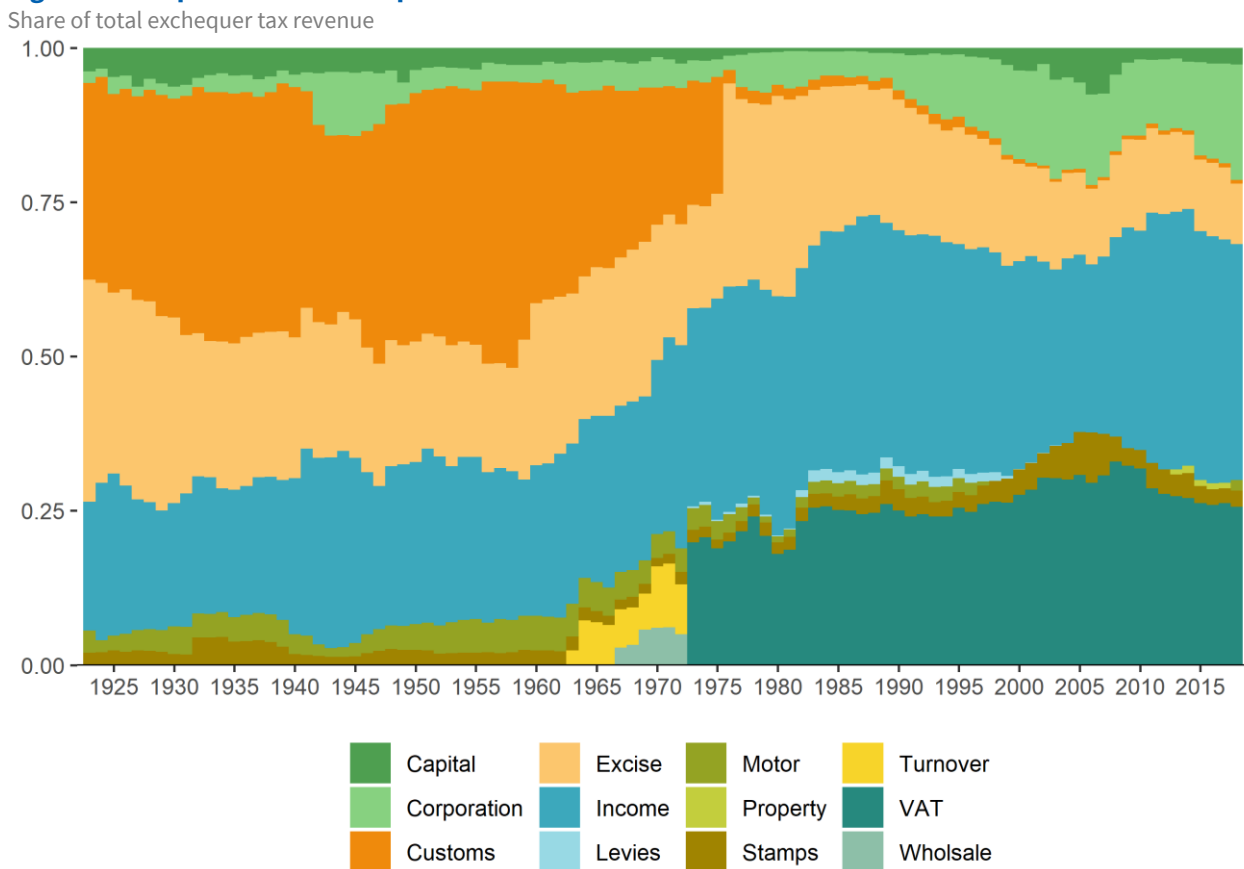
Significant structural changes in the composition of the tax system occurred in the 1970s. The foremost reason for the structural change in the tax system was Ireland's accession to the European Economic Community (EEC), now the European Union (EU). In 1972, Ireland adopted a value added tax (VAT) in preparation for joining the EEC. This replaced the wholesale and turnover taxes which were abolished in 1972. As a result of joining the EEC, the declining trend in the importance of customs tax as a revenue source was accelerated.²² Customs tax made up 21 per cent of tax revenue in 1972, the year prior to accession. This share of tax revenue fell to 2 per cent by 1975. This was offset by an increase in the share of excise duty in tax revenue from 18 per cent in 1972 to 33 per cent in 1975. VAT made up a further 19 per cent of tax revenue in 1975.

Since its introduction, VAT has played a significant role as a revenue source, contributing more than 18 per cent of tax revenue in each year. It reached an historical maximum share of tax revenue in 2008 (33 per cent), partly as a result of the construction boom at the time, with windfall estimates of VAT attributed to the

²² Imports from the EEC in 1969 accounted for 15.5 per cent of Irish imports, while Imports from the UK (which joined the EEC at the same time as Ireland) accounted for 47.7 per cent of Irish imports in the five-year period prior to 30th April 1970 (Dáil Éireann debate, Wednesday 8th July 1970, Vol. 248, No.5). As well as that, joining the EEC customs area would have lowered tariffs on non-member countries with which the EEC had trade agreements. Naturally, the lowering of tariffs on the majority of Irish imports lead to a reduction in customs revenue.

construction boom of €3.5 billion over 2006-2008 (Addison-Smyth and McQuinn, 2010).

Figure 1: Composition of Exchequer tax revenue 1922-2019



Sources: Fiscal Council and author's calculations.

The increased reliance on income tax as the main source of revenue is evident in recent years. This reflects the fact that Ireland's income tax base has been significantly broadened in the last 60 years (see Hardiman, 2004). However, despite its considerable significance, income tax has not reached the levels of importance that customs tax once played in the Irish tax system. At its peak, income tax accounted for only 42 per cent of tax revenue in 1987 (vs peak customs revenue of 46 per cent). The contrast between the levels of dependency on income tax and customs tax over the past century shows to some extent the significant changes that have taken place in the past century. Ireland transitioned from a protectionist economy to a much more open economy.

For a brief period in the 1940s revenue from corporation tax made up over 10 per cent of tax revenues. This was partly due to an excess profits tax of 50 per cent being

levied from 1941–1946. It wasn't until 1994 that the corporation tax share was more than 10 per cent again. Since then, the corporation tax share has grown further and reached 19 per cent of Exchequer tax revenue in 2018, reflecting an increasing disconnect between domestic economy activity and corporation tax revenue.²³

Excise duty has historically played an important role as a source of tax revenue, with an average share of tax revenue of 22 per cent since 1922.²⁴ However, in recent years the share of excise duty in tax revenue has declined and reached a historical low of 10 per cent of tax revenue in 2018. Capital taxes have historically played a limited role in tax revenue in Ireland, with an average share of 3 per cent over the last 98 years. However, partly as a result of the property boom capital taxes reached a peak share of 8 per cent of tax revenue in 2006.

The share of Exchequer tax revenue in GNI* remained relatively constant, and below 20 per cent of GNI* up until the late 1960s (Figure 2). Thereafter it increased steadily and reached a peak of 31 per cent of GNI* in 1988. This reflects the fact that in the 1980s, Ireland had the fastest growing tax-to-GNP ratio in the OECD (Barry, 2008) and a greater degree of centralisation of revenue sources (the relative size of local government has shrunk). Since then, the share of Exchequer tax revenue in GNI* has declined somewhat, particularly during the Celtic tiger era, but its share has largely fluctuated around the high 20s.

Figure 3 shows the growth in both real Exchequer revenue and real Exchequer tax revenue from 1922-2019. Tax revenue fluctuated significantly in the first 10 years of the state with real tax revenue falling by 11 per cent in 1924 and rising by 12 per cent in 1932. Tax revenue was falling during the start of the second World War, with real revenue growth negative for each year from 1939-1943. Tax revenue grew marginally (1 per cent) in 1944, but then grew dramatically over 1945-1947, with annual growth averaging 11.4 per cent. The 1950s was an unstable period in terms of tax revenue, with tax revenue growth negative in 4 years. It was not until 1975, before real tax revenue growth turned negative again, falling by 5.1 per cent. The growth in revenue in the run up to the most recent crisis was partially because of buoyant revenues

²³ In recent years, corporation tax receipts have exceeded what can be explained by the growth in domestic economic activity (see for example, Box H, Fiscal Council, 2020).

²⁴ Excise duty made up 64 per cent of all tax revenue in 1922, before declining in share to 36 per cent in 1932.

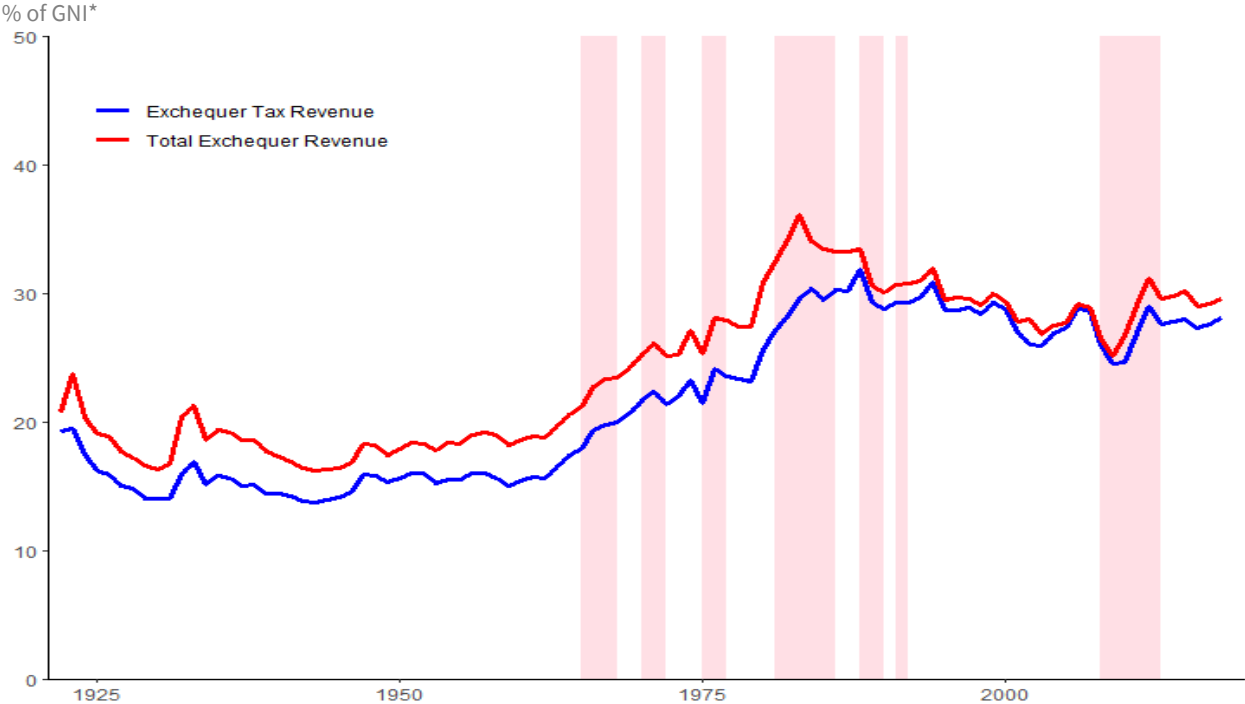
from the property boom. Approximately €5.5 billion of the revenue over 2006-2008 has been estimated to be windfall receipts in the form of VAT and stamp duty from the construction sector (Addison-Smyth and McQuinn, 2010). The unwinding of these windfalls led to the dramatic fall in revenue when the property bubble crashed, with nominal tax revenue falling by 19 per cent in 2009 (or 15.2 per cent in real terms).

Figure 4 shows the evolution of Irish national debt since 1922-2019. The State began with a very small debt burden at its foundation.²⁵ Since then, Irish national debt had four significant peaks, when expressed as a percentage of tax revenues: 1939, 1962, 1987 and 2013. In contrast when measured against GNI*, there were only two significant peaks: 1987 and 2013. This reflects the low share of tax revenue in GNI* up until the late 1960s. In 2013, national debt as a share of Exchequer tax revenue exceeded 500 per cent. This came just seven years after the series was at its lowest since 1925, at 87 per cent of tax revenue in 2006. This reflects both the fall in Exchequer tax revenue and the increase in the level of debt between 2006 and 2013.

The cost of this debt to the Exchequer is shown in Figure 5. Interest payments on the national debt were, for the most part, above 20 per cent of Exchequer tax revenue from 1960-1996. What is noticeable when you compare Figure 4 with Figure 5 is that—despite there being a larger debt burden during the most recent financial crisis than in the 1980s—the costs in terms of interest payments peaked in 1985 at 35 per cent of Exchequer tax revenue but only reached 19 per cent of Exchequer tax revenue in the recent financial crisis. This partly reflects the higher bond yields at the time, with the average annual yield peaking at 17 per cent in the 1980s whereas the average annual yield peaked just below 10 per cent in the recent crisis (Fitzgerald and Kenny 2018). This rapid increase in the cost of debt to the Exchequer is remarkable given that in 2007, interest as a share of tax revenue was 3 per cent, its lowest point since 1924.

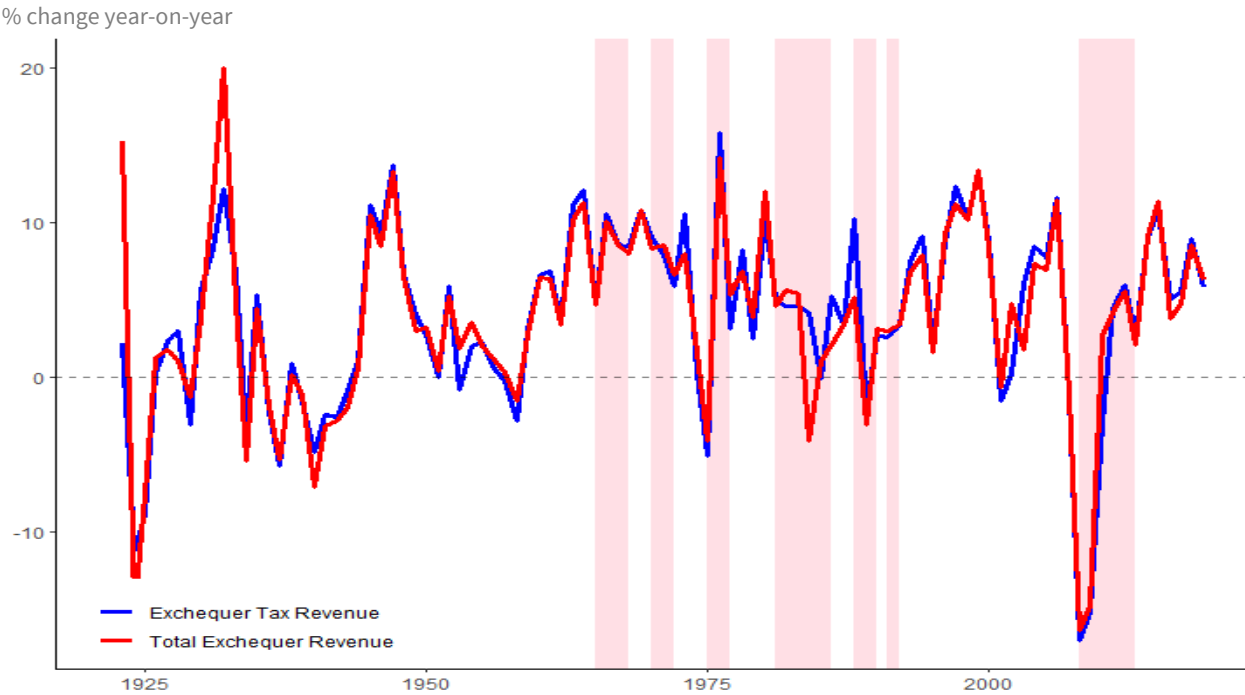
²⁵ See Fitzgerald and Kenny (2018) for further details on national debt since the foundation of the State.

Figure 2: Irish Exchequer revenue from 1922-2019



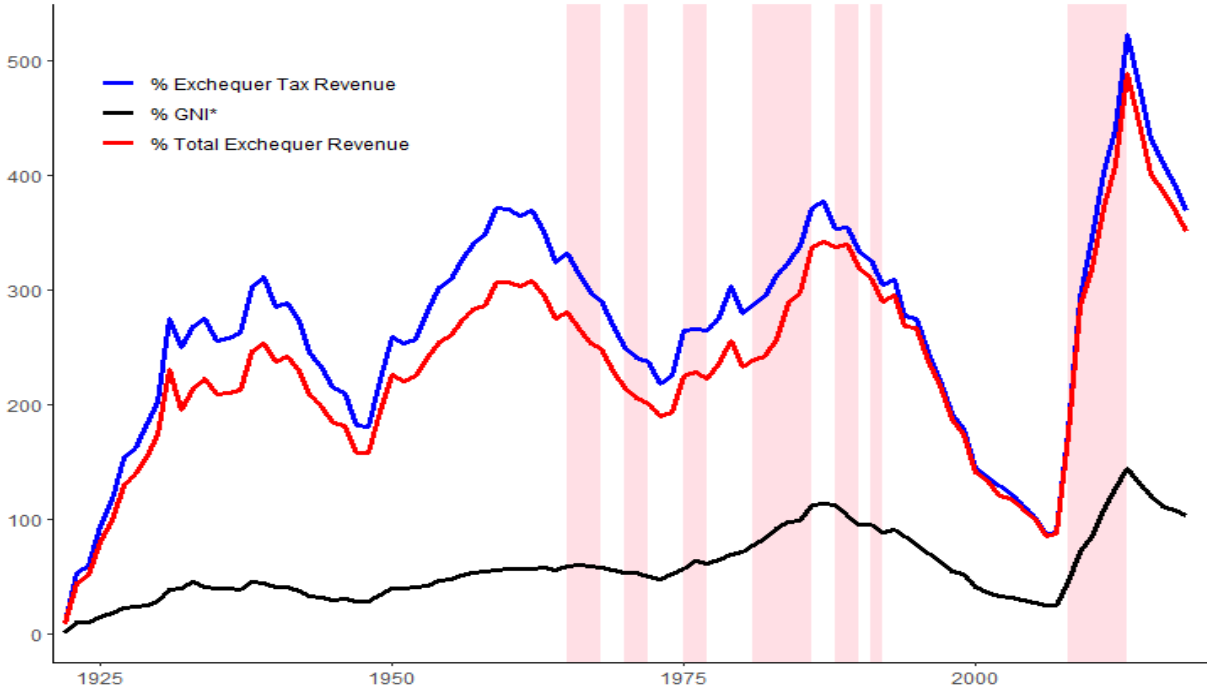
Sources: Fiscal Council; Gerlach and Stuart (2015) and author’s calculations.
 Notes: Pink shaded regions are periods of contractions, as estimated using the “employment cycle” from Fiscal Council (2018) for the period 1960-2009. For 1974, the revenue data is a linear interpolation between 1973 and 1975. This is because 1974 was a short financial year, running from 01/04/1974 to 31/12/1974. Thereafter the financial year was in line with the calendar year, which was not the case prior to 1974.

Figure 3: Real growth in revenue 1922-2019



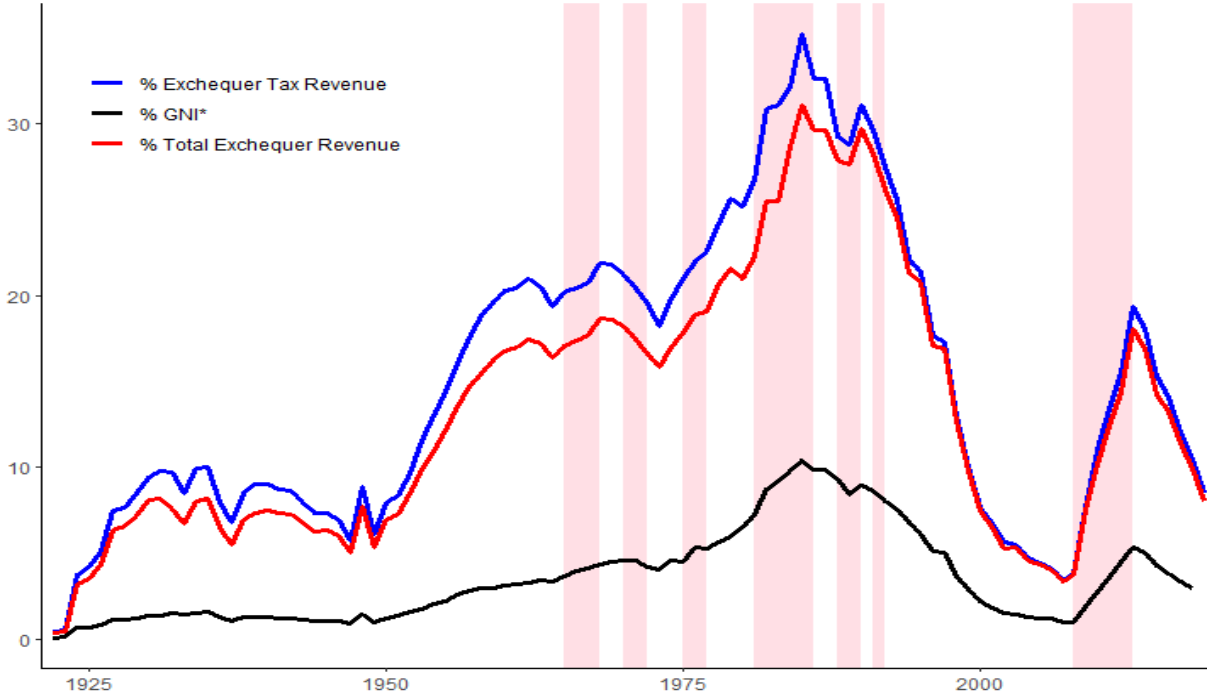
Sources: Fiscal Council and author’s calculations.
 Notes: Revenue is CPI deflated. Pink shaded regions are periods of contractions, as estimated using the “employment cycle” from Fiscal Council (2018) for the period 1960-2009. For 1974, the data in levels is a linear interpolation between 1973 and 1975. This is because 1974 was a short financial year, running from 01/04/1974 to 31/12/1974. Thereafter the financial year was in line with the calendar year, which was not the case prior to 1974.

Figure 4: Irish National Debt from 1922-2019



Sources: Fiscal Council; NTMA; Fitzgerald and Kenny (2018); CSO; Gerlach and Stuart (2015) and author’s calculations.
 Notes: Pink shaded regions are periods of contractions, as estimated using the “employment cycle” from Fiscal Council (2018) for the period 1960-2009. For 1974, the revenue data is a linear interpolation between 1973 and 1975. This is because 1974 was a short financial year, running from 01/04/1974 to 31/12/1974. Thereafter the financial year was in line with the calendar year, which was not the case prior to 1974.

Figure 5: Irish Interest Expenditure from 1922-2019



Sources: Fiscal Council; CSO; Gerlach and Stuart (2015) and author’s calculations.
 Note: Pink shaded regions are periods of contractions, as estimated using the “employment cycle” from Fiscal Council (2018) for the period 1960-2009. For 1974, the data in levels is a linear interpolation between 1973 and 1975. This is because 1974 was a short financial year, running from 01/04/1974 to 31/12/1974. Thereafter the financial year was in line with the calendar year, which was not the case prior to 1974.

3.1 Income Tax

For the majority of the 19th century, Ireland was exempt from the income taxation system that was in place in Britain at the time. This changed when the exemption for Ireland was removed in the *Income Tax Act, 1853*. In 1909, graduation (i.e. progressivity) was introduced to the income tax system, with an additional tax, a “supertax” (also known as a “sur-tax”), being paid on incomes above a certain threshold. This was the system that was adopted by the Irish Free State in 1922. Up until the end of the 1950s Ireland’s income tax was payable twice yearly, a year in arrears (Clarke, 2017). In 1960, the current Pay As You Earn (PAYE) system of income taxation was introduced (Hardiman, 2002).

Shown in Panel A of Figure 6 is the standard rate of income tax and the top marginal rate of income tax from 1920-2019.^{26,27} From 1927-1931 the standard rate of income tax was at its lowest at 15 per cent. By contrast, the standard rate of income tax was at its highest at 37.5 per cent during the World War II in 1941-1945 and from 1952-1958. The top marginal rate of income tax peaked from 1967-1974 at 80 per cent.²⁸ Since 1976, the top marginal rate of income tax has been on a downward trajectory (with the exception of 1983-1984, when it was increased) and is now currently at 40 per cent. However, were USC included, the top marginal rate of income tax would be 48 per cent in 2019.

Looking at periods of economic contractions denoted by pink recession bands, it appears that income tax rates have, for the most part, been raised procyclically during these periods. Only the late 1980s/early 1990s are an exception, where rates were not raised procyclically. Income tax rates when raised in contraction were typically cut not long after the contraction ended.

²⁶ This does not include the rates for social security contributions. See section 3.6 for these rates.

²⁷ From 1920-1974 all income tax (above a reduced rate threshold) was paid at the standard rate. An additional tax, a sur-tax/super-tax, applied on income above a certain threshold. For instance, in 1920, the standard rate of income tax was 30 per cent. Above an income of €38,100, an additional sur-tax of 30 per cent applied. Taken together, this meant that the marginal income tax above €38,100 was 60 per cent. This was essentially equivalent to today’s system, where the standard rate applies up to a certain threshold, with a higher rate above this threshold but formulated by means of an additional tax as opposed to a higher rate. For 1920-1974, the top rate of income tax shown in Figure 6 is the combination of the income tax rate and the top rate of sur-tax, and the top rate of income tax is shown from 1975-2019.

²⁸ Based on CPI deflated income bands, this top rate of income tax would have applied to incomes above €150,000 and €88,900 (in today’s terms) in 1967 and 1974, respectively.

Panel B of Figure 6 shows, to some degree, the complexity of the income tax system. From the peak of eleven different tax bands in 1920-1923, the complexity of the tax system, as measured by the number of tax bands, has been on a downward trend. However, this is only a partial picture of the complexity, as it says nothing about the number of “tax expenditures” related to income tax; items like tax credits and other exemptions. It also excludes the number of USC rates, which, were they included, would bring the total of income tax rates up to six in 2019.

Panel C Figure 6 shows the standard and top nominal income tax bands.²⁹ In 1922, the standard rate of income tax of 25 per cent was broad based and applied on incomes of up to €2,540, which adjusted for inflation would have been equivalent to €132,500.³⁰ The top marginal rate of 55 per cent applied to incomes above €38,100 in 1922, which is equivalent to €1.988 million in today’s terms. From 1932-1958, the income tax bands, in nominal terms remained unchanged. From 1920 up until 1966 (and again intermittently between 1970 and 1983), a reduced rate, below the standard rate, applied on low incomes. Between 1932–1966 this applied on incomes below €127.³¹

What is important to note about the income tax system in Ireland over the majority of the 20th century is that it had a narrow base. Relatively few income earners payed income tax at a rate above the standard rate. In 1938, 72 per cent of incomes did not exceed €317 (€17, 590 in today’s terms), with 6.5 per cent having incomes above the standard band of €1,905 (€105,720 in today’s terms), i.e. paid sur-tax (Department of Finance, 1946). By 1961, the standard rate of income tax of 31.7 per cent applied on incomes up to €3,174 (€63,600 in today’s terms), while the top marginal rate, of 69.2 per cent, applied to incomes above €9,523 (€190,750 in today’s terms). However, the number of people paying sur-tax on income remained low in 1970–71, with only 4,735 people paying sur-tax.³²

²⁹ For ease of presentation, tax bands in Figure 6 are shown in nominal terms instead of real terms.

³⁰ Deflated using the CPI with December 2016 as the base. A reduced rate of 15 per cent applied on incomes up to €286 (or €14,800 in real terms).

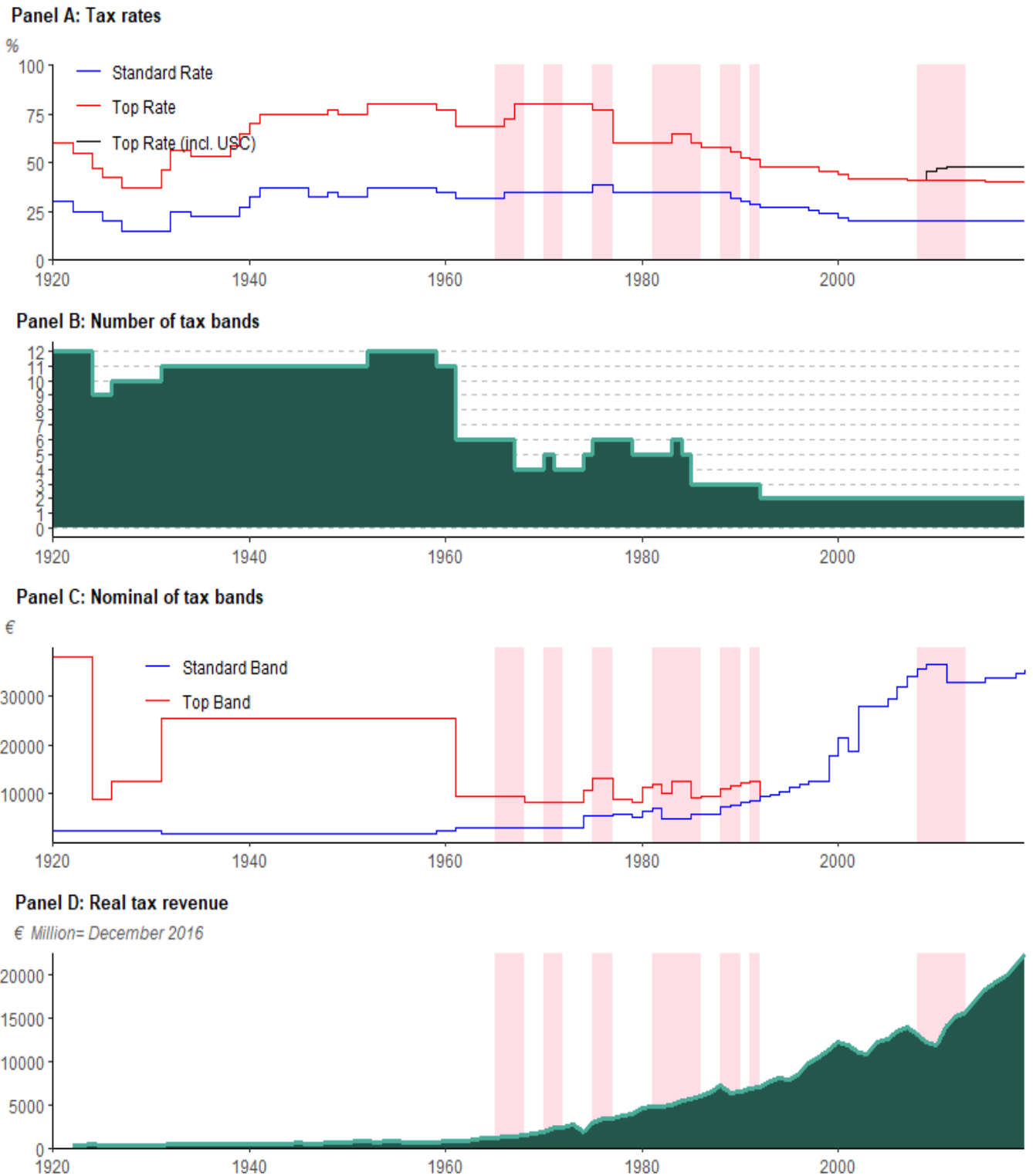
³¹ €127 in 1932 would have been equivalent to €7,766 in today’s terms, while €127 in 1966 would have been equivalent to €2,063 in today’s terms.

³² See response of Minister for Finance to questions on Income taxpayers (Dáil Éireann debate, Wednesday 17th May 1972, Vol. 260, No.13).

From the early 1980s onwards, both the standard rate and the top marginal rate of income tax have been trending downwards. This follows a similar declining trend in income tax rates for other countries over the same period (Vegh and Vuletin, 2015). By 2017, the income tax net was much broader. The standard rate of tax of 20 per cent, applied on incomes up to €33,800, with 43 per cent of income earners paying income tax at this rate (Revenue, 2019). Some 20 per cent of income earners paid income tax at the higher rate of 40 per cent.³³

³³ Top marginal rate reference here does not include USC. Were USC included the top marginal rate of 48 per cent would apply to incomes above €70,044.

Figure 6: Income Tax in Ireland 1920-2019



Sources: Fiscal Council; CSO and author's calculations.

Note: Pink shaded regions are periods of contractions, as estimated using the “employment cycle” from Fiscal Council (2018) for the period 1960-2009. Panel A shows the top marginal income tax rate (red) and the standard income tax rate (blue) from 1920-2019. Panel B shows the number of income tax bands from 1920-2019. The rates and bands shown are the rates and bands which correspond to a single person. The top rate of income tax represents income tax and the top rate of sur-tax from 1920-1973. Panel C shows the top nominal income tax band (red) and the standard nominal income tax band (blue) from 1920-2019 (USC not included). Panel D shows the real income tax revenue (CPI deflated; including USC) from 1922-2019.

3.2 Value Added Tax, Wholesale and Turnover Tax

In 1963, a turnover tax was introduced in order to reduce the dependency of tax revenue on excise and customs receipts, which only related to a small number of goods (Clarke, 2017). A rate of 2.5 per cent applied on a monthly turnover of more than €127 (€2,063 in real terms).³⁴ In 1966, a Wholesale tax was introduced at a rate of 5 per cent and was chargeable on the sale of goods such as foods clothing medicine and fuel (Clarke, 2017). Both taxes were ultimately abolished and replaced by VAT when Ireland joined the EEC in 1973.

Panel A in Figure 7 shows both the standard rate of Value Added Tax (VAT) and the top reduced rate of VAT from its introduction in 1972-2018.^{35, 36} Since its introduction there have been several reduced rates of VAT, including VAT exempt goods and services. In addition, from 1972-1978 there were increased rates of VAT (above the standard rate).³⁷ In all, there have been 13 changes to the standard rate of VAT. With 8 changes to the top reduced rate of VAT. However, as shown in Panel B of Figure 7, there have been as many as seven, and no fewer than 5 rates of VAT, since its introduction.³⁸ The standard rate peaked in 1982 at 30 per cent, and was as low as 16 per cent in 1972 when VAT was first introduced. While the standard rate of VAT has largely fluctuated around 23 per cent since 1983, over the same period, there has been a slow persistent upward trend in the standard rate of VAT for other countries of about 2 percentage points, albeit from a lower level of 15 per cent (Vegh and Vuletin, 2015).

Looking at the periods of contraction (in pink shaded region), there does not appear to be a clear cyclical pattern. There is a mixture of both tax cuts and tax increases over these contractionary periods. Panel C of Figure 7 shows the real VAT revenue from 1972-2019. For the most part, there has been a clear upward increase in VAT revenue since its introduction. The main exception being the recent crisis period when real VAT revenues fell by €5 billion from 2007-2011. While the revenue from

³⁴ A flat rate of €0.32 applied on monthly turnover below €127.

³⁵ It is important to note that the top reduced rate of VAT is not a consistent series, and the tax base it has applied to has varied widely over this period. It is presented here as one series for reference purposes only.

³⁶ The standard rate of VAT applied to 53 per cent of activity and the top reduced rate applied to 34 per cent of activity in 2020 (Revenue Commissioners, 2020).

³⁷ From 1983-1984 there was an additional standard rate of VAT of 35 per cent. The lower rate of 23 per cent is presented in Figure 7.

³⁸ This includes the rate of zero i.e. goods and services exempt from VAT.

VAT has been trending upward since 2011, real VAT revenue has not yet surpassed its pre-crisis peak in 2007. However, this pre-crisis peak in VAT revenue was boosted considerably by revenues related to the construction boom.

Figure 7: VAT in Ireland 1973-2019



Sources: Fiscal Council; CSO and author's calculations.

Note: Pink shaded regions are periods of contractions, as estimated using the "employment cycle" from Fiscal Council (2018) for the period 1960-2009. Panel A shows the standard VAT rate (blue line) and the top reduced rate of VAT (red line). Panel B shows the number of VAT rates that applied to goods and services supplied in Ireland (incl. the rate of zero). Panel C shows the real revenue from VAT from 1973-2019 (CPI deflated in December 2016 prices).

3.3 Corporation tax

Corporations in Ireland have been subject to taxes ever since the introduction of the income tax in 1853. While a progressive income tax system for individuals was introduced in 1909 by means of a sur-tax, this sur-tax did not apply to the income of corporations. In 1920, a corporation's profit tax was introduced. It is important to note, that this corporation profits tax is not comparable to the system of taxing corporate profits today. The old system meant that corporations paid tax on income, at the standard rate, and a tax on profits, corporations profits tax. This system remained in place until the *Corporation Tax Act, 1976*, which introduced the broad system we now have today.

Panel A in Figure 8 shows the standard rate of corporation tax in Ireland from 1920-2019.³⁹ The red line indicates a structural break in the series. Prior to 1974, the standard rate of corporation profits tax, which applied to Irish incorporated companies is shown.⁴⁰ After 1974, the standard rate of corporation tax is shown. The rate shown in Figure 8 for corporation's profit tax is that which applied to Irish incorporated companies. The old corporation profits tax reached a peak of 23 per cent in 1966 and remained at this rate until it was replaced by the new corporation tax system.⁴¹ When the new system was introduced, it set a standard rate of 50 per cent on profits for the years 1974-1976.⁴² The standard rate of corporation tax fell from 50 per cent in 1987 to 12.5 per cent in 2003 and has remained at that rate since then.⁴³ A declining trend in corporation tax was evident over the same period for other countries, with corporation tax rates falling from around 50 per cent in the early 1980s to 30 per cent by the late 2000s (Vegh and Vuletin, 2015).

Corporation tax receipts expanded rapidly after the late 1990s. Panel B in Figure 8 shows the real revenue from corporation profit tax/corporation tax from 1938-2019.

³⁹ Note, this refers to Corporation Profit tax from 1920-1974, which was a precursor to current Corporation tax system that was introduced in the Corporation Tax Act 1976.

⁴⁰ A higher rate of corporation profits tax applied to companies incorporated in foreign countries.

⁴¹ While the statutory rates may seem quite different at the point of the structural break in the figure, taking corporation profits tax and income tax together, the marginal rates of tax on corporations were around 40 and 50 per cent in the year prior to the abolition of corporation profits tax (Sandford and Morrissey, 1985).

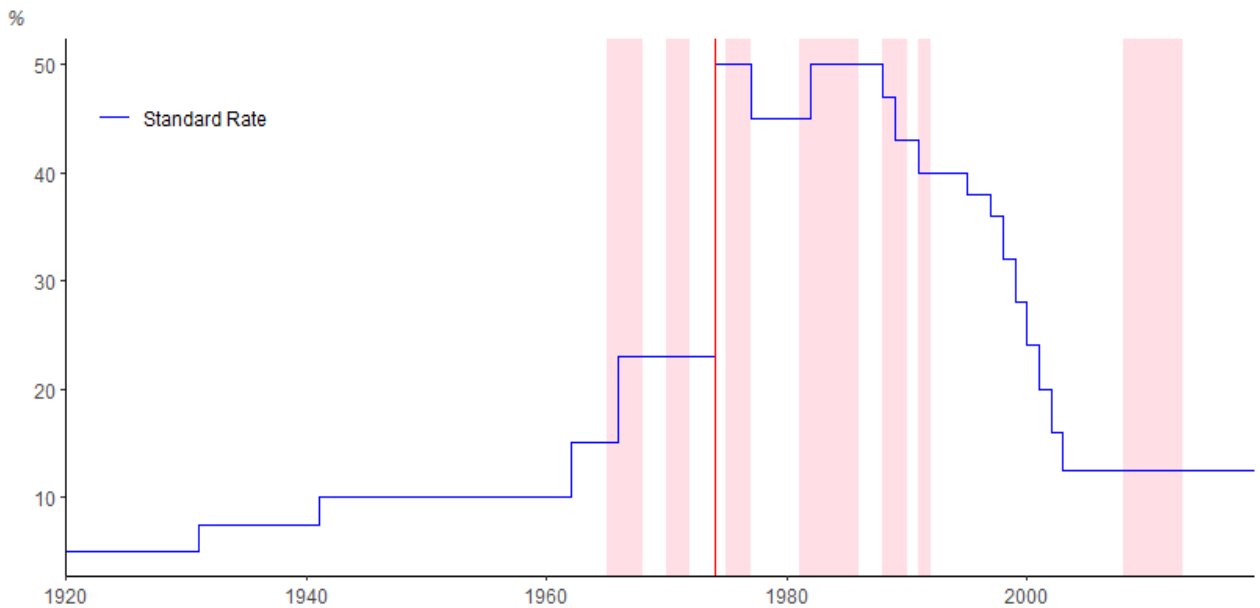
⁴² Other rates have applied since the new corporation tax system was introduced. For instance, a reduced rate for manufacturing companies of 10 per cent applied from 1981 to 2010.

⁴³ The *Finance Act, 1999* included a schedule of incremental annual reductions of the standard rate of corporation tax from 32 per cent in 1998 to 12.5 per cent by 2003.

From the late 1990s to 2006 real revenue from corporation tax grew by 600 per cent. A dramatic fall in corporation tax revenue occurred as a result of the property crash, with corporation tax revenue falling by roughly half from 2006 to 2011 but since then revenue from corporation tax has increased by almost 200 per cent.

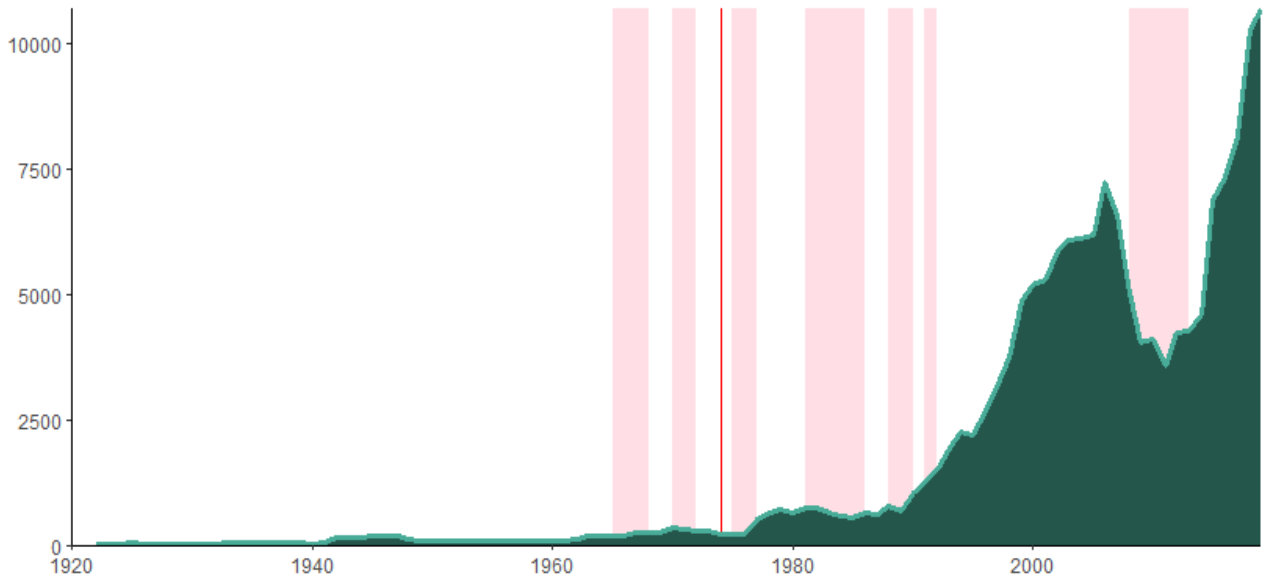
Figure 8: Corporation Tax in Ireland 1920-2019

Panel A: Tax rates



Panel B: Real tax revenue

€ Million = December 2016



Sources: Fiscal Council and author's calculations.

Note: Pink shaded regions are periods of contractions, as estimated using the "employment cycle" from Fiscal Council (2018) for the period 1960-2009. Panel A shows the standard rate of corporation profits tax, which applied to Irish headquartered companies, from 1920-1974 as well as the standard rate of corporation tax from 1975-2019. The red line indicates a structural break when the corporation tax system was reformed. Prior to 1974, companies paid both income tax and corporations profit tax. Panel B shows the real revenue from corporation tax from 1922-2019 (CPI deflated).

3.4 Taxes on capital and wealth

Taxes on capital and wealth come in many different forms and throughout the past century Ireland has had all forms of these taxes on wealth. However, as outlined above, these have played a limited role in funding the Exchequer.

Taxes on wealth include taxes on the stock of wealth (commonly referred to as a “wealth tax”) or a subset of that stock (for instance a property tax). Other taxes on wealth include taxing the transfer of wealth (estate duty and capital acquisition tax) or a tax on the increase in value of that wealth (capital gains tax).

Panel A of Figure 9 shows the top rate of Estate duty, capital acquisitions tax, and capital gains tax from 1920-2019.⁴⁴ Estate duty, a tax on the transfer of property upon somebody’s death, was first instituted in Ireland in 1894 (Clarke, 2014).⁴⁵ In 1922, there were 33 different bands for estate duty, with the rate of 40 per cent corresponding to the top estate duty band. This band applied to estates worth over €2,539,000 (or €129,683,000 in real terms). The median estate duty band was 16 per cent and applied on estates over €190,000 (or €9,717,000 in real terms). By the time estate duty was abolished in 1974 the number of rates was reduced to 19, with the top rate of 55 per cent applying on estates over €254,000 (or €2,134,000 in real terms).

Capital acquisitions tax was introduced alongside a wealth tax in order to replace the estate duty. It applied to all gifts and inheritance. When it was first introduced different rates and bands and exemption thresholds applied depending on how closely related the individuals gifting and receiving the asset were, with individuals classified into four groups. Shown in Figure 9 is the top rate of capital acquisitions tax, which applied to “Group A”, which includes gifts or inheritance from/to parents to/from their children. It was first introduced at a top rate of 50 per cent applied on all inheritance above €571,000 (€4,793,000 in real terms).⁴⁶ When capital

⁴⁴ The rate of capital acquisitions tax shown applies to the Class A/Group A category. This category applies to gifts/inheritance between children and their parents.

⁴⁵ Ireland also had a legacy duty and succession duty, but estate duty was the most important of these three.

⁴⁶ While capital acquisitions tax was introduced in the Capital Acquisitions Tax Act 1976, the tax applied on gifts/inheritance on or after 28th February 1974.

acquisitions tax was first introduced, there were seven different rates which applied for “Group A”, and as many as 18 different rates for “Group B”.⁴⁷

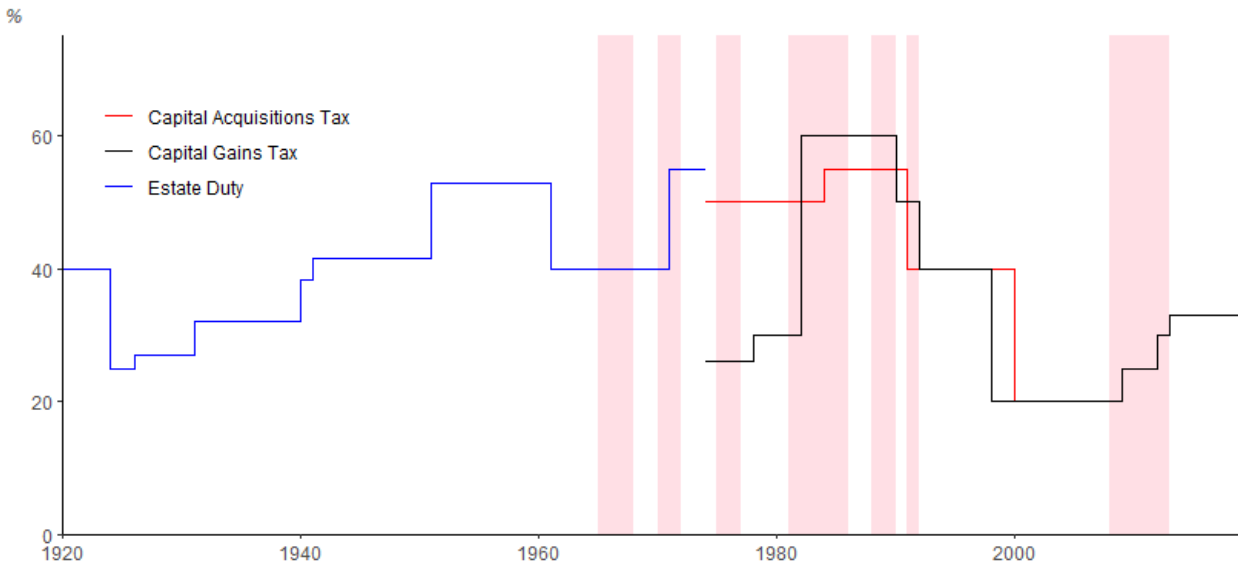
Capital gains tax, which is a tax on the profits from the disposal of certain assets, was introduced in 1975 at a rate of 26 per cent and was payable on assets disposed of on or after 6th April 1974. By 1982, the top rate of capital gains tax had increased to 60 per cent and remained there until 1989. In 1998 capital gains tax reached a low of 20 per cent, but has since been increased a number of times and now stands at 33 per cent.

As a result of the property boom, revenue from taxes on capital increased almost three-fold between 2000 and 2007 (Figure 9, Panel B). This increase in revenue from capital taxes was reduced substantially as a result of the property crash.

⁴⁷ Including the rate of zero. Group B applied to a linear dependent other than a child (e.g. grandchild).

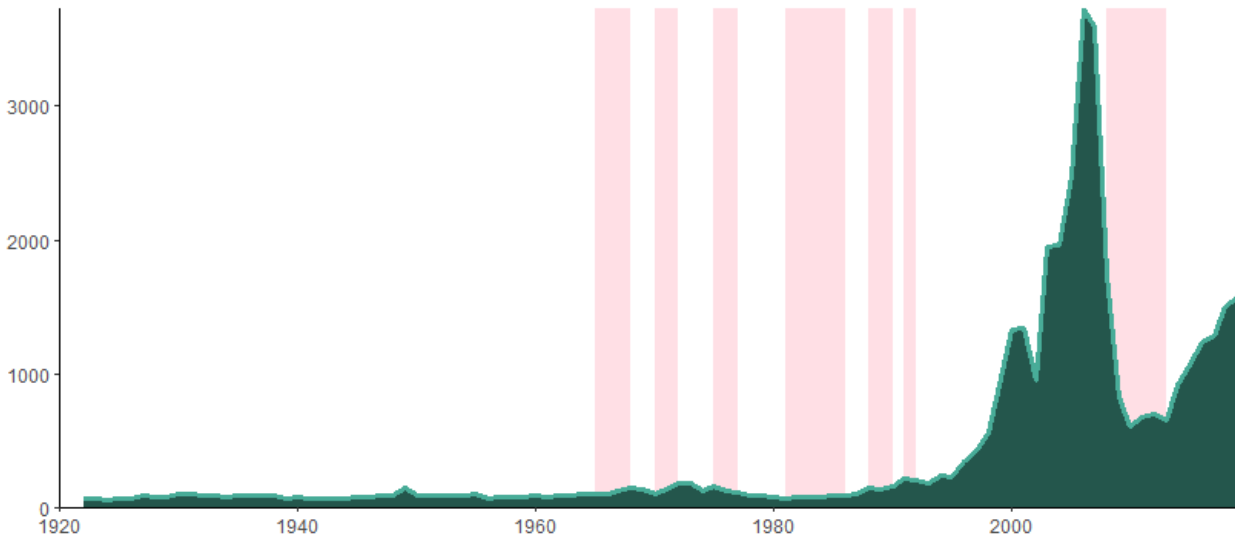
Figure 9: Capital taxes in Ireland 1920-2019

Panel A: Tax Rates



Panel B: Real tax revenue

€ Million = December 2016



Sources: Fiscal Council and author's calculations.

Note: Pink shaded regions are periods of contractions, as estimated using the “employment cycle” from Fiscal Council (2018) for the period 1960-2009. Panel A shows the top rate of Estate Duty (which applied from 1920-1974), capital gains tax (from 1975-2019) and capital acquisitions tax (for group A which applied to close relatives, from 1974-2019). Panel B shows the real revenue from capital taxes from 1922-2019 (CPI deflated). Capital taxes here includes, estate duty, capital acquisitions tax, capital tax, wealth tax and residential property tax.

Table 1: Other taxes on capital and wealth

Tax	Period	Standard Rate	Exemption Threshold
Wealth Tax	April 1975-April 1978	1.0%	€88,881/€114,276
Residential Property tax	April 1983- April 1992	1.5%	€82,533
	April 1992-April 1994	1.5%	€114,276
	April 1994-April 1995	1.0%	€95,230
	April 1995-April 1997	1.5%	€119,355
	Local Property tax	January 2013-Present	0.18%

Sources: Fiscal Council and author's calculations.

Note: The exemption threshold for both wealth tax and the residential property tax are presented in nominal terms for the initial reference year. The thresholds were indexed for subsequent years. The threshold for wealth tax shown here applied to a single person and a married person respectively (an additional allowance for minor child applied). An income exemption also applied to the residential property tax. Higher rates applied to the residential property tax from April 1994-April 1995. A higher rate of 0.25 per cent applies to the local property tax on properties worth over €1,000,000. Local authorities may vary the local property tax up or down by up to 15 per cent of the rate which applies.

Table 1 shows some of the other taxes on capital and wealth that have been introduced in Ireland. In 1975 a wealth tax was introduced in Ireland. It was brought in alongside capital gains tax in order to replace the old estate duty system. Ultimately, the imposition of the wealth tax did not last very long and was abolished in April 1978. For a comprehensive overview of the administration, economic effects and the political economy of Ireland's brief experience with the wealth tax see Sandford and Morrissey (1985).⁴⁸ In 1983 a tax on residential property was introduced at a rate of 1.5 per cent over properties worth €82,533 (€190,000 in real terms).⁴⁹ This tax remained in place at various rates up until it was eventually abolished in 1997. However, a local property tax was introduced in 2013 and applied at a much lower rate 0.18 per cent on all property worth below €1.0 million (0.25 per cent on all property above €1.0 million).

⁴⁸ For a detailed analysis of what the impact of a wealth tax in Ireland would look like under a variety of possible wealth tax schemes, see Lawless and Lynch (2016).

⁴⁹ An income exemption threshold also applied to this tax.

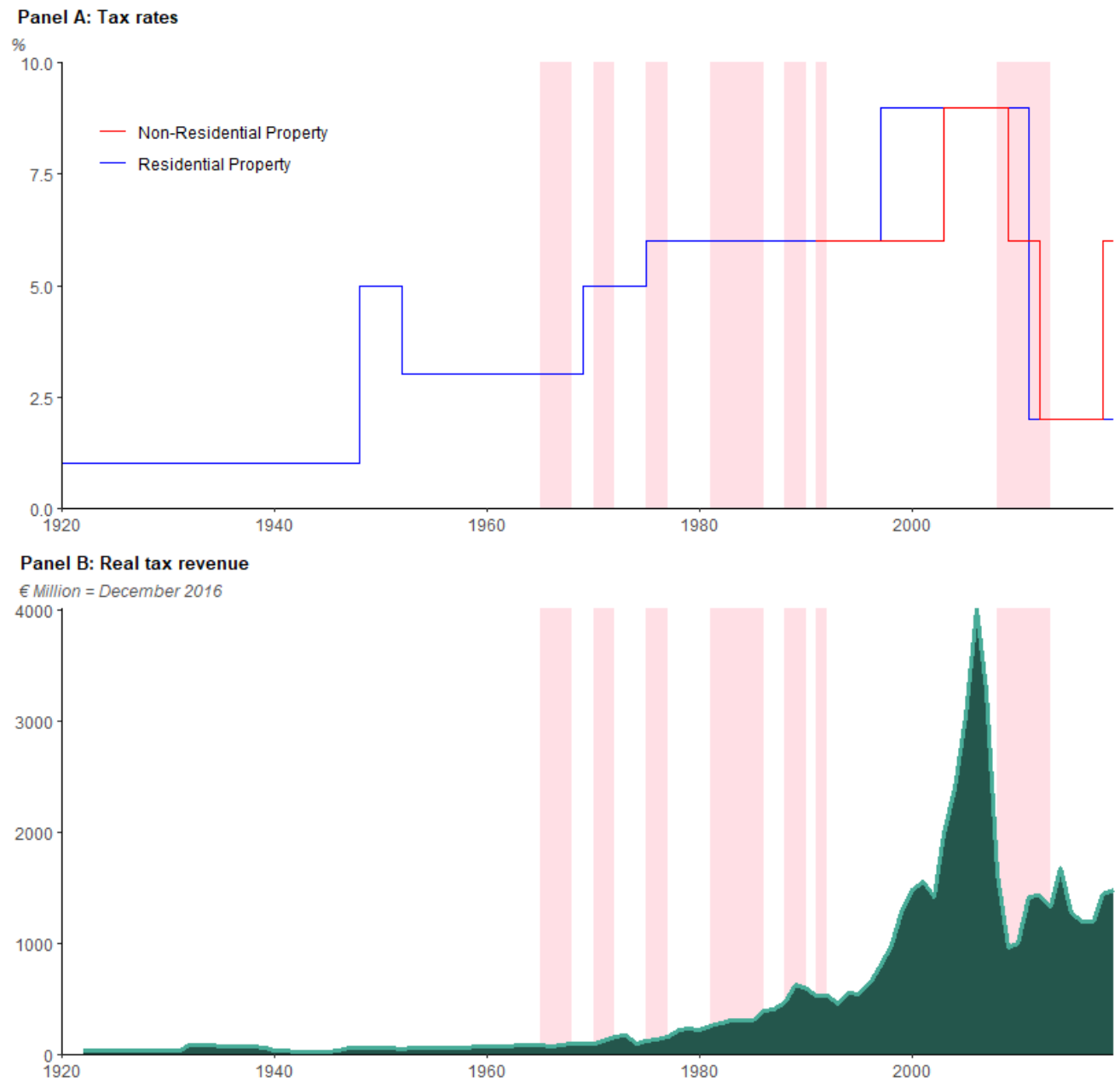
3.5 Stamps

Stamp duty is a tax on the transfer of certain written documents. For instance, stamp duty is payable on the “Deeds of Transfer” of a property, and on the transfer of shares of an Irish company, amongst others. Various forms of stamp duty have been in place since the foundation of the State.

Figure 10 shows the top rate of stamp duty for residential property and non-residential property from 1920-2019.⁵⁰ In 1922, the top rate of stamp duty on residential property was 1 per cent and applied on transactions of property worth over €635 (€32,400 in real terms). In 1990, a separate rate scheme was introduced on non-residential property, but the rates and bands introduced at the time were equivalent to those for residential property. In 2000, a separate scheme was introduced for residential property for first time buyers, the rates payable at the lower bands were lower than the standard scheme. From 2007 to 2010 first time buyers were exempt from property tax. By 2019, the top rate of stamp duty on residential property was 2 per cent and applies on property worth more than €1.0 million, whereas stamp duty on non-residential was 6 per cent and applied to all non-residential property.

⁵⁰ In 2017, stamp duty on property accounted for approximately one third of total Exchequer receipts from stamp duty (receipts from the health insurance levy have not been paid into the Exchequer since 2013). Two thirds of the stamp duty receipts from property related to non-residential property (Department of Finance, 2018).

Figure 10: Stamp duty in Ireland 1920-2019



Sources: Fiscal Council and author's calculations.

Note: Pink shaded regions are periods of contractions, as estimated using the "employment cycle" from Fiscal Council (2018) for the period 1960-2009. Panel A shows the top rate of residential property and the top rate of non-residential property tax from 1920-2019. Panel B shows the real revenue from stamp duty from 1922-2019 (CPI deflated).

3.6 Pay-Related Social Insurance, Health contribution and Training Levies

Ireland has had various social welfare payments since 1911. In 1952, a standalone fund, the Social Insurance Fund, was set up in order to fund these welfare payments.⁵¹ Between 1952-1979 social insurance contributions were determined by a flat rate rather than earnings-related. In 1952 the weekly rate was €0.14 per week for male employees and €0.08 per week for female employees, which is the equivalent of €3.76 and €2.15 a week in today's terms. The employers' weekly rate was €0.13 for male employees and €0.10 for female employees (€3.22 and €2.42 a week in today's terms).

In 1979, these flat rates of social insurance contributions were replaced by the introduction of Pay-Related Social Insurance (PRSI). The introduction of PRSI meant that contributions to the Social Insurance fund were now earnings related. PRSI was introduced with a standard rate of 3.4 per cent for employees and 7.8 per cent for employers (Figure 11, Top panel). Since its introduction, PRSI has been a substantial source of revenue (Figure 11, Bottom panel).

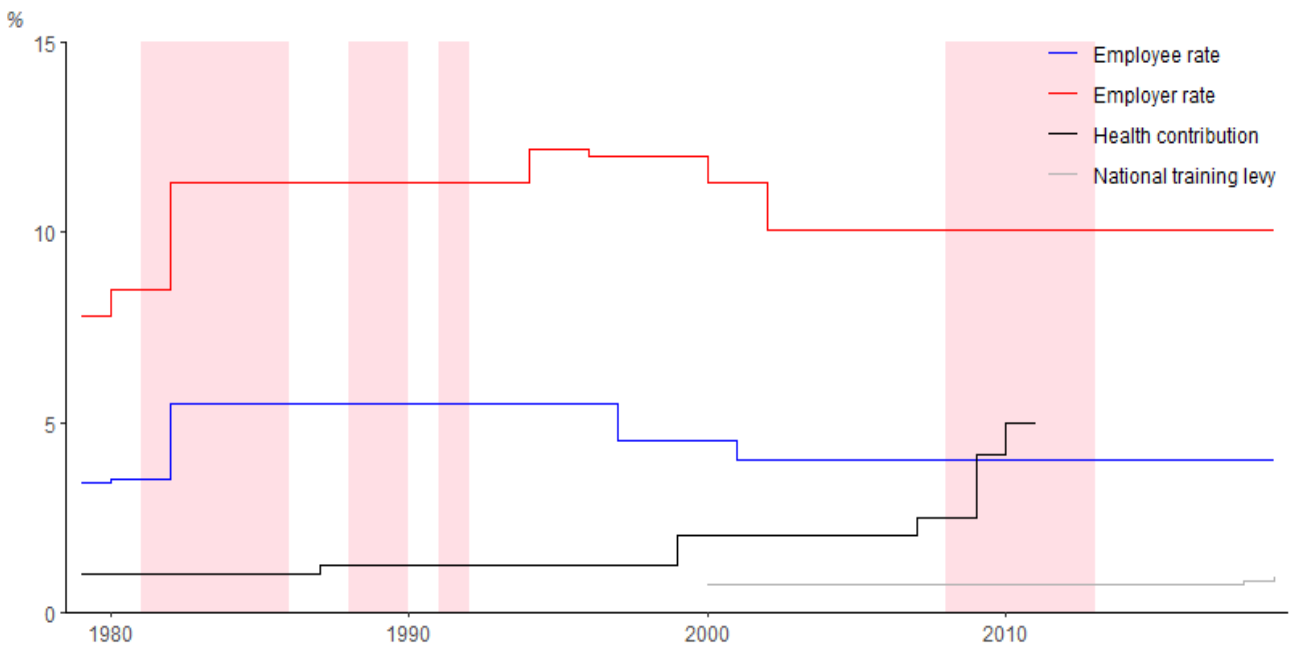
Also shown in Figure 11 is the Health Contribution and the National Training Levy. A Health contribution was first introduced in 1971 as a flat weekly charge of €0.19 (€2.26 in real terms). By 1978, the weekly charge had been increased to €0.63 (€3.03 in today's terms). In 1979, this flat rate was replaced with an earnings-related rate of 1 per cent. The Health contribution, along with the Income levy were eventually replaced by the introduction of the USC (see Section 3.1).

In 1982, a youth employment and training levy was introduced at a rate of 1 per cent of earnings in order to pay for the establishment of the Youth Employment Agency. This levy was abolished in 1999. In 2000, a new national training levy was introduced at a rate of 0.7 per cent of earnings and was payable by employers. By 2020, that national training levy was payable at a rate of 1 per cent.

⁵¹ Prior to this there existed a separate National Health Insurance fund and an Unemployment fund. Separate votes also existed for Old Age Pensions, Widows and Orphans pensions. These were all consolidated into the Social Insurance Fund under the *Social Welfare Act, 1952*.

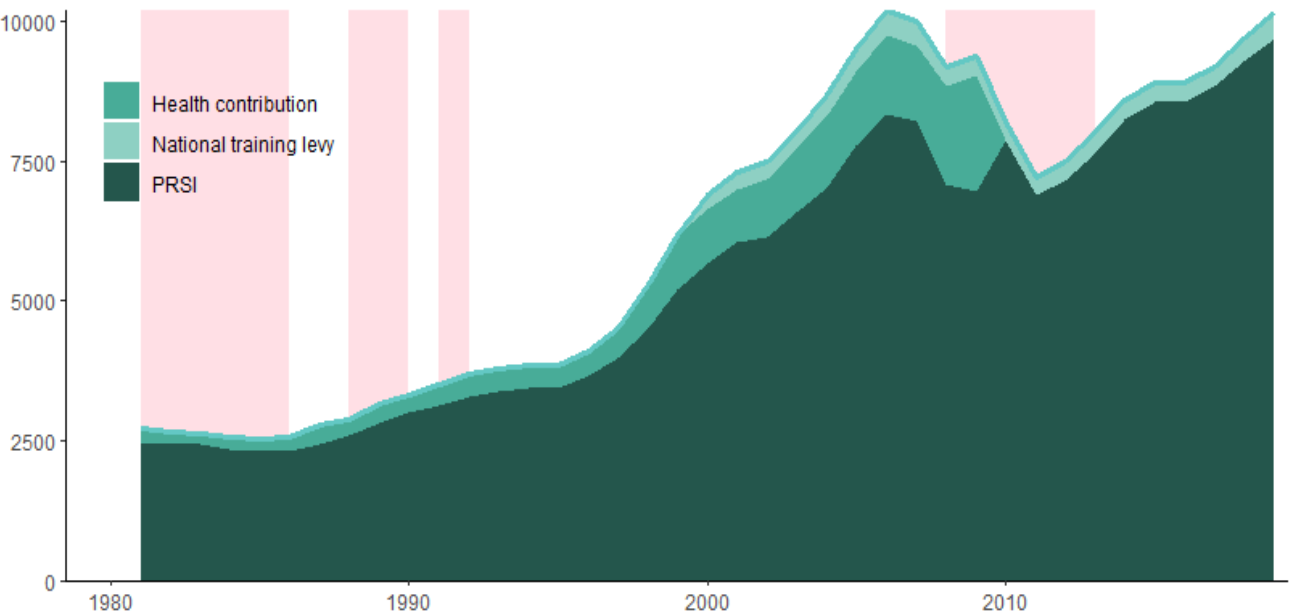
Figure 11: PRSI, Health contribution and National training levy in Ireland 1979-2019

Panel A: Tax rates



Panel B: Real tax revenue

€ Million = December 2016



Sources: Department of Finance and author's calculations.

Note: Pink shaded regions are periods of contractions, as estimated using the “employment cycle” from Fiscal Council (2018) for the period 1980-2009. Panel A shows the standard rate of PRSI for employees and employers, the rate of health contribution from 1979-2010, and the rate of national training levy paid by employers from 1979-2019. Panel B shows the real revenue from PRSI, health contribution and the national training levy from 1980-2019 (CPI deflated).

4. The cyclicality of Ireland's tax policy

We now address a gap in the literature by investigating the cyclicality of tax policy over the past century. Rather than focusing on aggregate revenues as has been done elsewhere and for shorter time periods, we focus on how the tax instruments available to the policymaker have been changed over the past century. In particular, we examine how tax rates have been adjusted over the economic cycle. In addition, we use a separate tax policy changes dataset to investigate how discretionary tax measures—which incorporate all tax policy instruments (rates, bands, credits, exemptions, etc.)—have been taken over the cycle.

We split our analysis into two overlapping time periods. First, we take a long-run perspective and look at the cyclicality of income tax from 1922-2019. Second, we deal with the cyclicality of tax policy for the more recent period of 1975-2019.

There are several reasons for separating the analysis into a short and long-term samples. First, estimates of the economic cycle, the output gap, are more reliable for the more recent period and we use the estimates of Casey (2019), which is based on a multivariate suite of models' approach to estimating potential output. The estimates we derive for the output gap for the entire sample (1922–2019) are based on a single univariate model: either a HP filter or a Hamilton filter. These tend not to be as plausible as the suite of models approach, which involve multivariate and other approaches. Second, the system of taxation after 1975 is much more similar to the one we have today. For instance, the corporation tax system was changed significantly as a result of the Corporation Tax Act 1976.⁵² Prior to this Act, corporations paid tax on income and on profits. VAT was first introduced in 1972, and so was in effect for the entire period of 1975-2019. The system of taxing capital also changed significantly in the 1970s with the abolition of the estate duty, and the introduction of both capital acquisitions tax and capital gains tax. Finally, the government's financial year has only coincided with the calendar year since 1975. Taking the post 1975 era allows for the construction of a tax rate index by taking the weighted average of changes in tax rates among the main tax headings, as in Vegh and Vuletin (2015). The tax rate index is constructed by using weights that are

⁵² This Act introduced corporation tax rates for the 1975 financial year and subsequent years.

derived from the share of each tax heading in tax revenue in a given financial year. As the macroeconomic variables relate to a calendar year, it seems appropriate to isolate the period where these coincide.⁵³

4.1 The cyclicity of income taxation from 1922-2019

In this section we take a long-run view and focus on the changes in the rates of tax on income since 1922. To investigate the cyclical nature of taxation we estimate a similar regression to that of Vegh and Vuletin (2015):

$$\Delta Tax\ rate_t = \alpha + \beta Cycle_t + e_t \quad (1)$$

Where, $\Delta Tax\ rate$ is the percentage point change in the tax rate at time t , and $Cycle_t$ is the estimate of the business cycle at time t .⁵⁴ From equation (1), β is then the estimate of the stance of tax policy. A negative sign for the estimate of β would indicate that the tax rates have been changed procyclically, while a positive sign would indicate that the tax rates have been changed countercyclically. We use three estimates of the cycle in our analysis in this section.⁵⁵ First, we use the growth rate of real modified gross national income (RGNI*).⁵⁶ We also use estimates of the output gap derived using a HP filter, and a Hamilton filter on the RGNI*. As the dependant variable is the percentage point change in the tax rate, we allow for the errors to exhibit heteroscedasticity and autocorrelation. As a result, we use heteroskedastic and auto-correlation consistent standard errors throughout.

To understand how taxation on income was conducted over the past century, we estimate equation 1 for several different rates of income tax. In addition, we also combine these rates with social security contributions. PRSI was introduced in 1979,

⁵³ Although this is slightly mitigated by the fact that tax rates may be changed during the calendar year. This is often the case, as up until 2001, the tax year—as opposed to the financial year—began on 6th April, so changes in tax rates often occurred on this date. In such circumstances, the tax rates that applied for the majority of the calendar year are used in estimation.

⁵⁴ Vegh and Vuletin (2015) use the percentage change in the tax rate as the dependant variable. We take a slightly different approach and use the percentage point change in the tax rate as the dependant variable as we believe this is both more easily interpretable and more economically meaningful.

⁵⁵ Note, estimates of the cyclical variables are on a calendar year basis. In most years, tax rates were changed over the course of a calendar year. In circumstances where this arises, the income tax rates that were in place for the majority of the calendar year are used in estimation.

⁵⁶ Using growth rates as the indicator of cyclicity is a common approach in the literature due to the difficulty in accurately estimating the economic cycle. For instance, in their analysis, Vegh and Vuletin (2015) use the growth rates of real GDP as the measure of the cycle, not the output gap.

however, prior to this a flat social security contribution was paid by employees. Therefore, the introduction of PRSI in 1979 was not necessarily an increase in the rate of tax on income for many taxpayers. For this reason, dummy variables are included in the equations that include PRSI, with the dummy taking the value of one in 1979, and zero otherwise.⁵⁷ The Income levy (which we have merged with the USC series), was introduced in 2009 and represented an increase in the rate of tax on income. Therefore, we have not included a dummy for its introduction.

We find evidence that income tax rates have been changed procyclically over the past century in Ireland. Table 3 shows the results of equation 1 for various rates of income tax from 1922-2019. The results are consistent across all tax rates. Using the growth rate of real GNI* as the cyclical indicator, there is strong evidence that income tax rates have been changed procyclically. A one percentage point increase in the real growth rate of GNI* is associated with a 0.21 percentage point decrease in the standard rate of income tax. If the output gap were used as the cyclical indicator the results are more mixed. The output gap, derived from a HP filter, points to tax rates being changed acyclically over the past century. However, it appears income tax policy is also conducted in a procyclical manner when the output gap is estimated using a Hamilton filter. A one percentage point increase in the output gap, as derived using the Hamilton filter, is associated with a 0.12 percentage point reduction in the standard rate of income tax.

The issue of endogeneity of economic growth and the tax rate is addressed in section 4.4

⁵⁷ As a robustness check, we dropped the dummy variables from the equations that include PRSI. This did not materially alter the results.

Table 3: The cyclicity of income tax rates from 1922-2019

	Standard rate of income tax			Standard rate of income tax (incl. PRSI)			Top rate of income tax			Top rate of income tax (incl. USC)			Top rate of income tax (incl. USC and PRSI)		
Output Gap (HP)	-0.13			-0.13			0.00			-0.06			-0.06		
	[0.09]			[0.10]			[0.15]			[0.15]			[0.16]		
Output Gap (Hamilton)	-0.12**			-0.12**			-0.14**			-0.19***			-0.19***		
	[0.05]			[0.05]			[0.06]			[0.04]			[0.05]		
RGNI* growth	-0.21***			-0.22***			-0.22**			-0.29***			-0.29***		
	[0.08]			[0.08]			[0.10]			[0.09]			[0.09]		
<i>R</i> ²	0.02	0.10	0.13	0.04	0.13	0.16	0.00	0.05	0.05	0.00	0.09	0.09	0.01	0.11	0.10
No. of tax rate changes	24	24	24	27	27	27	32	32	32	35	35	35	38	38	38
Observations	98	95	97	98	95	97	98	95	97	98	95	97	98	95	97

Sources: Author's calculations.

Note: The dependent variable is the percentage point change in the tax rate. The output gaps used are based on a HP filter of real GNI* with $\lambda = 6.25$ and a Hamilton filter, with $h = 2, p = 2$. PRSI refers to the standard rate of employees PRSI. In the equations with PRSI included, a dummy variable is included for the introduction of PRSI in 1979. Coefficients for dummy variables and intercept term are not reported. HAC standard errors in parentheses. * indicates significance at 10 per cent level. ** indicates significance at the 5 per cent level. *** indicates significance at the 1 per cent level.

4.2 The cyclicity of taxation from 1975-2019

In this section, we focus on the more recent period and investigate cyclicity of taxation from 1975-2019 given that the tax system is more comparable to the current tax system and that estimates of the cycle are likely to be more meaningful.

4.2.1 Tax rate index

The cyclicity of tax policy since 1975, can be examined on an individual tax head basis as shown above for income taxes, and by means of an overall tax rate index.

Following Vegh and Vuletin (2015), we construct the overall tax rate index as a weighted average of the changes in tax rates for various taxes. As Vegh and Vuletin (2015) argue, while it can be difficult to obtain an appropriate single indicator to measure the cyclicity of overall tax policy, a tax rate index can provide suggestive evidence of the cyclicity of overall tax policy. The index is made up of tax rates for income tax, VAT, corporation tax, capital gains tax, capital acquisitions tax, and stamp duty with a weight attached to each tax corresponding to its share in tax revenue.⁵⁸ By weighting each tax rate by their corresponding share of tax revenue, the corresponding importance of each tax rate change in the overall tax system is taken into account. Formally, that is:

$$\begin{aligned}\Delta tax\ rate\ index_t &= w_t^{IT} \times \Delta\ income\ tax_t + w_t^{VAT} \times \Delta\ VAT_t \\ &+ w_t^{CT} \times \Delta\ corporation\ tax_t \\ &+ w_t^{CGT} \times \Delta\ capital\ gains\ tax_t \\ &+ w_t^{CAT} \times \Delta\ capital\ acquisitions\ tax_t \\ &+ w_t^{SD} \times \Delta\ stamp\ duty_t\end{aligned}\tag{2}$$

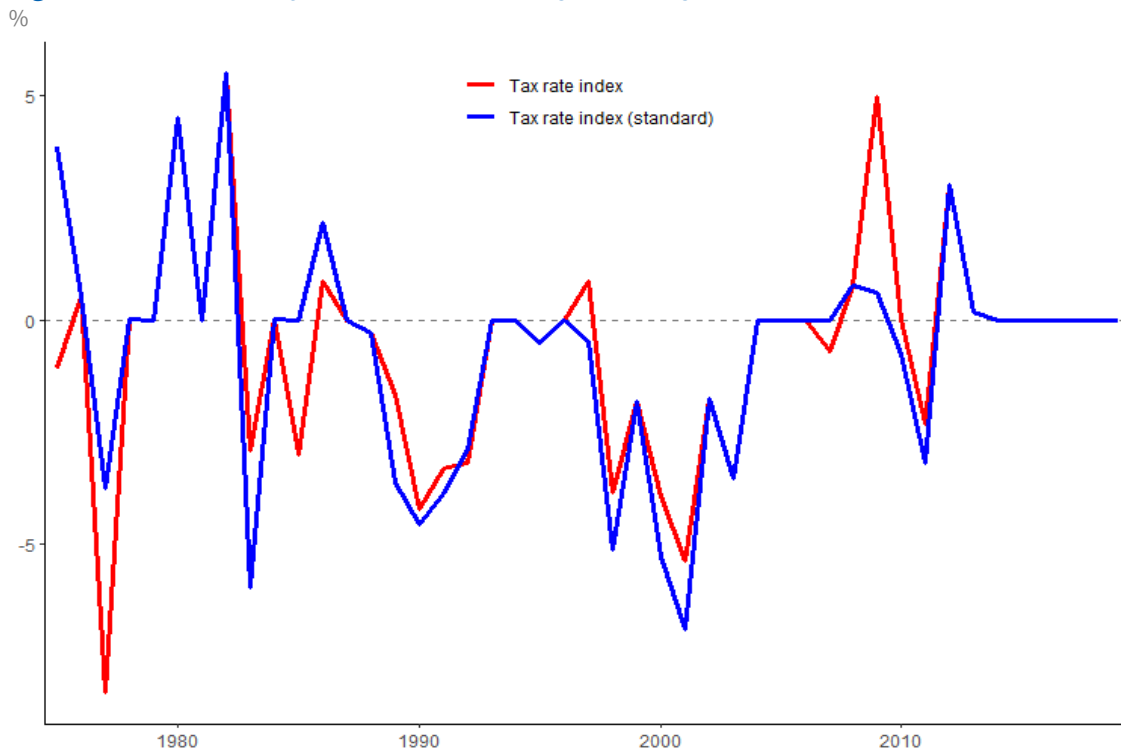
Where $\Delta\ income\ tax_t$, $\Delta\ VAT_t$, $\Delta\ corporation\ tax$, $\Delta\ capital\ gains\ tax_t$, $\Delta\ capital\ acquisitions\ tax_t$ and $\Delta\ stamp\ duty_t$ are the percentage change in the top rate of income tax including USC (or alternatively, the standard rate of income tax), the standard rate of VAT, and the standard rate of corporation tax, the top rate of capital gains tax, the top rate of capital acquisitions tax and the top rate of stamp duty for residential properties and w_t^{IT} , w_t^{VAT} , w_t^{CT} , w_t^{CGT} , w_t^{CAT} and w_t^{SD} are the

⁵⁸ This tax rate index is a broader index than that used by Vegh and Vuletin (2015), who construct the tax rate index using only rates of income tax, VAT, and corporation tax.

shares of income tax, VAT and corporation tax, capital gains tax, capital acquisitions tax and stamp duty in Exchequer revenue, at time t .⁵⁹ That is, for the equations using individual taxes, we use the percentage point change in each of the individual taxes as the dependent variable, but for constructing the tax rate index we use the percentage change in the tax rates. This is to allow for a more appropriate weight for aggregation to be attached to the changes in the individual taxes.⁶⁰

Figure 9 shows the two tax rate indices from 1975–2019. Both indices display qualitative evidence of procyclicality. There were large cuts to tax rates when there was strong growth and positive output gaps in 1977, further cuts to tax rates during the Celtic tiger and property bubble period, followed by increases in the tax rates during the great recession.

Figure 12: Discretionary tax measures 1987 Q1 – 2019 Q4



Sources: Author's calculations.

Note: Data are constructed based on Equation 2.

⁵⁹ In the results that follow, we update the weight attached to each tax in the tax rate index in each year. This may incorporate short-term fluctuations in the share of each tax due to non-policy changes. However, we have also carried out estimation based on a tax rate index which uses weights based on the 1975-2019 average share of each tax head. The results using this tax rate index are similar.

⁶⁰ As a robustness check we also construct the tax rate index using percentage point changes in the tax rates instead of percentage changes, and the results in terms of estimates of the stance of tax policy are the same.

4.2.2 Cyclicity of tax rates

In Table 4 we examine how income tax rates are changed across the business cycle, first, using the output gap measure of the cycle and, second, using real GNI* growth as the measure of the cycle. Using the output gap estimates of Casey (2019), suggests that, while the sign on the cyclical indicator is negative in all cases, the income tax rate changes were acyclical (see Section 4.4 for some evidence to the contrary using an instrumental variable approach).⁶¹ However, using the real GNI* growth rate, a one percentage point increase in the growth rate is found to be associated with a 0.23 percentage point reduction in the top rate of income tax (incl. USC). The latter suggests a procyclical pattern to income tax rate changes.

The cyclicity of changes to the rates of other taxes is also investigated and the results are shown in Table 5. However, as some of these tax rates were not altered frequently, there is limited variation in their rates, with some tax rates being altered less than 10 times over the period (stamp duty, capital gains tax and capital acquisitions tax). The number of tax rate changes are outlined at the bottom of Table 5. As a result of the limited variation in these rates, these results are largely illustrative and should be interpreted alongside the tax indices in the last two columns of Table 5.

The evidence points to changes in VAT, capital acquisitions tax and stamp duty being made acyclically, with both cyclical indicators having a coefficient that is not statistically different than zero for any of these taxes. For corporation tax and capital gains tax, using the growth rate of real GNI* as a cyclical indicator, points to both taxes being changed procyclically. A one percentage point increase in the real growth rate of GNI* is associated with a 0.37 reduction in the top rate of capital gains tax and a 0.13 reduction in the standard rate of corporation tax. However, if the output gap is used as the cyclical indicator, the evidence points to these tax rates being altered acyclically.

⁶¹ As a further check, the less reliable estimates of the output gap using the HP filter and the Hamilton filter were also used as cyclical indicators. The estimates using the HP filter pointed to income tax rates being changed acyclically, while the estimates using the Hamilton filter pointed to the rates being changed procyclically. Once endogeneity was addressed the HP filter estimates also pointed to procyclical changes in the tax rates.

Table 5 also shows the results of estimating the cyclicity of the tax rate index constructed using equation 2, as measured using the standard rate of income tax, or separately, the top rate of income tax (including USC).⁶² The tax indices show signs of procyclicality if one uses the growth rate of real GNI* as the cyclical indicator. However, using the output gap estimate as the cyclical indicator points to the tax system being changed acyclically.

⁶² Aggregating the data into a tax rate index gives rise to 28 observations in this sample with non-zero entries in the case of the tax rate index using the standard rate of income tax and 31 observations with non-zero observations when the top rate of income tax (including USC) is used.

Table 4: Cyclicity of the income tax rates (1975-2019)

	Standard rate of income tax		Standard rate of income tax (incl. PRSI)		Top rate Income tax		Top rate of income tax (incl. USC)		Top rate of income tax (incl. USC and PRSI)	
Output Gap	-0.02		-0.02		-0.03		0.10		-0.11	
	[0.05]		[0.06]		[0.13]		[0.11]		[0.12]	
RGNI* growth		-0.07**		-0.08**		-0.22**		-0.23**		-0.25**
		[0.03]		[0.04]		[0.10]		[0.10]		[0.10]
R^2	0.00	0.07	0.19	0.25	0.00	0.05	0.01	0.09	0.05	0.13
No. of tax rate changes	10	10	13	13	14	14	17	17	20	20
Observations	45	45	45	45	45	45	45	45	45	45

Sources: Author's calculations.

Note: The dependent variable is the percentage point change for each individual tax rate. The output gap used is that of Casey (2019). PRSI refers to the standard rate of employees PRSI. In the equations with PRSI included, a dummy variable is included for the introduction of PRSI in 1979. Coefficients for dummy variables and intercept term are not reported. HAC standard errors in parentheses. * indicates significance at 10 per cent level. ** indicates significance at the 5 per cent level. *** indicates significance at the 1 per cent level.

Table 5: Cyclicity of the tax rates (1975-2019)

	VAT		Corporation Tax		Capital Gains tax		Capital acquisitions tax		Stamp duty		Tax rate index (standard)		Tax rate index (top rate)	
Output Gap	0.06		-0.09		0.03		-0.27		0.11		-0.05		-0.08	
	[0.07]		[0.12]		[0.18]		[0.22]		[0.10]		[0.17]		[0.13]	
RGNI* growth		-0.01		-0.13**		-0.38**		-0.25		0.10		-0.12*		-0.20**
		[0.05]		[0.06]		[0.16]		[0.17]		[0.08]		[0.07]		[0.10]
R^2	0.01	0.00	0.02	0.08	0.00	0.06	0.03	0.06	0.06	0.11	0.00	0.03	0.01	0.10
No. of tax rate changes	12	12	13	13	8	8	6	6	3	3	28	28	31	31
Observations	45	45	45	45	45	45	45	45	45	45	45	45	45	45

Sources: Author's calculations.

Note: The dependent variable is the percentage point change for each individual tax rate. The tax rate index is as constructed in equation 2 using either the standard rate of income tax or the top rate of income tax (incl. USC and PRSI). The output gap used is that of Casey (2019). Intercept term not reported. HAC standard errors in parentheses. * indicates significance at 10 per cent level. ** indicates significance at the 5 per cent level. *** indicates significance at the 1 per cent level.

4.3 The cyclicity of discretionary tax measures

This section widens the analysis in the previous section from the focus on tax rates to include the role of changes in that tax bands, tax credits and exemptions. Tax bands, tax credits and exemptions are also tax policy instruments which play a vital role in the conduct of fiscal policy. Decisions to change (or not) the tax bands and tax credits can impact the net cyclical stance of tax policy.

To investigate the cyclical nature of tax policy—as a whole—we use the approach of Barrios and Fagnoli (2010), who use the estimated yield (or cost) from all discretionary tax changes in each year to investigate the cyclicity of tax policy. To do so, we construct a new tax policy changes dataset.⁶³ This dataset provides the revenue yield (or cost) of all discretionary tax measure changes (tax bands, tax rates, tax credits, etc.), for each tax heading, introduced in the budgets from 1987-2019.

Two important caveats should be noted with this dataset. First, estimates of the yield/cost of individual tax policy measure are made on an *ex-ante* basis and these are not updated *ex-post*. *Ex-ante* estimates of tax yields will inevitably have some degree of error.⁶⁴ Second, estimates of yields are based on a “no policy change” scenario. Therefore, any increases in tax bands or tax credits are recorded as revenue reducing measures. There is no systematic recording of estimates of the yield from keeping tax bands and tax credits constant. Keeping tax bands and tax credits constant in a booming economy will expand the tax base and yield additional revenue (i.e., be countercyclical) as wages rise and people drift into higher tax bands. As a result, to the extent that we find that income tax policy (or, by extension, overall tax policy) is conducted procyclically using these estimates of discretionary tax measures, the size of the association will be an upper bound on the actual magnitude of the association.⁶⁵

⁶³ A tax policy changes dataset is available for Ireland from Conroy (2019) over the period 1987-2018. However, this dataset is only available on an annual frequency. As a result, a new dataset was constructed here at a quarterly frequency.

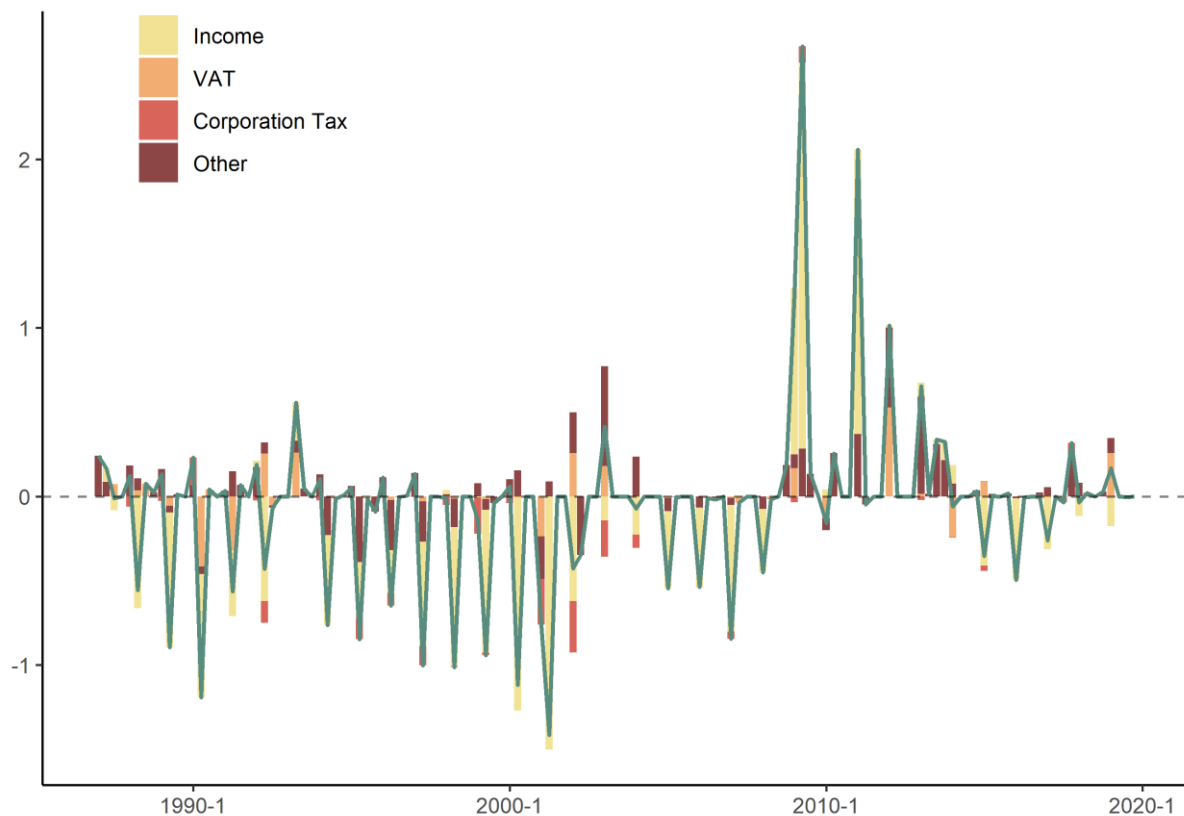
⁶⁴ These estimates rely on early official estimates of the predicted impact of prospective tax changes. They therefore rely on modelling work and judgments which may prove inaccurate.

⁶⁵ For reference, income tax bands were changed in 24 of the 34 years included in the sample. In only two years of this sample the tax bands were lowered. Estimates of the yield from keeping tax rates constant are available in recent years, but only for a limited number of years. For consistency, these estimates have not been included. However, for context, the estimate of the yield from keeping tax bands constant was €455 million in 2017, and €536 million in 2018.

Figure 13 shows the share of discretionary tax measure changes, for the three main tax headings, expressed as a percent of GNI* from 1987 Q1-2019 Q4. In most years, changes to the income tax system have been the most significant tax policy change. Total discretionary tax measures were revenue reducing in all but three years from 1989-2008, which from a qualitative perspective appears to be evidence of procyclicality as this is the period generally considered as the “Celtic tiger” era. Net revenue raising measures were then taken during the most recent financial crisis in order to close the sizeable government budget deficit that had emerged. For instance, in 2009 Q2 net revenue raising measures totalling 2.7 per cent of GNI* were implemented.

Figure 13: Discretionary tax measures 1987 Q1 – 2019 Q4

% of GNI*



Sources: CSO; Gerlach and Stuart (2015), and author’s calculations.

Note: The green line shows the net effect of discretionary tax measure changes on total revenue.

To estimate the cyclical nature of discretionary tax measures we estimate the following regression:

$$DTM_t = \alpha + \beta Cycle_t + e_t \quad (3)$$

Where, DTM_t is the full year estimate of discretionary tax measure as a share of annual GNI*, introduced at time t , $Cycle_t$ is the estimate of the business cycle at time t and the coefficient β is the estimate of the cyclical stance of tax policy. Here we use the year-on-year growth rate of domestic GVA, and the output gap estimates of Casey (2019) as the cyclical indicators. Table 6 shows the results of the estimation of equation three for eight individual tax headings and total tax revenue.⁶⁶

Again, we find clear evidence of tax policy being conducted in a procyclical manner. In particular, there is evidence that income tax and overall tax policy as a whole have been altered procyclically. There is some evidence that excise duty, capital taxes and PRSI has been altered procyclically. All other tax headings do not exhibit any clear cyclical pattern in how they have been altered.

We find that a one percentage point increase in the output gap estimate for a quarter—an improvement in cyclical conditions—is associated with procyclical revenue-reducing measures of 0.05 per cent of GNI*. If we take nominal GNI* as approximately €200 billion in 2018, a one percentage point increase in the year-on-year growth rate for of real domestic GVA would be associated with discretionary revenue reducing measures of €100 million in that quarter.

⁶⁶ The measure of total revenue here includes income tax, corporation tax, VAT, capital taxes, property tax, stamps, excise, PRSI, and the health levy.

Table 6: Cyclical conduct of discretionary tax measures (1987Q1-2019Q4)

	Income Tax		VAT		Corporation Tax		Excise		Stamps		Capital		PRSI		Total Revenue	
Output Gap	-0.033***		-0.003		-0.003		-0.003		-0.002		-0.003		-0.003		-0.050***	
	[0.013]		[0.004]		[0.002]		[0.003]		[0.002]		[0.002]		[0.003]		[0.017]	
Real domestic GVA growth	-0.042**		-0.004		-0.001		-0.004**		0.000		-0.002***		-0.003**		-0.056***	
	[0.017]		[0.002]		[0.001]		[0.002]		[0.000]		[0.001]		[0.001]		[0.019]	
R^2	0.02	0.13	0.00	0.01	0.00	0.00	0.00	0.03	0.01	0.00	0.02	0.04	0.00	0.01	0.04	0.16
Observations	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132

Sources: Author's calculations.

Note: The dependent variable is the percentage share of discretionary revenue measures in annual GNI*. The output gap used is that of Casey (2019). Intercept term not reported. HAC standard errors in parentheses. * Indicates significance at 10 per cent level. ** indicates significance at the 5 per cent level. *** indicates significance at the 1 per cent level.

4.4 Endogeneity and procyclicality

Up to now, the assumption in the estimation of the empirical results is that equation 1 and equation 3 are correctly identified. However, it can be argued that changes in the tax rate in a given year may affect the rate of growth in the same year. For example, economic activity in a given year might be dampened by the potential distortions/behavioural changes that an increase in a tax rate may cause. If that is the case, then equations 1 and 3 would fall foul of reverse causality. To address this potential issue, as the change in the tax rate in year t cannot affect the growth rate in year $t - 1$, we instrument both cyclical indicators, the output gap and the real growth rate of GNI*, with the lag of the growth rate in real GNI* or the 4-quarter lag of domestic GVA growth, where relevant.⁶⁷ Results show that, in all cases, we can reject the null hypothesis that the lag of the growth rate is a weak instrument for both the growth rate and the output gap.

The reason the lag of the output gap is not used as an instrument for the output gap is due to the way the output gap is estimated. Output gap estimates are usually obtained using filtering techniques, as is the case here. That is, the output gap in year t , is also dependent on the level of output in year $t + 1$ and $t + 2$ etc. due to the filtering that is required to estimate a potential output level. To the extent that a change in the tax rate in year t effects output in year t or $t + 1$, this will also affect the estimate of the output gap in year t and $t - 1$, and so endogeneity problems, if any, may still remain. As a result, it was decided to use the lag of the growth rate to instrument for the output gap, instead of the lag of the output gap.

Table 7 shows the results of an investigation into the cyclicity of income tax policy using two-stage least squares estimation. The instrumental variable (IV) approach provides broadly similar results with a negative sign on the cyclical indicator across all equations. The Wu-Hausman test suggests that endogeneity is an issue when the output gap, as estimated using a HP filter, is used as the measure of the cycle in the equations that include the top rate of income tax. Using the two-stage least squares instrumental variable approach for these equations, points to the top rate of income tax with USC and PRSI included being changed procyclically. On the other hand, the top rate of income tax, excluding USC or PRSI, does not show signs of being changed

⁶⁷ As an additional robustness check, the lag of real GNI* growth or the 4-quarter lag of domestic GVA growth were used directly as the cyclical indicator. The results are similar.

procyclically when the HP filter estimate of the output gap is used. For the equations where endogeneity does not appear to be a concern, as measured by the Wu-Hausman test, the original OLS estimates are preferred. Where the Wu-Hausman test suggests endogeneity is an issue, the IV estimates are preferred.

The reason the lag of the output gap is not used as an instrument for the output gap is due to the way the output gap is estimated. Output gap estimates are usually obtained using filtering techniques, as is the case here. That is, the output gap in year t , is also dependent on the level of output in year $t + 1$ and $t + 2$ etc. due to the filtering that is required to estimate a potential output level. To the extent that a change in the tax rate in year t effects output in year t or $t + 1$, this will also affect the estimate of the output gap in year t and $t - 1$, and so endogeneity problems, if any, may still remain. As a result, it was decided to use the lag of the growth rate to instrument for the output gap, instead of the lag of the output gap.

Table 7 shows the results of an investigation into the cyclicity of income tax policy using two-stage least squares estimation. The instrumental variable (IV) approach provides broadly similar results with a negative sign on the cyclical indicator across all equations. The Wu-Hausman test suggests that endogeneity is an issue when the output gap, as estimated using a HP filter, is used as the measure of the cycle in the equations that include the top rate of income tax. Using the two-stage least squares instrumental variable approach for these equations, points to the top rate of income tax with USC and PRSI included being changed procyclically. On the other hand, the top rate of income tax, excluding USC or PRSI, does not show signs of being changed procyclically when the HP filter estimate of the output gap is used. For the equations where endogeneity does not appear to be a concern, as measured by the Wu-Hausman test, the original OLS estimates are preferred. Where the Wu-Hausman test suggests endogeneity is an issue, the IV estimates are preferred.

Table 7: Instrumental variable estimation - cyclicity of income tax rates (1922-2019)

	Standard rate of Income tax			Standard rate of Income tax (incl. PRSI)			Top rate of Income tax			Top rate of Income tax (incl. USC)			Top rate of Income tax (incl. USC and PRSI)		
Output Gap (HP)	-0.33 [0.22]			-0.36 [0.24]			-0.39 [0.30]			-0.54* [0.32]			-0.58* [0.33]		
Output Gap (Hamilton)	-0.08 [0.05]			-0.09 [0.06]			-0.12* [0.06]			-0.16*** [0.05]			-0.17*** [0.05]		
RGNI* growth	-0.21* [0.12]			-0.23* [0.13]			-0.25 [0.17]			-0.34** [0.17]			-0.37** [0.17]		
Weak instruments	23.21***	137.91***	22.34***	22.26***	135.99***	21.76***	23.21***	137.91***	22.34***	23.21***	137.91***	22.34***	22.26***	135.99***	22.00***
Wu-Hausman	1.67	0.98	0.00	2.02	0.75	0.00	2.7	0.13	0.03	4.38**	0.32	0.12	4.94**	0.23	0.11
Observations	96	95	96	96	95	96	96	95	96	96	95	96	96	95	96

Sources: Author's calculations.

Note: Note: The dependent variable is the percentage point change in the tax rate. The output gaps used are based on a HP filter of real GNI* with $\lambda = 6.25$ and a Hamilton filter, with $h = 2, p = 2$. Both the output gaps and the Real GNI* growth rate are instrumented using the lag of the Real GNI* growth rate. PRSI refers to the standard rate of employees PRSI. In the equations with PRSI included, a dummy variable is included for the introduction of PRSI in 1979. Intercept term and dummy not reported. HAC standard errors in parentheses. * indicates significance at 10 per cent level. ** indicates significance at the 5 per cent level. *** indicates significance at the 1 per cent level.

Turning to the more recent period, Table 8 shows the cyclicity of income tax rates from 1975-2019 using the IV approach and with the more plausible output gap estimates of Casey (2019). Again, all coefficients have a negative sign. In three cases where the output gap is used as the cyclical indicator and the Wu-Hausman test suggests that endogeneity is a concern, for the standard rate of income tax, the standard rate of income tax (incl. PRSI) and the top rate of income tax (incl. USC and PRSI), the IV estimates point to some evidence that these rates have been changed procyclically.

Table 9 shows the results of the IV estimates for other taxes over this more recent period. Again, for the most part, the signs on the coefficients of the cyclical indicators are similar to those of the corresponding OLS estimates. In several cases where the output gap is used as the cyclical indicator, the Wu-Hausman test suggest that endogeneity is a problem in the OLS estimates. Using the IV estimates for these equations with the output gap as the cyclical indicator, points to corporation tax and capital gains tax being changed acyclically from 1975-2019, whereas capital acquisitions tax and both the tax indices show evidence that these have been changed procyclically.

The results of an instrumental variable estimation using discretionary tax measures are shown in Table 10. In general, the signs on the coefficients are similar to those from the OLS estimation, that is, all coefficients have a negative sign. The Wu-Hausman test suggests that endogeneity is an issue in the equations for income tax, excise duty, PRSI, and total revenues, for equations using the output gap as the cyclical indicator. The IV estimates for income tax, stamp duty and total revenue suggest that changes to these taxes were conducted procyclically, with some evidence that PRSI and corporation tax were changed procyclically. The results indicate that a one percentage point increase in the year-on-year growth rate of domestic GVA for a is associated with to a 0.06 per cent of annual GNI* cut in income taxes in the quarter, and a 0.095 per cent cut in total tax revenue in the quarter. To put this in context, 0.095 per cent of GNI* in 2018 is approximately equal to a €190 million. A sustained 1 percentage point increase in the year-on-year growth rate of domestic GVA over four quarters, would result in a tax cut of €760 million in that year. However, as highlighted in Section 4.3 the size of these association is likely to be an upper bound on the true size of the association.

Table 8: Instrumental variable estimation - Cyclicity of the income tax rates (1975-2019)

	Standard rate of income tax		Standard rate of income tax (incl. PRSI)		Top rate Income tax		Top rate Income tax (incl. USC)		Top rate of income tax (incl. USC and PRSI)	
Output Gap	-0.21*		-0.28*		-0.19		-0.47		-0.56*	
	[0.12]		[0.17]		[0.14]		[0.29]		[0.31]	
RGNI* growth	-0.12*		-0.15*		-0.11		-0.26**		-0.30***	
	[0.06]		[0.08]		[0.08]		[0.10]		[0.10]	
Weak instruments	20.07***	16.99***	16.85***	16.58***	20.07***	16.99***	20.07***	16.99***	20.07***	16.58***
Wu-Hausman	4.33**	0.84	4.69**	1.43	0.96	0.00	2.42	0.07	3.20*	0.24
Observations	45	45	45	45	45	45	45	45	45	45

Sources: Author's calculations.

Note: The dependent variable is the percentage point change for each individual tax rate. The output gap used is that of Casey (2019). Both the output gap and the Real GNI* growth rate are instrumented using the lag of the Real GNI* growth rate. PRSI refers to the standard rate of employees PRSI. In the equations with PRSI included, a dummy variable is included for the introduction of PRSI in 1979. Coefficients for dummy variables and intercept term are not reported. HAC standard errors in parentheses. * indicates significance at 10 per cent level. ** indicates significance at the 5 per cent level. *** indicates significance at the 1 per cent level.

Table 9: Instrumental variable estimation - Cyclicity of the tax rates (1975-2019)

	VAT		Corporation Tax		Capital Gains Tax		Capital Acquisitions Tax		Stamp Duty		Tax rate index (standard)		Tax rate index (top rate)	
Output Gap	-0.11		-0.47		-1.20		-1.40**		0.20*		-0.59*		-0.69**	
	[0.15]		[0.29]		[0.76]		[0.65]		[0.12]		[0.34]		[0.31]	
RGNI* growth	-0.06		-0.26*		-0.67*		-0.78**		0.11		-0.33		-0.38**	
	[0.09]		[0.14]		[0.38]		[0.37]		[0.08]		[0.22]		[0.15]	
Weak instruments	20.07***	16.99***	20.07***	16.99***	20.07***	16.99***	20.07***	16.99***	20.07***	16.99***	20.07***	16.99***	20.07***	16.99***
Wu-Hausman	1.40	0.78	4.11**	1.85	3.27*	1.26	4.04**	3.14*	1.00	0.08	3.84*	1.73	4.94**	2.14
Observations	45	45	45	45	45	45	45	45	45	45	45	45	45	45

Sources: Author's calculations.

Note: The dependent variable is the percentage point change for each individual tax rate. The tax rate index is as constructed in equation 2 using either the standard rate of income tax or the top rate of income tax (incl. USC and PRSI). The output gap used is that of Casey (2019). Both the output gap and the Real GNI* growth rate are instrumented using the lag of the Real GNI* growth rate. Intercept term not reported. HAC standard errors in parentheses. * indicates significance at 10 per cent level. ** indicates significance at the 5 per cent level. *** indicates significance at the 1 per cent level.

Table 10: Instrumental variable estimation - Cyclical conduct of discretionary tax measures (1987 Q1-2019 Q4)

	Income Tax		VAT		Corporation Tax		Excise		Stamps		Capital		PRSI		Total Revenue	
Output Gap	-0.09**		-0.004		-0.007*		-0.012**		-0.007**		-0.010		-0.012*		-	
	[0.038]		[0.007]		[0.004]		[0.006]		[0.04]		[0.006]		[0.006]		[0.047]	
Real domestic GVA growth	-0.060**		-0.003		-0.005*		-0.008		-0.005*		-0.006		-0.008*		-0.095**	
	[0.025]		[0.005]		[0.003]		[0.005]		[0.003]		[0.004]		[0.004]		[0.038]	
Weak instruments	21.51***	53.97***	21.51***	53.97***	21.51***	53.97***	21.51***	53.97***	21.51***	53.97***	21.51***	53.97***	21.51***	53.97***	21.51***	53.97***
Wu-Hausman	3.63*	1.16	0.08	0.03	1.43	1.86	3.10*	1.18	2.74	3.74	2.03	0.79	2.96*	2.01	4.77**	2.60
Observations	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132

Source: Author's calculations.

Note: The dependent variable is the percentage share of discretionary revenue measures in annual GNI*. The output gap used is that of Casey (2019). Both the output gap and the Real GNI* growth rate are instrumented using the lag of the Real GNI* growth rate. Intercept term not reported. HAC standard errors in parentheses. * Indicates significance at 10 per cent level. ** indicates significance at the 5 per cent level. *** indicates significance at the 1 per cent level.

4.5 Discussion of results

Overall, the evidence points to income tax rates being changed procyclically over the past century. This reflects both our OLS-based estimates and our IV estimates.⁶⁸

When we focus on to the more recent period of 1975-2019, the evidence of procyclicality in the changes to income tax rates remains. By using a tax rate index, constructed as a weighted average of the changes in the main tax heads, we show that the overall association between tax rate changes and the cycle is from 1975-2019 was negative, indicating that tax policy was conducted procyclically.

However, tax rates are only one policy instrument available in the conduct of tax policy. A more holistic assessment would need to account for changes in other tax policy instruments, like tax credits or tax bands that could potentially offset the fiscal impact of changing the tax rates.

Focusing on the tax system as a whole, by using estimates of discretionary tax measures, we find further evidence that the overall tax policy in Ireland has been conducted procyclically since 1987. In particular, we find that the changes to the income tax system and to overall tax policy have been made procyclically. Changes to VAT have been made acyclically. Other tax heads have been changed either procyclically or acyclically. No evidence was found to suggest that any tax heading was altered countercyclically.

Overall, the evidence suggests that tax policy in Ireland over the past century has not been conducted in an optimal fashion, either from a Keynesian perspective or from a “tax smoothing” perspective of Barro (1979). Instead, the evidence suggests that tax policy in Ireland has been conducted procyclically, with taxes being cut in good times and being raised in bad times. This places Ireland in the company of developing nations and in stark contrast with the tax policy of other developed economies, where tax policy is conducted acyclically (Vegh and Vuletin, 2015).

⁶⁸ As well as lagged estimates.

5. Conclusions

The Irish tax system has undergone significant changes over the past century. We document how the share of taxation in the economy approximately doubled over the period 1960-1980. Perhaps the most significant change to the Irish tax system occurred in the 1970s. Prior to joining the EEC, more than a fifth of tax revenue was from customs tax. The elimination of tariffs on some of our largest trading partners saw this share fall dramatically. VAT was also introduced as part of Ireland's accession to the EEC and replaced the wholesale and turnover taxes. In addition, significant reform to Ireland's system of taxing capital took place in the 1970s.

We fill a gap in the literature on Irish fiscal policy by investigating how tax policy—as opposed to tax revenues, which are endogenous to the cycle—are changed over the business cycle. We create a new dataset on tax rates and tax bands for the main tax headings in Ireland, from 1920-2019.

We find that Irish tax policy has been routinely procyclical since the foundation of the state. First, we show evidence of this procyclicality in terms of how changes in Ireland's income tax rates have been made.

Second, we consider the wider tax system beyond just rates. We use an additional tax policy changes dataset to show that total discretionary tax measures—which incorporate all tax policy instruments (rates, bands, credits, exemptions, etc.)—have been taken in a procyclical manner over the period 1987-2019. In addition, discretionary changes to income tax and to overall tax policy have been made procyclically. There is no evidence to suggest that any tax head has been changed countercyclically.

These results indicate that tax policy has not acted to stabilise the macroeconomy in Ireland over the past century. Instead of acting to mitigate the fluctuations in the Irish economy, tax policy has exacerbated them. This contrasts with empirical evidence for other developed countries where tax policy has been acyclical and puts Ireland among developing countries whose tax policy has been procyclical. It is also in contrast to the Keynesian view of optimal fiscal policy, with tax rates positively correlated with the cycle, and the theory of “tax smoothing” of Barro (1979), with no correlation between tax rates and the cycle.

References

- Addison-Smyth, D. and McQuinn, K., 2010. Quantifying revenue windfalls from the Irish housing market. *The Economic and Social Review*, 41(2), p.201.
- Barro, R.J., 1979. On the determination of the public debt. *Journal of political Economy*, 87(5, Part 1), pp.940-971.
- Bry, G. and C. Boschan, 1971. Cyclical Analysis of Time Series: Selected Procedures and Computer Programs. *National Bureau of Economic Research*.
- Barrios, S. and Fagnoli, R., 2010. Discretionary measures and tax revenues in the run-up to the financial crisis. *European Commission Economic Papers* no. 419.
- Barry, F., 2008. Ireland–politics, institutions and post-war economic growth. In *CESifo Forum* (Vol. 9, No. 1, pp. 23-34). München: ifo Institut für Wirtschaftsforschung an der Universität München.
- Bénétrix, A.S. and Lane, P.R., 2012. The cyclical conduct of Irish fiscal policy. *The World Economy*, 35(10), pp.1277-1290.
- Casey, E., 2019. Inside the “Upside Down”: Estimating Ireland’s Output Gap. *The Economic and Social Review*, 50(1, Spring), pp.5-34.
- Clarke, P., 2017. The Historical Development of the Irish Taxation System. *Accounting, Finance and Governance Review*, 21, pp.1-2.
- Coffey, S., 2017. Review of Ireland's Corporation Tax Code. *Department of Finance (Ireland)*, available at: <https://www.gov.ie/en/publication/fa53d4-review-of-irelands-corporation-tax-code/?referrer=/wp-content/uploads/2017/09/170912-review-of-irelands-corporation-tax-code.pdf/>
- Conroy, N., 2019. Estimating Ireland’s Tax Elasticities: A Policy-Adjusted Approach. *Irish Fiscal Advisory Council Working Paper* No. 10.
- Cronin, D., and McQuinn, K., 2018. The cyclicality of Irish fiscal policy ex-ante and ex-post. *The Economic and Social Review*, 49(1, Spring), pp.1-16.

de Cogan, D. 2013. The Wartime Origins of the Irish Corporation Tax. *Irish Journal of Legal Studies*, pp 15-32.

Department of Finance, 1946. National Income and Expenditure 1938-1944. Department of Finance, Dublin, Ireland.

Department of Finance, 2018. Capital Taxes–Stamp duty. *Tax Strategy group – TSG 18/09*. Department of Finance, Dublin, Ireland.

Hunt, C., 2005. Discretion and cyclicity in Irish budgetary management 1969-2003. *The Economic and Social Review*, Vol. 36, No. 3, Winter, pp. 295-321.

FitzGerald, J. and Kenny, S., 2018. Managing a Century of Debt. *Lund Papers in Economic History. General Issues*, (2018: 171).

Fiscal Council, (2018). Fiscal Assessment Report, June 2018. Dublin: Irish Fiscal Advisory Council. Available at: <http://www.fiscalcouncil.ie/publications/>

Fiscal Council, (2020). Fiscal Assessment Report, May 2020. Dublin: Irish Fiscal Advisory Council. Available at: <http://www.fiscalcouncil.ie/publications/>

Frankel, J.A., Vegh, C.A. and Vuletin, G., 2013. On graduation from fiscal procyclicality. *Journal of Development Economics*, 100(1), pp.32-47.

Gerlach, S., and Stuart, R. 2015. Money, Interest Rates and Prices in Ireland, 1933-2012, *Irish Economic and Social History*, 42(1), 1-32, December.

Hamilton, J.D., 2018. Why you should never use the Hodrick-Prescott filter. *Review of Economics and Statistics*, 100(5), pp.831-843.

Hardiman, N., 2002. The development of the Irish tax state. *Irish Political Studies*, 17(1), pp.29-58.

Hardiman, N., 2004. Paying for government. ISSC Discussion Paper Series, WP 2004/11.

Kaminsky, G., Reinhart, C. and Végh, C., 2004. When it rains, it pours: Procyclical macropolicies and capital flows. *NBER Macroeconomics Annual*, 2004, pp.11-53.

Kearney, I., McCoy, D., Duffy, D., McMahon, M. and Smyth, D., 2000. Assessing the stance of Irish fiscal policy (No. BP2001/1). Economic and Social Research Institute (ESRI).

Lane, P.R., 1998. On the cyclicity of Irish fiscal policy. *Economic and Social Review*, 29(1), pp.1-16.

Lane, P.R., 2003. The cyclical behaviour of fiscal policy: evidence from the OECD. *Journal of Public economics*, 87(12), pp.2661-2675.

Lawless, M. and Lynch, D., 2016. Scenarios and distributional implications of a household wealth tax in Ireland. *ESRI Working Paper*, No. 549.

Ravn, M.O. and Uhlig, H., 2002. On adjusting the Hodrick-Prescott filter for the frequency of observations. *Review of economics and statistics*, 84(2), pp.371-376.

Revenue Commissioners, 2019. Income earners by income tax rate. Version: July 2019. Office of the Revenue Commissioners, Dublin, Ireland.

Revenue Commissioners, 2020. Ready Reckoner – Pre Budget 2021. Version: May 2020. Office of the Revenue Commissioners, Dublin, Ireland.

Sandford, C. and Morrissey, O., 1985. The Irish wealth tax: A case study in economics and politics. *Economic and Social Research Institute (ESRI) Research Series*.

Strawczynski, M., 2014. Cyclicity of statutory tax rates. *Israel Economic Review*, 11(1).

Talvi, E. and Vegh, C.A., 2005. Tax base variability and procyclical fiscal policy in developing countries. *Journal of Development economics*, 78(1), pp.156-190.

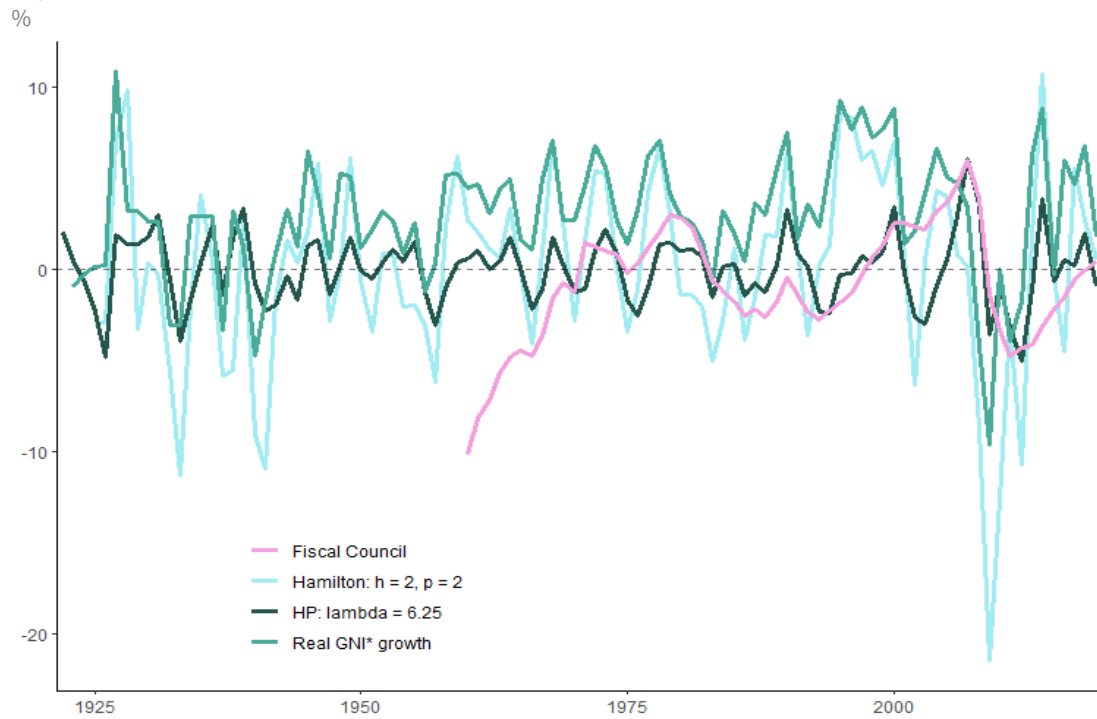
Vegh, C.A. and Vuletin, G., 2015. How is tax policy conducted over the business cycle? *American Economic Journal: Economic Policy*, 7(3), pp.327-70.

Walsh, A. and Sanger, C., 2014. The historical development and international context of the Irish corporate tax system. *EY*, report Commissioned by the Department of Finance.

Woo, J., 2009. Why do more polarized countries run more procyclical fiscal policy?. *The Review of Economics and Statistics*, 91(4), pp.850-870.

Appendix 1: Additional Charts

Figure A.1: Measures of the economic cycle from 1922-2019



Sources: CSO; Casey (2019), Gerlach and Stuart (2015) and author's calculations.

Note: Hamilton, HP and Fiscal Council are all measures of the output gap. Fiscal Council is the estimate of the output gap from Casey (2019).