An Oifig Buiséid Pharlaiminteach
Parliamentary Budget Office

Tithe an Oireachtais
Houses of the Oireachtas

Working Paper Series

No. 1 of 2020

Revenue volatility and the role of the Rainy-Day Fund: Potential mechanisms for identifying and setting aside excess receipts

Jacopo Bedogni† & Keith Fitzgerald†

April 2020

† The authors Jacopo Bedogni and Keith Fitzgerald are economists in the Parliamentary Budget Office (PBO), Houses of the Oireachtas. PBO Working Papers present primary research in progress intended to elicit comments and encourage debate. The content is subject to review and revision. The analysis and views contained in this paper are those of the authors only, and are not necessarily reflective of the position of the PBO or of the Houses of the Oireachtas generally. The authors would like to thank Diarmaid Smyth and Eddie Casey for their constructive feedback and advice. For queries, contact Keith.Fitzgerald@Oireachtas.ie or Jacopo.Bedogni@Oireachtas.ie.

Revenue volatility and the role of the Rainy-Day Fund: Potential mechanisms for identifying and setting aside excess receipts

Abstract

This paper examines the role of the Rainy-Day Fund in Ireland as an instrument to accumulate fiscal buffers and mitigate the effects of revenue volatility, mostly linked to Corporation Tax receipts, on the public finances. We contribute to fiscal policy-making by proposing potential mechanisms for identifying excess tax receipts and governing allocations to the fund. The rules we propose have an overarching objective to link public spending to some equilibrium or volatility minimising level of revenue, and to reduce the link between public spending and volatile or transient revenues. We show that the application of these rules over 2015 – 2019 would have facilitated a total allocation to the Rainy-Day Fund ranging from €5.3 billion to €13.9 billion.

Keywords: Rainy-Day Fund, Revenue Volatility, Fiscal Policy

JEL Classification: H2, G110, E610

Introduction

This paper is motivated by the growing reliance of the Irish Exchequer on volatile and potentially transient revenues sourced from Corporation Tax.

A key policy action implemented in Ireland to address fiscal vulnerabilities was the establishment of a Rainy-Day Fund (RDF). The RDF was envisaged as a tool to promote counter-cyclical fiscal policy, and to mitigate the adverse effects of revenue volatility on the public finances. As currently designed, the RDF permits an annual Exchequer transfer of €500 million (with the option of deferring payment in exceptional circumstances).

Additional proposals for reducing fiscal vulnerabilities were set out in a policy document by the Department of Finance (2019a). This document highlights two main areas of concern:

- the sustainability of the current levels of Corporation Tax (CT) receipts, considering changes to the international tax environment; and,
- the shortcomings of the current EU fiscal framework (which has inadvertently induced pro-cyclical fiscal policies).[1]

On CT sustainability, the Department's main proposal entails setting aside, on an annual basis, some portion of "excess" receipts for investment in a Rainy-Day Fund. In this case, excess receipts are defined as the amount by which the share of CT revenue exceeds the long-run average share of total revenue.

The idea of "excess" revenue relates to the significant outperformance of CT in recent years versus expectations (most notably since 2015). A debate has emerged regarding the extent to which this outperformance can be sustained. There is general concern that at least some portion of these unexpected receipts represents transient or temporary (i.e. "windfall") revenue that should not be used by government to fund permanent or ongoing spending commitments (or tax cuts).

However, estimating the excess is difficult. Several alternative approaches have been proposed by various research bodies, with each varying in terms of complexity. The simplest approach explored by the Department assumes that CT revenue reverts to 2014 levels (with the implicit assumption that this represents a sustainable level of receipts). The Department has also modelled an approach that assumes CT revenue grows in line with growth in Modified Gross National Income (or GNI*). More technical approaches that have been proposed elsewhere, involve the use of linear regression models to predict CT receipts (the difference between the predicted level of CT and the actual outturn is identified as excess).

[1] In relation to the EU fiscal rules, the Department's recommendations include the development of alternative estimates of the Irish economic cycle (i.e. potential output and the output gap) and the re-statement of numerical rules in terms of more appropriate measures of the performance of the Irish economy, such as Modified Gross National Income or GNI* (e.g. using the debt-to-GNI* ratio, rather than debt-to-GDP).

Although there are several proposals for identifying excess CT revenue, relatively few of these have been operationalised as a rule or mechanism for determining an appropriate allocation of funds to the RDF. In this paper we provide an overview and critical assessment of the proposals to date, before then introducing our alternative rules for governing allocations to the RDF. The objective is to minimise the risk that public spending is linked to highly volatile sources of revenue. As such, the rules involve identifying some equilibrium or volatility minimising level of revenue, above which, receipts should be considered as "excess" and marked for allocation to the RDF.

Specifically, our rules are based on:

- medium-run average shares;
- volatility minimising shares; and,
- revenue allocations linked to a cyclical indicator of Irish economic activity (for this paper, we use our proposed cyclical indicator formed using Principal Component Analysis).

Our first two rules can be applied to revenue from any tax categories, however, for illustrative purposes we will focus on CT revenue, while our third rule is applied in respect of overall Exchequer revenue.

This paper is divided into 6 main sections. In Section 1 we set out the context and provide a primer on Rainy-Day Funds. In Section 2, we assess the rationale behind saving for a rainy day, examining the cyclicality of Irish fiscal policy and the degree of volatility of Ireland's macroeconomic and fiscal aggregates. We also illustrate the main trade-offs influencing the decision by the State to capitalise an RDF, and present a theoretical model exploring these factors. In Section 3 we provide an overview of Ireland's "National Surplus Reserve Fund for Exceptional Contingencies" (i.e. the Rainy-Day Fund). In Section 4, we review the most common approach in the US to capitalising RDFs, and we also analyse the proposals of domestic bodies for identifying excess CT receipts and setting them aside. In Section 5 we present our main analysis outlining our alternative rules. Finally, in Section 6 we discuss issues around withdrawals from the RDF, and the replenishment of the RDF, and offer some concluding remarks.

1. Policy background

1.1. A primer on rainy-day funds

A rainy-day fund is generally a counter-cyclical fiscal policy tool to facilitate budget stabilisation. On a basic level, RDFs entail the accumulation of funds during periods of strong economic performance, which are then deployed in economic downturns. These funds are common in US states (as of 2019 all US states had at least one RDF (NASBO, 2019)) but are less common in the EU. This is likely explained by the differences in the fiscal framework of the US versus the EU.

On the one hand, there are strict borrowing limits in US states, with rules generally requiring a balanced budget being set at the federal level. In these circumstances, revenue shortfalls must be offset by tax increases and/or spending reductions, and RDFs can be used to protect the state budget from tax revenue volatility, temporary revenue shortfalls or unexpected spending pressures. On the other hand, while EU Member States are subject to a more complex set of fiscal rules governing the general government balance, the structural balance, government debt and growth in public spending, it is possible for Member States to cover revenue shortfalls by issuing debt.

Proposals have been put forward by several institutions, such as the IMF (2018) and the ESM (2018), to introduce a common European RDF representing a central fiscal capacity. However, in these cases, the RDF is intended as a large macroeconomic stabilisation fund, aimed at providing significant counter-cyclical support to the European economy.

In effect, an RDF that is well-designed and adequately capitalised can:

- support budget stabilisation, as funds accumulated in good times can be used to offset revenue shortfalls and meet increases in cyclical spending in a downturn. This fiscal stability can also help to reduce the level of uncertainty for economic agents;
- provide additional fiscal space, lessening the need for fiscal consolidation (such as tax increases and reductions in spending) in bad times;
- help manage the State's reliance on very volatile revenue sources (generally, there are limitations on the State in terms of its ability to restructure the tax system to better manage tax revenue volatility); and
- help mitigate the 'deficit bias' (the propensity of governments to be short-sighted and allow persistent increases in the deficit and public debt to meet voter demands) by setting aside unexpected revenue.

However, there are also important trade-offs influencing the decision by the State to capitalise a rainy-day fund. These will be explored in the section that follows.

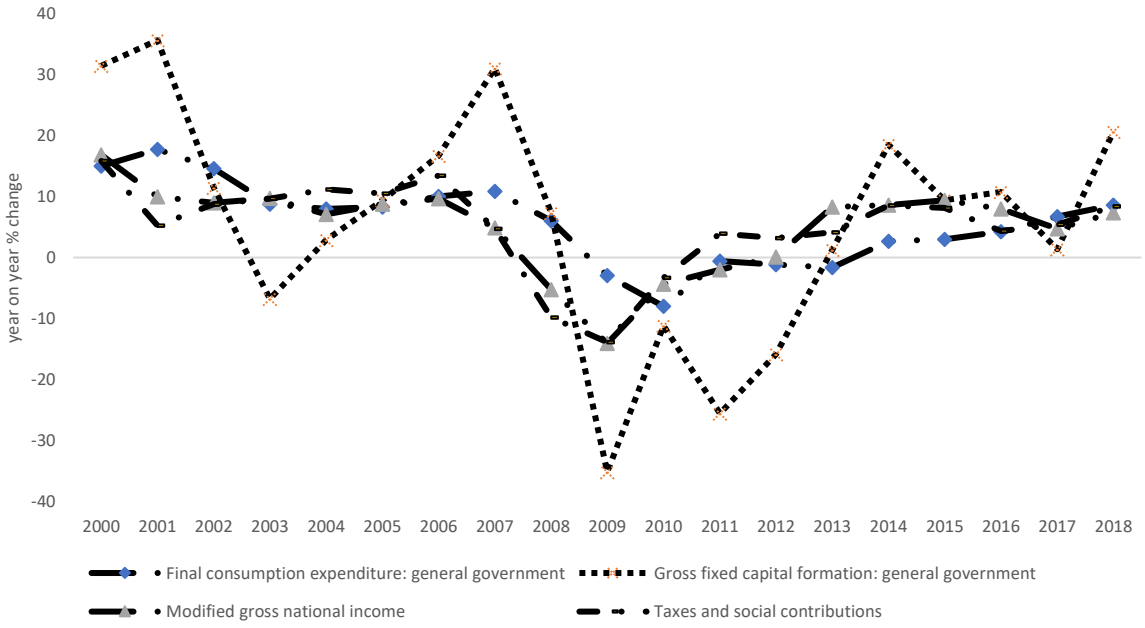
2. Assessing the rationale for a rainy-day fund in Ireland

2.1 Promoting counter-cyclical fiscal policy

Keynesian principles suggest that fiscal policy should behave in a counter-cyclical manner. Namely, it should lean against the cycle and smooth temporary surges and drops in economic activity. This means that if the economy is at risk of overheating, policy makers should attempt to cool it down by adopting contractionary fiscal policies (i.e. increase taxes and/or reduce public spending). Conversely, if the economy is in a recession, demand should be boosted by way of expansionary fiscal policy (i.e. through higher spending and/or lower taxation).

There is evidence suggesting that the conduct of fiscal policy in Ireland during the last few decades was procyclical (for example see Cronin and McQuinn (2018); Lane (2003); Scott and Bedogni (2017) and Conroy (2019)). This is explored in Figure 1.

Figure 1: The cyclicality of Irish fiscal policy, 2000 - 2018



Source: Authors' analysis of Ameco and CSO data

While tax and public spending policies are decentralised and taken at a domestic level, these are subject to the EU fiscal rules of the Stability and Growth Pact (SGP).[2] In the case of Ireland (but not limited to it), the EU fiscal framework has not prevented pro-cyclical fiscal policy (particularly during the mid-2000s), but in some cases has contributed to it (in the aftermath of the global financial crisis of 2008).

From a fiscal policy viewpoint, a rainy-day fund represents a domestic policy tool that can help foster counter-cyclical fiscal policy. Funds accumulated in periods of strong growth can be

[2] Transposed domestically under the Fiscal Responsibility Act 2012 and 2013.

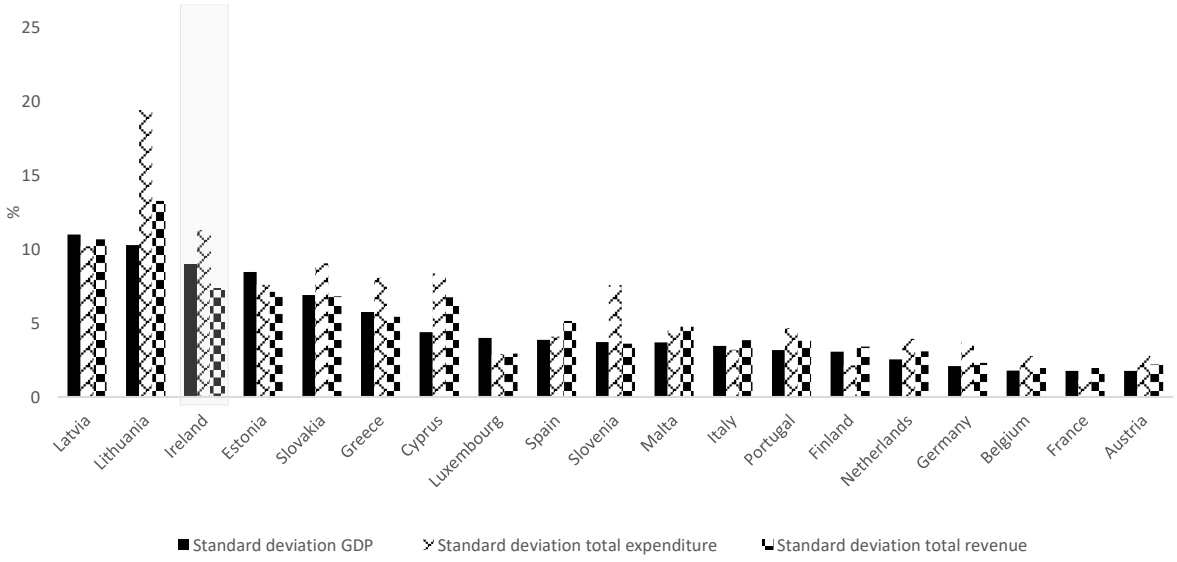
deployed to offset temporary revenue shortfalls (i.e. in a recession) and to meet increases in cyclical spending (e.g. unemployment supports). In addition, volatile and potentially transient tax revenues can be transferred to an RDF as they are realised. This would ensure that, for example, windfall tax receipts are not used to fund permanent spending commitments and/or tax reductions.

Conefrey, O'Reilly and Walsh (2019) model the macroeconomic impact of spending a fiscal windfall of €1.7 billion over a three-year period, using the Central Bank's COSMO model. They find that, in the context of an economy at full capacity, spending the fiscal windfall could lead to upward pressure on wages, a loss in competitiveness, and lower output in the traded sector. They further suggest that establishing a fiscal buffer could help the State to avoid relying on procyclical fiscal tightening in response to a negative shock, mitigating the loss of output and employment in a downturn.

2.2. Managing the risks of excessive tax revenue volatility

The rationale for an RDF is likely to be stronger for economies showing a high degree of volatility in their macroeconomic and fiscal aggregates. This appears to be the case for Ireland, as it displays a comparatively high level of macroeconomic and fiscal volatility (the 3rd highest in the Eurozone - see Figure 2), as measured by the standard deviation of the annual percentage changes in GDP,[3] total revenue, and total public expenditure.

Figure 2: Macroeconomic and fiscal volatility in the Euro area, 1996 - 2018



Source: Authors' analysis of Ameco data. **Notes**: Macro-fiscal volatility calculated is as the standard deviation of the annual percentage changes in GDP, total revenue and total public expenditure over 1996-2018.

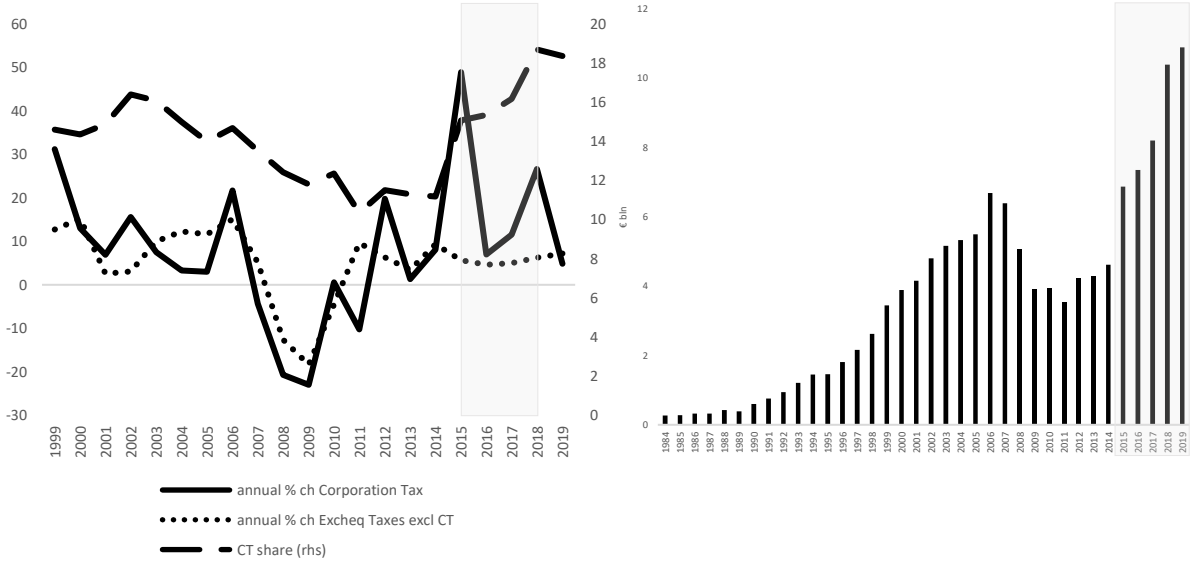
[3] This relatively high level of macroeconomic and fiscal volatility holds once 2015 is excluded for Ireland (with a standard deviation of 7.1%), and when GNI* is used as an alternative measure of activity (with a standard deviation of 7.2%).

More volatile growth rates indicates that the economy is more likely to experience sharp increases and drops in activity. Macroeconomic volatility impacts on revenue volatility. This, in turn, has implications for the cyclicality of fiscal policy, the stability of the revenue base, and the ability to produce accurate fiscal forecasts.[4]

Revenue volatility is a symptom of (among other factors) a concentrated production base. In several countries, this arises from a dependence on revenues sourced from natural resources (e.g. Norway, Saudi Arabia). However, in the Irish case, this dependence is on the productive activities of foreign-owned multinational corporations.

In Ireland, CT receipts have been exceptionally volatile in recent years (i.e. there have been sizeable revenue surprises). These developments were driven largely by increased corporate profitability and by external factors related to the changing global tax environment. Corporation Tax receipts increased by 135 per cent from 2014 to 2019, with a 49 per cent increase in 2015 alone. CT accounted for 18.4% of total Exchequer revenue in 2019, compared to a long-term (1999 - 2018) average share of 14%. Figures 3a and 3b show the historic trends in CT receipts.

Figure 3a and 3b: Historic trends in Corporation Tax receipts



Source: Authors' analysis of Department of Finance data. **Notes:** The share of CT in total tax revenue has increased substantially since 2015.

[4] For Ireland, we analysed the official forecast errors by tax head over the period 2000-2017. We have found that the accuracy of the Government's fiscal forecasts is better for Income tax, Excise Duty and VAT. Conversely, there are large forecasts errors for the most volatile tax categories such as Stamp Duties, Capital Taxes, Customs and Corporation Tax. There is also evidence of bias in forecasting Capital Taxes and Stamp Duties, due to the boom and bust phases these taxes have experienced (see Casey and Hannon (2016) for a similar analysis). More recent work by the Tax Forecasting Methodological Review Group (2019) recommends that the elasticity for CT be increased. It further claims that the overall forecasting performance of the Department of Finance over the past decade was robust.

In recent years, unexpected CT receipts have been the main contributor to higher-than-expected total revenue. Figure 3a shows that, prior to 2015, annual growth in CT was aligned with growth in total Exchequer revenue excluding CT (with both moving in line with the underlying performance of the economy). However, this pattern changed in 2015 due to the unprecedented outperformance of CT, above and beyond what can be reasonably expected or explained by macroeconomic aggregates.

2.3. Alternative options to the Rainy-Day Fund

In meeting revenue shortfalls, there are alternative options available to government. These shortfalls can be met through a process of fiscal consolidation, by increasing taxes and/or reducing public spending. However, it can take time for enough revenue to be raised or for spending programmes to be effectively wound down. In addition, revenues may not respond to tax policy changes as expected (e.g. due to unforeseen changes in tax-payer behaviour). Furthermore, fiscal consolidation can require substantial political capital, and an incumbent may not have the means to pursue the changes required to restore order to the public finances. In particular, cuts to social welfare programmes tend to be politically sensitive, meaning that budget pressures can often impact disproportionately on capital spending. This is particularly true of projects that are likely to yield benefits that are borne by future administrations. These cuts can leave substantial legacy effects, and capacity constraints, from which recovery is difficult. The process of fiscal consolidation may also be inappropriate if a revenue shortfall is temporary in nature.

Aside from this, government can also issue debt to finance spending commitments in the event of a revenue shortfall, particularly in respect of temporary shortfalls. However, in the context of a macroeconomic and fiscal crisis, this additional borrowing may be costly (as investors demand a greater return that reflects the underlying weakness of the economy) particularly if debt levels are already high. However, this may be more appealing than fiscal consolidation from the perspective of an incumbent, particularly as the cost of additional borrowing will likely be borne by future administrations.[5]

Ultimately the relative merits of fiscal consolidation or borrowing, versus the use of an RDF, depends on several key factors. These include:

- the macroeconomic and fiscal outlook;
- the rigidity of the incumbent's tax and spending plans, and the political capital required to effect change;
- existing public debt levels, the State's borrowing capacity, and the interest rate environment;
- the associated opportunity costs of capitalising the RDF; and

[5] Further, debt financing can be a tool for an incumbent to impose limitations on the future spending plans of the opposition.

- in an EU context, the interaction of the RDF with the fiscal rules.[6]

For example, the setting aside of large amounts of revenue may not be optimal if borrowing is permitted, interest rates are low, the level of public debt is low, and there are significant capacity constraints in the economy (i.e. sizeable opportunity costs).

We explore the factors affecting the decision to capitalise an RDF in a simple theoretical model in the Annex to this paper.

3. Ireland's National Surplus Reserve Fund for Exceptional Contingencies

An RDF was set up in Ireland on a statutory basis in October 2019. The stated purpose of the RDF is to address exceptional circumstances or severe, unanticipated events. Such circumstances, which are in excess of normal economic fluctuations, are aligned with the Stability and Growth Pact legislation as:

- an unusual event outside the control of the State impacting on the financial position; or,
- a severe economic downturn.

In addition, a drawdown of funds can happen:

- to prevent potential serious damage to the financial system in the State and ensure the continued stability of that system; or
- to support major structural reforms having direct long-term positive effects.

The Minister for Finance can take a decision to drawdown funds from the RDF based on expert advice. The Minister can then seek a Government decision, which will finally require approval by Parliament.

In the Irish context, the RDF was conceived to address specific events or one-off shocks rather than a means to smooth the economic cycle. However, the Minister for Finance has indicated that a portion of the recent surge in CT revenue may be set aside in the RDF.[7] This would assist in managing CT revenue volatility, by setting aside potentially transient (unexpected or windfall) revenues.

The RDF was seeded with a €1.5bn transfer from the assets of the Ireland Strategic Investment Fund (ISIF) and is managed by the National Treasury Management Agency (NTMA) on behalf

[6] Casey et al. (2018) highlight the risk that a fiscal stimulus in a future downturn funded through an RDF may potentially lead to a breach of the EU fiscal rules. They propose a working mechanism for withdrawing funds within the existing EU fiscal framework. In a nutshell, this would entail disregarding RDF-funded spending when assessing compliance with the fiscal rules.

[7] Financial Statement – Budget 2019, 9th October 2018.

of the Minister for Finance. Funds are invested and held in near-cash assets. Annual transfers of €500 million were originally prescribed from 2019 to 2023.

This annual transfer can be lowered by the expenditure incurred by the State in respect of costs arising because of a natural or other disaster. In addition, Parliament may, on a proposal by the Minister for Finance, authorise the Minister not to pay the prescribed amount. Due to the decision to budget for a 'disorderly' Brexit in Budget 2020, the annual transfer of €500 million will not be made until 2021.[8]

Ireland's RDF is capped at €8 billion. The Fiscal Council (among others) have highlighted that this design is not optimal if the purpose of the fund is to smooth the effects of the economic cycle (i.e. saving windfall revenues) and to respond to large macroeconomic imbalances. The size of the Irish RDF in 2019 was €1.5bn, which is 1.8% of general government expenditure or 0.7% of GNI*.

In the US, it is common to define an upper limit on the amount to be invested in a state-level RDF. This may be explained by the opportunity costs associated with larger funds, and the pressures placed on an incumbent by the electorate in relation to these opportunity costs. The median RDF balance in the US, as a share of general fund spending, was estimated to be 7.6% in 2019 (NASBO, 2019). This is an increase from 1.6% in 2010 and has been driven by revenue buoyancy. Most of the US states have an RDF of at least 5% of general fund spending. McNichol and Boadi (2011) argue that a more adequate cap, in line with recommendations by the Government Finance Officers Association, would be 15% or more of operating expenditures. If we were to apply the 15% recommended level to Irish data, this would imply an RDF of a nominal size of €12.9 billion in 2019 (€4.9 billion more than the current cap).

[8] Budget 2020 – Economic and Fiscal Outlook, 8 October 2019.

4. Alternative rules for determining allocations to Ireland's Rainy-Day Fund

In this section we outline a range of approaches proposed by different bodies for quantifying the level of excess CT revenue, as well as proposals for mechanisms to govern allocations to the RDF.

4.1 The US Approach – allocating the year-end budget surplus

We begin by discussing the rules used in certain US states that require transferring a proportion of the end of year budget surplus. In mathematical terms this can be written as:

$$\text{RDF Allocation}_t = x * e_t$$

where e_t is the end of year budget surplus at time t and x [0,1] is the predefined share to be set aside in the RDF. Examples of US states adopting this strategy are:

- Pennsylvania, where the "Budget Stabilisation Reserve Fund" is capitalised through an annual transfer of 25% of the general fund end-year surplus;
- South Dakota, where allocations to the "Budget Reserve Fund" depend on an automatic deposit of any unspent general funds at year end;
- Nevada, where 7% of the general fund balance is subtracted from the end-year balance, and 40% of the reminder is set aside in a stabilisation fund; and
- Utah, where automatic transfers of 25% of the year-end surplus are made into a "General Fund Budget Reserve Account".

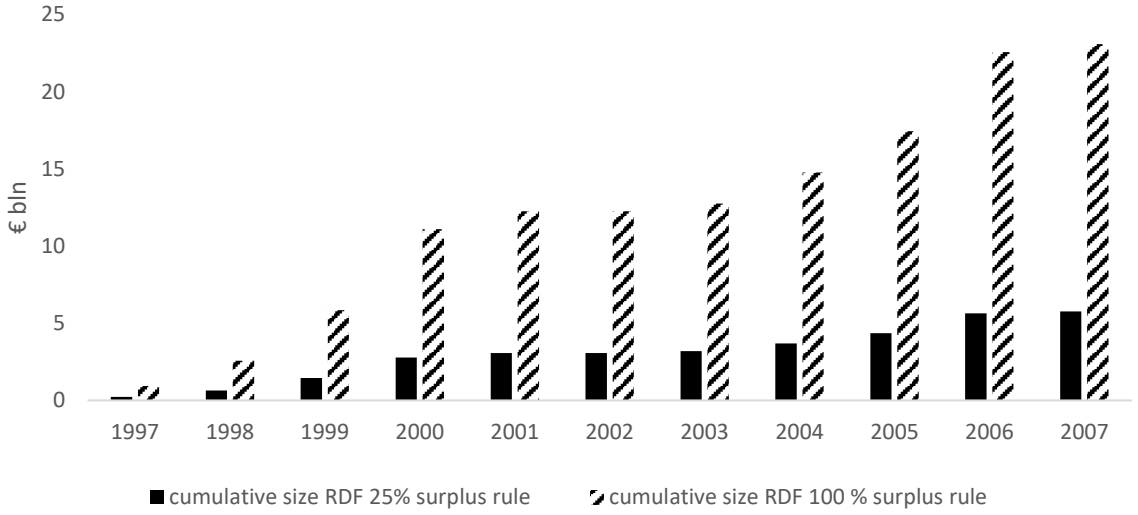
To examine how these rules would work in the Irish context, we use historical data for Ireland over 1997-2007, to simulate the size of a hypothetical RDF. We model:

- Automatic transfers of 25% of the year-end surplus (this is mirroring the approach of US states such as Pennsylvania and Utah); and
- Automatic transfers of 100% of the year-end surplus.

In the first instance, an annual transfer of 25% of the year-end surplus over time, would have allowed for the accumulation of funds in the RDF of €5.7 billion by 2007. This would have been insufficient to close the budget deficit in 2008 alone (of €13.2 billion). If the totality of the year-end surplus had been payed into an RDF (i.e. 100%), its size would have been €23.2 billion by 2007, sufficient to cover the deficit in 2008 only.[9]

[9] It must be noted that from the early 2000s Ireland capitalised a fund which, despite having a different purpose, was ultimately used to offset the negative effects of the financial crisis that began in 2008. The National Pensions Reserve Fund (or NPRF) was established in 2001 with an objective to build up reserves (invested in a globally diversified portfolio) to help meet the costs of the ageing population from 2025 onwards. The deposit rule entailed annual payments of 1% of GNP. The NPRF was valued at €22.7 billion at the end of 2010. An amount of €11.35 billion was taken from the fund and used to recapitalise Allied Irish Banks and Bank of Ireland. In 2014, the National

Figure 4: Hypothetical rules allocating the end-year surplus to capitalise the RDF, 1997 - 2007



Source: Authors' calculations based on CSO data

Setting aside some portion of the budget surplus (while also using some to pay down debt) is a reasonable approach.[10] However the main weakness of this approach relates to the existence of a 'deficit bias' in the Irish public finances, arising from political economy considerations and spending overruns. Over 1995-2018, Ireland ran budget surpluses in 1997-2001 and 2003-2007. The largest surplus was in 2000 (at €5.3 billion). However, the government balance was, on average, in deficit over the period of analysis.

Additionally, an RDF that is capitalised through the year-end surplus does not directly address the issue of managing tax revenue volatility. As a result, while we note that these rules aren't mutually exclusive (proposals to mitigate revenue volatility could work alongside additional transfers from any year-end surplus), in the following section we outline more appropriate rules that are tailored to the Irish experience.

4.2 Proposals for the Irish context

Department of Finance policy paper

In a policy paper presented by the Minister for Finance (December 2019), the Department outlines several proposals for identifying excess CT revenue. The paper models the impact on

Pensions Reserve Fund was converted into a new fund - the Ireland Strategic Investment Fund (or ISIF), into which the remaining assets of the NPRF were transferred.

[10] There are alternative uses for the budget surplus, other than allocating a to an RDF. For example, the surplus could be directed to pay down outstanding debt or to fund once-off expenditure. We don't propose to explore these trade-offs in any great detail in this paper, but this could feature in future research.

the general government balance of a shock that is equivalent to a loss in CT revenue, considered to be excess. Three approaches are proposed:

- CT receipts are assumed to move in line with growth in GNI* from 2017 (the portion of the revenue outturn above this level is considered to be excess). This implies a potential CT revenue loss of approximately €1 billion per annum;
- The long-run average share of CT in Exchequer revenue (from 2000 to 2018, at 14%) is used to define the "centre of gravity". That is, CT is assumed to revert to this share from 2020. This implies a CT revenue loss of €2 billion per annum;
- CT receipts are assumed to revert to their 2014 level (before the initial surge in CT revenue witnessed in 2015). This implies a decline in revenue of €6 billion by 2021, relative to baseline. However, this approach assumes all of the increase in CT beyond 2014 is temporary. It does not account for receipts arising from the sustainable growth in the CT base post-2014.

The paper further proposes that the long-run share (over 2000 to 2018) could act as a tool for determining the portion of CT revenue that could be allocated to the RDF. Specifically, the paper proposes allocating half of the excess revenue identified using this approach to the RDF, resulting in an allocation of €2.2 billion over 2018 to 2019 (and a further €3.9 billion over 2020 to 2023).

It is argued that this long-run share represents the "centre of gravity" for CT, and the point to which the share of CT can be expected to revert over time. However, it seems unreasonable to assume the CT base is the same today, as it was in 2000, given the considerable influx of multinational companies to the State in recent years. In addition, it isn't clear that 2000 represents a natural starting point for this analysis. Specifically, there were changes to the CT system beyond 2000 – for example, the 12.5% rate in respect of trading income applied from January 2003 (Walsh and Sanger (2014)).

Irish Fiscal Advisory Council (Fiscal Council)

The Fiscal Council have called for a clear policy framework governing the handling of excess revenue, suggesting a fixed rule[11] under which government must set aside excess receipts above a threshold level.[12] The Council (2019) also proposes several approaches to identifying the degree of CT outperformance relative to underlying macroeconomic fundamentals. These approaches are useful in understanding the portion of CT revenue that can be classified as excess, and might therefore be considered for allocation to the RDF:

[11] They further propose the use of a Prudence Account, to temporarily hold receipts that are in excess of the monthly Exchequer profiles. At the end of the year, the funds held in the prudence account would then be transferred to the Rainy-Day Fund. The base for the next year's forecast would be the forecast of the current year, meaning that any excess is not built into next year's base.

[12] The Council notes that, had government set aside revenues in excess of forecasts since 2015 (adjusting for revenue surprises in making forecasts), the RDF would have contained €12.3 billion by end-2018.

Regression-based estimates: this approach forecasts CT revenue (using standard models) with 2011 as the base year (before the surge in CT realised in subsequent years). CT is assumed to grow with domestic GVA and GNI* (removing the distortionary impact of multinationals), subject to standard parameters that characterise these relationships. Estimates are compared to actual outturns, and a 95 per cent confidence interval is formed. The results suggest that between €3 billion and €6 billion of annual CT receipts, as of 2018, are excess, and cannot be explained by macroeconomic performance.

Official forecasts versus outturns: using an early set of forecasts (from Budget 2015 in October 2014), outturns for each year are assessed against predicted values. €5.4 billion in annual CT receipts are found to be excess.

Comparison to historical norms: the current share of CT in overall Exchequer revenue is assessed against the long-run average share (12.5 per cent over 1990 – 2017). The difference between these two shares amounts to a revenue excess of €3.5 billion in 2018.

Comparison to international norms: the size of the taxable CT base (measured by Net Operating Surplus) is assessed as a share of economic activity (measured by GVA for non-financial companies). Ireland is at the upper end of the distribution of EU Member States. A return to the 75th percentile would imply an excess of revenue in 2018 that ranges from €3.4 to €4.3 billion.

McGuinness and Smyth (2019)

McGuinness and Smyth (2019) use a range of error-correction models (ECMs) in assessing the CT outturn for 2018. The paper claims that approximately 10 per cent of this outturn cannot be explained by standard macroeconomic variables. The explanatory power of macroeconomic aggregates is found to be sensitive to model specification, sample period and the presence of structural breaks. Within-year estimates using the standard forecasting approach of the Department[13] are found to outperform ECMs/VECMs (emphasising the importance of specialist in-house expertise in applying a judgement factor to estimates in particular), while these models perform better for year-ahead forecasts.

McGuinness and Smyth (2019) emphasise the idiosyncratic and systemic risk factors attached to CT receipts, with firm- and sector-specific shocks posing a risk to sustainability. They

[13] The Department of Finance forecasts tax revenue in line with the following equation:

$$\mathrm{Rev}_{t+1} = \mathrm{Rev}_t + (\mathrm{Rev}_t)(\mathrm{G}_{t+1} \,.\, \mathrm{E}) + \mathrm{T}_{t+1} + \mathrm{M}_{t+1} + \mathrm{J}_{t+1}$$

Where, Rev_{t+1} is next year's revenue, Rev_t is this year's revenue, G_{t+1} is next year's growth rate of the macro-driver, E is the elasticity between the macro-driver and revenue, T_{t+1} is any once-off revenue anticipated for next year, M_{t+1} is the impact of any policy changes taking effect next year, J_{t+1} is the *ex post* judgement factor that is applied by the modeller in respect of expected revenue for next year. For CT, G_{t+1} is Gross Operating Surplus (a proxy for firm profitability), while E is equal to 1. The Tax Forecasting Methodological Review (2019) recommends that the elasticity for CT be increased. For year-ahead estimates, the report recommends that forecasts be informed by ECMs developed within the Department (see McGuinness and Smyth (2019)). For within-year estimates, exchange of information between the Revenue Commissioners and the Department is found to be an integral part of forecasting CT.

conclude that it is difficult to be overly definitive on whether recent CT excesses have been windfalls or, if these excesses are representative of longer-term structural changes to the economy.

Central Bank of Ireland

Using standard forecasting methods, the Central Bank of Ireland (2020) estimate a counterfactual level of CT over 2015 - 2019, had revenue grown in line with nominal GNI*. They find that almost €4¼ billion (40% of the total) could be classified as windfall in 2019. This mirrors the regression-based approach proposed by the Fiscal Council and McGuinness and Smyth (2019) (outlined above).

Ideally, CT windfalls estimated using this empirical approach could be set aside and invested in an RDF. In terms of operationalisation, windfalls would need to be estimated *ex ante* (using next year's forecast of the relevant macro-driver) and apportioned in line with monthly profiles. This would facilitate the within-year transfer of windfalls to the RDF, as and when they arise.

However, using this approach, the size of the estimated windfalls will depend largely on the chosen starting point (e.g. predicting receipts from the 2019 outturn will mean that a sizeable amount of potentially excess revenue will be included in the base going forward).

This approach also relies on accurate revenue forecasts (and accurate monthly profiling) by the Department. Generally, the purpose of the Department's forecast is to predict the level of revenue that is available to government in the next year. To this end, the Department does take account of anticipated one-off revenues. However, sizeable forecasts errors in respect of CT in recent years suggests that the Department has not been successful in taking full account of revenue surprises. For this reason, any rule that would identify an excess based on the difference from this forecast will likely underestimate the true size of revenue windfalls.

In the Irish context, there are also issues with forecasts based on certain economic indicators (such as GDP), particularly in real-time, as these indicators tend to be subject to significant revisions (Casey and Smyth, 2016).

Following from this, we present three alternative rules for governing allocations to the RDF. These rules are based on:

- Medium-run rolling average shares;
- Volatility minimising shares; and,
- Revenue allocations linked to a cyclical indicator of Irish economic activity (we use our proposed cyclical indicator formed using Principal Component Analysis).

5. Linking Rainy-Day Fund allocations to tax revenue volatility

In this section, we propose various rules intended to aid policy-makers in identifying an appropriate level of revenue to allocate to the RDF. Our goal is to minimise the risk that public spending is linked to highly volatile sources of revenue. To that end, these rules involve

identifying some equilibrium or volatility minimising level of revenue, above which, receipts should be considered as "excess" and marked for allocation to the RDF.

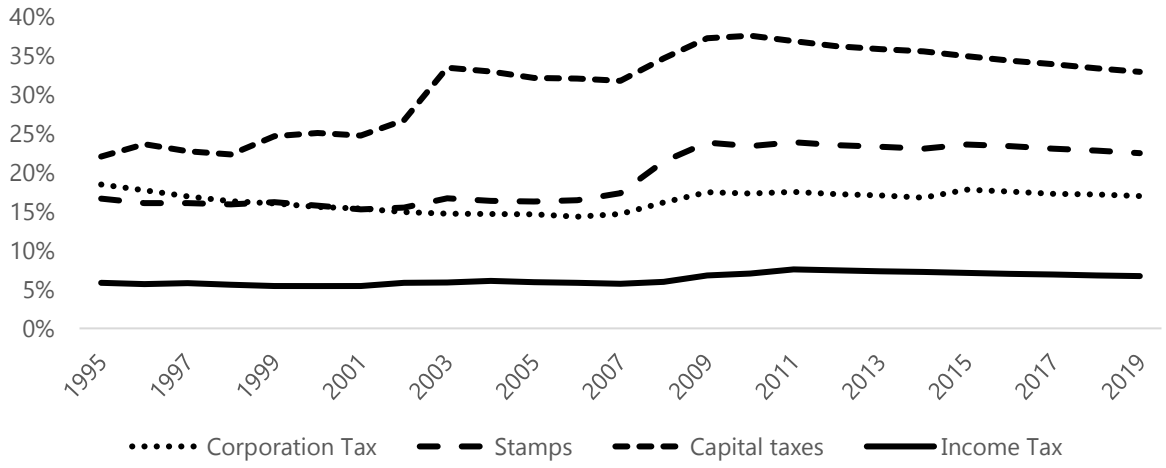
These rules are set in the context of the current allocation mechanism, which involves an annual transfer of €500 million, with the option of forfeiting this transfer in the event of an unexpected shock. It is further set in the context of proposals from other research bodies for identifying excess CT (as detailed previously).

The debate on revenue volatility has focused heavily on CT, and for this reason we prioritise the discussion of CT in our paper. However, the rules we propose can be applied to other tax categories that experience similarly high levels of volatility (e.g. this has been the case historically for Capital Taxes and Stamp Duty).

Going forward, identifying volatile taxes to which these rules would apply could be based on a rolling or recursive assessment of the standard deviation of each revenue series. This approach recognises that the structure of the economy (and of the tax system) changes over time. In other words, the standard deviation as assessed over the historical lifetime of a tax, may not accurately reflect the riskiness of that tax in the present day (e.g. CT in the 1980s, versus more recent history).

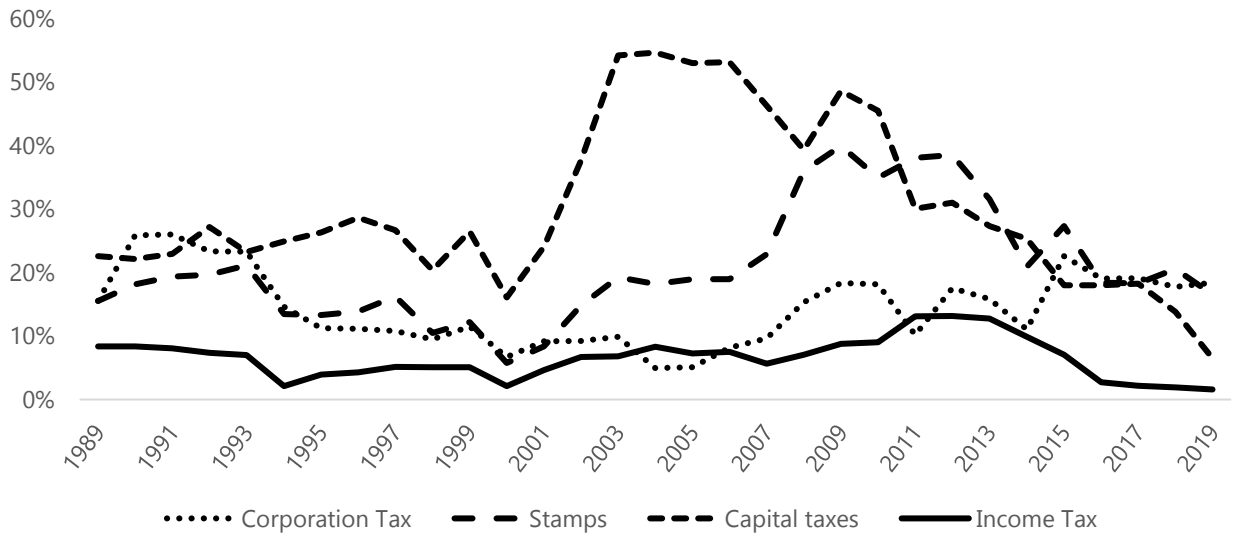
Figure 5 and Figure 6 show the standard deviation of CT, Stamp Duty, Capital Taxes and (for comparative context) Income Tax on a recursive and rolling basis respectively. As is evident, the former three taxes display considerably more volatility over time than Income Tax, and this difference is most pronounced for Stamp Duty and Capital Taxes. It must be noted that while Stamp Duty and Capital Taxes appear to be more volatile than CT, the size of the CT yield in recent years lends it greater significance.

Figure 5: Recursive standard deviation of growth rates – CT, Stamp Duty, Capital Taxes and Income Tax, 1985 - 2019



Source: Authors' analysis of revenue data from the Department of Public Expenditure and Reform databank. **Note:** This figure shows the standard deviation of CT, Stamp Duty, Capital Taxes and Income Tax on a rolling-recursive basis, with 1985 chosen as the base year. Income Tax is included to act as a relatively stable benchmark against which the volatility of the other taxes can be assessed.

Figure 6: Rolling standard deviation of growth rates – CT, Stamp Duty, Capital Taxes and Income Tax



Source: Authors' analysis of revenue data from the Department of Public Expenditure and Reform databank. **Note:** This figure shows the standard deviation of CT, Stamp Duty, Capital Taxes and Income Tax on a five-year rolling basis, beginning in 1984. Income Tax is included to act as a relatively stable benchmark against which the volatility of the other taxes can be assessed.

5.1 Accounting for changes in the tax system over time, using medium-run average shares

The use of the long-run average share to guide allocation to the RDF, implies that this share captures the share that the tax can be expected to gravitate towards over time (i.e. it captures the equilibrium share for that tax). This is the scenario illustrated by the Department of Finance (2019a). If we assume that the underlying structure of the economy and specifically of the productive (and taxable) base was not subject to substantial change over the period in question, then this would be a reasonable approach.

However, this is unlikely to be the case particularly in the Irish context. Ireland's tax base (and tax system), has undergone significant structural reform since the 1980s, including the introduction of the 12.5% CT rate in respect of trading income in 1998 (applied from 2003), and the influx of multinational companies over the past 20 years. For this reason, giving equal weight to tax shares from the 1980s and tax shares from more recent times (which might be more reflective of the future trajectory) is inappropriate, particularly when the goal of the proposal is to inform current and future decision-making.

One solution involves the use of a moving (or recursive) average share. This ensures that older (and less relevant) shares are removed from the calculation of the average, which is updated each year with the latest data. This means that the average share will more accurately reflect the tax base and tax system of the present day, and somewhat mitigates the issue of including

older observations in the sample (i.e. those that refer to a period that is characterised by an economy that is structurally different).

We estimate the medium-term average share of each tax as:

$$\frac{\mathrm{r_{i,t}}}{\sum_{\mathrm{i=1}}^{\mathrm{N}} \mathrm{r_{i,t}}} = \mathrm{w_{i,t}}$$

$$\sum_{\mathrm{i=1}}^{\mathrm{N}} \mathrm{w_{i,t}} = 1$$

$$\frac{1}{\mathrm{k}} \sum_{\mathrm{t=0}}^{\mathrm{k-1}} \mathrm{w_{i,-t}} = \mathrm{w_{i,t}}\,*$$

Where N is the number of taxes, $r_{i,t}$ is the revenue for tax i at time t, $w_{i,t}$ is the share of tax i at time t, and $w_{i,t}*$ is the k-year average share of tax i.

We estimate five-year rolling average shares.[14] That is, we calculate $w_{i,t}*$ for the case when k=5, for each tax. These shares are treated as benchmark shares. We compare the forecast share of tax i in $t+1$ ($w_{i,t+1}$) against the benchmark share ($w_{i,t}*$). The difference between the two ($w_{i,t+1} - w_{i,t}*$) is used to determine the total amount of revenue from the tax that is allocated to the Rainy-Day Fund in t+1:

$$\text{RDF Allocation}_{\mathrm{i,t+1}} = \left(\mathrm{w_{i,t+1}} - \mathrm{w_{i,t}}\,*\right)\left(\sum_{\mathrm{i=1}}^{\mathrm{N}} \mathrm{r_{i,t+1}}\right)$$

We focus our analysis on CT, and calculate based on the approach outlined above, the excess for each of 2015 to 2019. As shown in Table 1 below, this approach would have seen €9.7 billion in CT receipts allocated to the Rainy-Day Fund from 2015 to 2019.

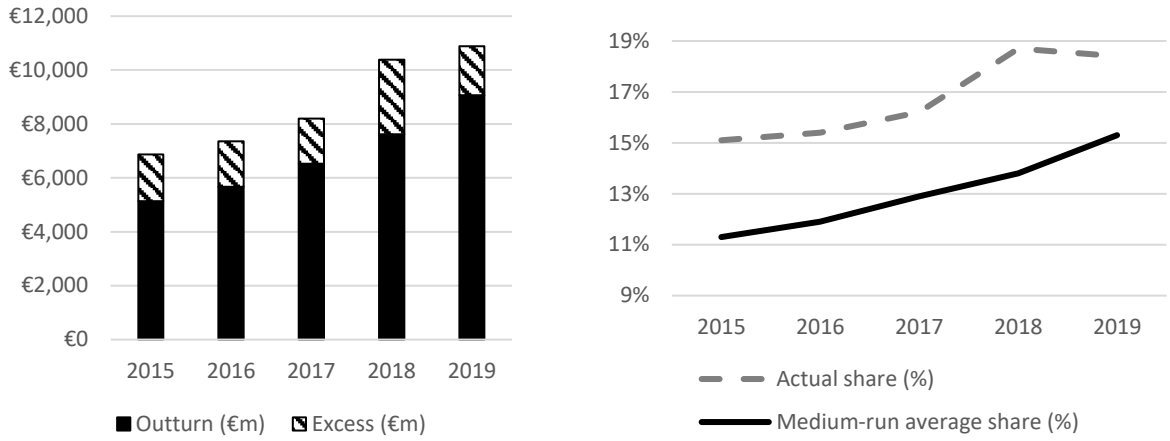
Table 1. Medium-run share versus actual share, Corporation Tax

Corporation Tax	**2015**	**2016**	**2017**	**2018**	**2019**
$\mathrm{w_{i,t+1}}$	15.1%	15.4%	16.2%	18.7%	18.4%
$\mathrm{w_{i.t}}$*	11.3%	11.9%	12.9%	13.8%	15.3%
$\mathrm{w_{i.t+1}} - \mathrm{w_{i.t}}$*	3.7%	3.5%	3.3%	4.9%	3.1%
Outturn (€m)	6,872	7,351	8,201	10,385	10,888
Excess (€m)	1,735	1,684	1,674	2,771	1,817

Source: Authors' analysis of revenue data from the Department of Public Expenditure and Reform databank. **Note.** Differences due to rounding effects.

[14] We propose a period of five years to ensure that older observations from periods characterised by a very different tax system are not included and given equal weight to more recent observations. This is important, as the rules are intended to inform current and future policy-making. The length of this period could otherwise be anchored to the length of Irish economic cycles, which tend to average seven years.

Figure 7. Medium-run share versus actual share, Corporation Tax



Source: Authors' analysis of revenue data from the Department of Public Expenditure and Reform databank. **Note.** The medium-run share is based on a five-year rolling average share (e.g. the share in 2015 is compared to the five-year average share over 2010 – 2014 inclusive). The excess is calculated as the difference between the actual share (2015) and the medium-run share (2010- 2014), as a percentage of total tax revenue for the year of interest (2015).

5.2 Minimising the link between public spending and volatile tax revenue, using volatility minimising shares

It is problematic to link spending commitments to an unstable and volatile source of revenue. The use of an RDF itself cannot stabilise the revenue base or reduce the volatility of a particular tax (this is dependent on macroeconomic developments and tax policy changes that affect the tax base). However, an RDF can help in linking spending to more reliable revenue streams, by providing a vehicle for the setting aside of transient revenues. In this section, we propose using the volatility minimising share (Fitzgerald and Bedogni, 2019) as a benchmark share to guide allocations to the RDF in respect of more volatile taxes. This reduces the risk of linking public expenditure to unstable revenue sources.

When the forecast share of a tax for the coming year ($w_{i,t+1}$) exceeds the volatility minimising share ($w_{i,t}$*), it follows that a lower share of that tax would reduce the volatility of overall tax revenue (while maintaining the same level of overall revenue growth). We propose that, for a volatile tax, the portion of revenue in excess of the volatility minimising share of that tax should be allocated to the RDF. In effect, this means that government would only spend the amount of revenue raised from that tax that corresponds to the volatility minimising share of the tax in the overall tax portfolio.

In formal terms, and following Fitzgerald and Bedogni (2019), we solve the following mean-variance optimisation problem:

Minimise (1)

$$\sum_{i=1}^{N}\sum_{j=1}^{N} u_i\, w_j \sigma_{ij}$$

Subject to the constraints (2)

$$\sum_{i=1}^{N} w_i = 1$$

$$0 \leq \min_i \leq w_i \leq \max_i \leq 1 \qquad i = 1, \ldots, N$$

Where *N* is the number of taxes, u_i is the expected mean return of tax *i*, σ_{ij} is the covariance between the returns for taxes *i* and *j*, w_i is the proportion (share) of the total tax portfolio that is attributed to tax *i*, and $\min_i$ and $\max_i$ refer to the sample minimum and maximum shares of tax *i* respectively.

We solve the optimisation problem in (1) subject to the constraints in (2) to establish the volatility minimising share for each tax. We estimate σ_{ij} over a rolling five-year window. We also impose feasibility constraints in estimating the volatility minimising shares. In other words, each tax share is bound below and above by the minimum and maximum value of its share in the tax portfolio respectively, over the last five-years. These feasibility constraints are intended to represent the limitations on the opportunity set of policymakers in the implementation of tax policy changes (e.g. given the limited political capital of an incumbent, as well as the structural limitations of the tax base).

We denote $w_{i,t}$* as the volatility minimising share of tax *i*[15] - this is the benchmark share. As in the preceding analysis, by estimating $w_{i,t}$* for each tax over a rolling window of five years, we allow for the possibility that the structure of the tax system, and the tax base, will change over time. For this reason, we impose constraints on the tax shares that more reasonably reflect the economy and tax system of the present day.

We estimate the appropriate allocation to the RDF as:

$$\text{RDF Allocation}_{t+1} = \left(w_{i,t+1} - w_{i,t}*\right)\left(\sum_{i=1}^{N} r_{i,t+1}\right)$$

As before, we focus our analysis on CT and calculate, based on the approach outlined above, the excess for each of 2015 to 2019. As shown in Table 2 below, this approach would have seen €13.9 billion allocated to the Rainy Day Fund (based on excess Corporation Tax alone)

[15] It follows that $\sum_{i=1}^{N} w_i * = 1$.

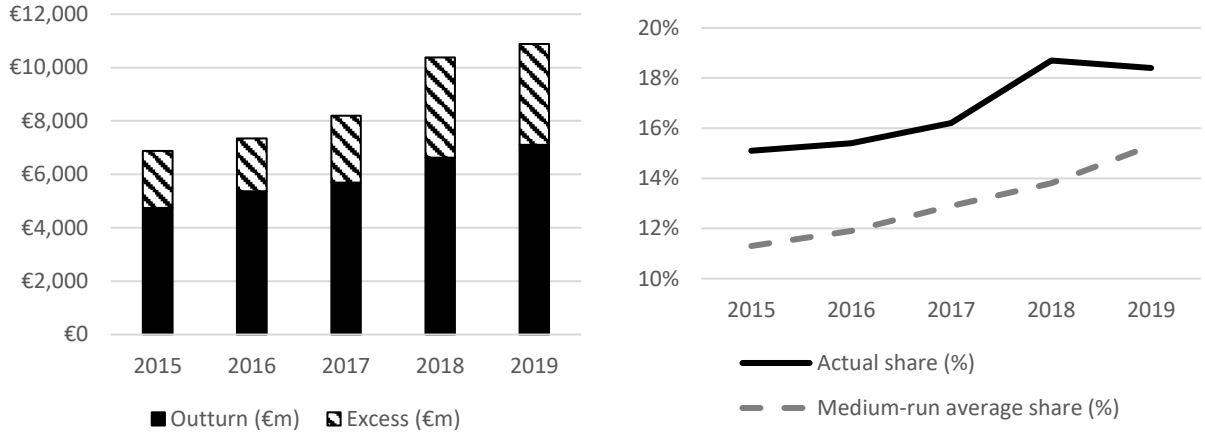
from 2015 to 2019 (over 43% more than that which would have been allocated based on the medium-run average share, outlined previously).

Table 2. Volatility minimising share versus actual share, Corporation Tax

Corporation Tax	2015	2016	2017	2018	2019
$w_{i,t+1}$	15.1%	15.4%	16.2%	18.7%	18.4%
$w_{i,t}^*$	10.3%	11.2%	11.2%	11.8%	11.8%
$w_{i,t+1} - w_{i,t}^*$	4.7%	4.2%	5.0%	6.9%	6.6%
Outturn (€m)	6,872	7,351	8,201	10,385	10,888
Excess (€m)	2,132	1,981	2,506	3,762	3,780

Source: Authors' analysis of revenue data from the Department of Public Expenditure and Reform databank. **Note.** *2019 based on the estimated outturn. Differences due to rounding effects.

Figure 8. Volatility minimising share versus actual share, Corporation Tax



Source: Authors' analysis of revenue data from the Department of Public Expenditure and Reform databank. **Note.** The volatility minimising share is the share that minimises overall tax portfolio volatility, where the share of each tax is bound below and above by five-year minimum and maximum values respectively. The excess is calculated as the difference between the actual share, and the volatility minimising share, as a percentage of total tax revenue for the year of interest.

5.3 Contributions linked to the economic cycle

There is a literature that suggests linking allocations to an RDF to assessments of macroeconomic imbalances, proxied using output gaps, or deviations of GDP growth rates from long-term growth forecasts (see Delbecque (2013) and Pisani-Ferry et al. (2013)). In these approaches, the main role of the RDF is not budget stabilisation or the mitigation of revenue volatility, but as a tool for macroeconomic management. As such, allocations to the RDF would be made when the economy is at risk of overheating (i.e. there is a positive output gap) to help take the 'heat' out of the economy. Conversely, funds would be released from the RDF in a recession.

Carnot et al. (2017) propose a "double-condition" rule with payments to the fund when unemployment is low (i.e. relative to the historical long-term average or full employment rate) and decreasing (compared to the previous year), and disbursements from the fund when unemployment is high and increasing. In this case, the focus on unemployment is motivated by the observation that the unemployment rate effectively captures cyclical developments, and tends not to be subject to significant revisions, compared to unobservable variables such as the output gap.

Generally, the calculation of the output gap (using standard trend-cycle decomposition models) is affected by several issues, including the mismeasurement of potential GDP (particularly in real-time), pro-cyclical estimates, and revisions or statistical distortions affecting GDP (for a wider discussion of these issues see Bedogni and Meaney (2017, 2018), Casey (2018) and Barnes and Casey (2019)).

In this section, we formulate a macro-rule based on our proposed cyclical indicator of economic activity for Ireland. Specifically, we apply a Principal Component Analysis (PCA) to summarise, into a few common factors, all the available information about the economic cycle from several macroeconomic variables. The approach is broken down into the following steps:

1. We select the cyclical indicators for inclusion. These are the inputs for our composite cyclical indicator. We prefer to use variables that capture ongoing cyclical developments, that are less affected by data revisions, and are available at "high-frequency" (or monthly). The variables we have included in the paper are outlined in the table below:

Table 3: Input variables to the cyclical indicator

	Variable	Sector
a.	the unemployment rate (all ages, both sexes); and	Labour market
b.	the number of people on the live register (all ages, both sexes).	
c.	the annual change in consumer price inflation; and	Prices
d.	the annual change in consumer price inflation for hotels and restaurants.	
e.	the number of new house guarantee registrations.	Housing market[16]
f.	the Irish Price Index of Ordinary Stocks and Shares (ISEQ);[17] and,	Financial indicators
g.	the real effective exchange rate.	
h.	the annual change in the number of private cars licensed.	Consumption

Source: CSO databank and Eurostat. **Notes**: The sample period is 1999m1- 2019m12. Monthly data is then aggregated into annual data.

2. We standardise these variables. As a result, these can be interpreted as deviations (as the number of standard deviations) from their long-term mean value. We apply PCA, which gives weights to the input variables (see Table 4), and retains the first principal component[18] as our composite indicator. This composite indicator allows us to assess the current state of the economy.

[16] The house price index is only available from 2005 and is therefore excluded. This is generally an issue with potentially suitable variables available for only a short time frame, compared to other variables, such as unemployment.

[17] Future iterations could also consider composite indexes of the US stock market given the importance for the Irish economy of US firms. McGuinness and Smyth (2019) find that the US stock market (proxied using the NASDAQ) has some explanatory power in predicting Irish CT receipts (they find an elasticity of just over one).

[18] The first component explains 55% of the total variance in the dataset.

Table 4: Principal components (eigenvectors)

Variable	**Component 1**
Unemployment rate	-0.4533
Live register	-0.4639
Consumer price inflation	0.3527
Consumer price inflation for hotels and restaurants	0.4260
New house guarantee registrations	0.3807
ISEQ	0.3285
Real effective exchange rate	-0.1270
Private cars licensed	0.0658

3. We specify and estimate a linear regression model which links annual total revenue growth (T) to our cyclical indicator (CY) over the sample period 1999 - 2019, (see the specification and estimates below):[19]

$$dln(T)_t = a + bCY_t + e_t$$

Table 5: Regression analysis estimates

	OLS estimates
Cyclical Indicator	1.99**
Constant	5.58***
Observations	21
R-squared	0.23

Notes: *** p<0.01, ** p<0.05, * p<0.1

[19] Where *dln*(T) is the year-on-year total tax revenue growth rate, and CY is our cyclical indicator (in levels). As a robustness check, we estimated the relationship over 1999-2018 using revenue growth rates adjusted for policy changes, drawing from the dataset of Conroy (2019). We find that the constant – our main variable of interest – is broadly unchanged (5.4% from 5.6%), but the coefficient of the cyclical indicator is substantially higher (4). This is explained by the higher volatility of the policy adjusted series compared to the unadjusted one, particularly at key turning points of the economic cycle. During the mid-2000s, policy changes (i.e. tax cuts) reduced revenue growth, however once the recession occurred, policy changes (this time tax increases) increased revenue growth and partially offset the otherwise larger cyclical decrease in taxes.

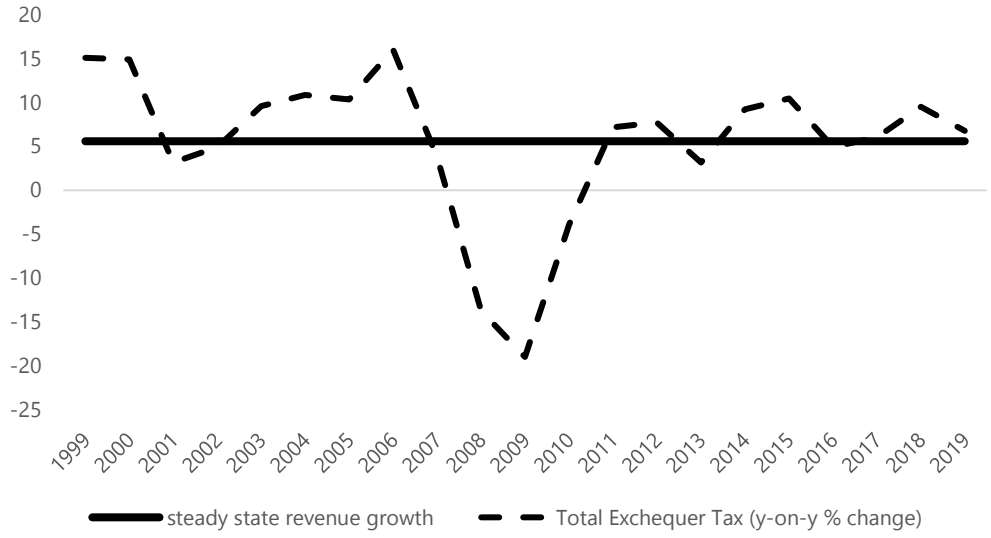
Figure 9: Cyclical indicator and revenue growth

Source: Authors' analysis

4. We finally explore two potential rules to guide revenue allocations to the RDF:

    a. The results allow us to estimate the revenue growth rate which is compatible with a value of zero for the cyclical indicator. This could be assumed to be a "steady state" revenue growth rate, compatible with the absence of macroeconomic imbalances. This rate is estimated from the constant in our regression model, at 5.58%. We therefore propose a rule (illustrated in Figure 10 below) that when annual revenue growth exceeds 5.58%, the difference is set aside in the RDF. This approach would allocate €5.32 billion over 2015 – 2019 (with no allocation in 2016 as revenue growth was below the steady state level). Ideally, to account for changes over time, consideration should be given to re-estimating this steady-state growth rate in each year, as new information is released.

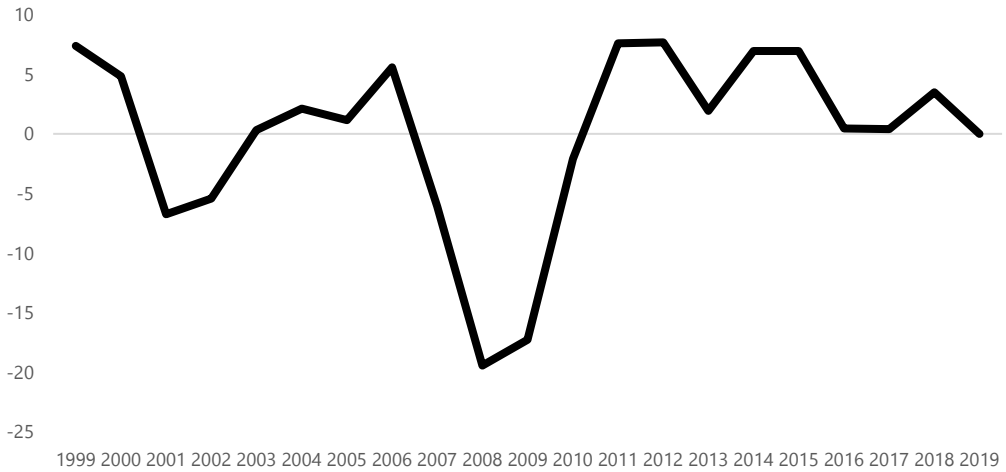
Figure 10: Benchmarking revenue growth to equilibrium growth



Source: Authors' analysis

b. Alternatively, we can use the model to estimate the predicted value of revenue growth, and subsequently calculate the gap between actual revenue growth and the growth rate predicted by the cyclical indicator. A positive gap would mean that revenue growth is exceeding what can be explained by cyclical developments (an approximation of windfall revenue). This amount could be allocated to the RDF. This approach would allocate €5.53 billion over 2015 – 2019.

Figure 11: Gap between actual revenue growth and growth predicted by the cyclical indicator (%)



Source: Authors' analysis

5.4 Operationalising these rules

In practical terms, policy makers won't know the actual tax take until year-end. While predicted levels of CT could be compared to the annual forecast for the year, by their very nature, revenue surprises have not been captured effectively in Departmental forecasts to date. This would mean that an allocation rule that relies on these forecasts would fail to allocate the correct amount to the RDF. To operationalise these rules effectively, annual revenue forecasts would need to be made with a reasonable degree of accuracy.[20]

To that end, the revenue excess identified under these rules, should be seen as the minimum target allocation, with additional allocations encouraged should the true excess exceed expectations. Conversely, should conditions change, and outturns perform more poorly than originally expected, planned allocations to the RDF should be reconsidered (as is current practice).

The allocation of excess revenues to the RDF within-year should be a fundamental part of any rule, and this needs to be considered in terms of operationalisation. This is necessary to prevent this revenue from being spent as and when it is realised (e.g. in meeting spending overruns). The Department's monthly tax profiles can be used to determine how much of the expected excess revenue should be allocated on a monthly basis.

Rules based on medium-term and volatility minimising shares

Under this rule, the tax share arising from the annual revenue forecast would be assessed against the benchmark share (either the medium-term average or volatility minimising share, depending on the chosen rule). The revenue excess would be calculated and would then be apportioned on a monthly basis in line with monthly tax profiles (i.e. based on historical trends in the tax take, administrative factors affecting the timing of payments etc.).

For example, if 50% of CT revenue is expected to be collected in November, then 50% of the estimated revenue excess will be assigned to November. Assuming forecasts are reasonably accurate, this 50% would be transferable to the RDF by the end of November.

Rules based on the economic cycle

The cyclical indicator would be calculated using the most recent data available and would be updated as new information is released. Revenue growth forecasts would be assessed against the "equilibrium" level of receipts predicted by the model. Given that the cyclical indicator would be available on a monthly basis, the monthly tax profiles for total tax revenue would be

[20] The Tax Forecasting Methodological Review (2019) reaffirms the difficulty in accurately predicting CT revenue. This holds for the Department's forecasting model, as well as alternative approaches. The review finds that one-year ahead forecast errors have averaged €739 million annually, over the past decade, rising to €1.1 billion over 2014 – 2018. This suggests that almost three quarters of total tax forecasting errors are attributable to CT. These errors largely relate to issues with the macro-driver, with concerns that Gross Operating Surplus is not fully capturing activity levels in real time. For the substantial outperformance of CT post-2014, large starting point errors are also found to exist.

used (as above) to determine how much of the tax receipts received in each month should be set aside for allocation to the RDF.

6. A note on withdrawing from, and replenishing, the Rainy-Day Fund

One important, and often overlooked consideration, is the mechanism that would determine drawdowns from the RDF. Counter-cyclical fiscal funds should be inherently flexible, allowing them to be readily deployed should adverse macroeconomic conditions materialise. However, it is important that drawdown rules are not so loosely defined that they facilitate the misappropriation by an incumbent or inappropriate use more broadly. As an example, Rose (2008) finds that incumbents use a greater proportion of the RDF in an election year, regardless of the magnitude of any shock. Furthermore, providing veto powers to key players is shown to be a more effective means of mitigating the manipulation of RDFs than linking withdrawals to economic performance.

One key consideration is the extent to which RDF withdrawals should be linked to the revenue side of the government account, rather than spending. Designing a rule that would permit the use of the RDF should revenues fall below forecasted levels or below their equilibrium growth rate, would mean that spending growth is maintained at rates aligned with revenue fundamentals. As an example, this might be the annual growth in revenue when the economy is operating at potential (when the output gap is zero, it can be assumed that revenue is growing at the steady state level as outlined previously), or it could reflect the medium-to-long term average growth in revenues (or some measure of the optimal share of that revenue in the Exchequer account).

Linking RDF drawdowns to the performance of revenues rather than spending (or, for example the government budget balance) would assist in preventing the use of the RDF to cover overruns in current expenditure (e.g. in relation to Health) that have caused a deterioration in the general government balance in recent years relative to expectations. Coupling the use of the RDF with trends in public spending, could serve to further undermine or soften the budget constraints under which government departments are expected to operate.

Another important consideration relates to rules concerning the replenishment of the RDF. Research has shown that overly prescriptive replenishment rules can dissuade the use of the fund when it may be needed most (Zahradnik, 2005). Realistically, replenishment should occur only if the economy has recovered from a downturn, to avoid pro-cyclical fiscal policy. However, a possible drawback is that in a period of recovery, rigid replenishment rules can result in important spending programmes effectively competing with the RDF for funding allocations.

Ultimately, the potential rules that would govern the replenishment of the RDF should be linked to the purpose of the fund. If the intention of the RDF is to primarily mitigate the risks associated with revenue volatility, replenishment is only required should revenue volatility persist over time (in line with the rules outlined and proposed elsewhere in this paper).

However, if the goal is to create a sizeable fund that can respond adequately to a severe economic shock, replenishment should be a priority, and might be appropriately linked to the underlying performance of the economy (i.e. allocate a proportion of the budget surplus, as per some states in the US, or an amount in line with the size of the output gap). This would ensure routine and regular transfers to the RDF.

Conclusion

This paper has investigated the role of the RDF in Ireland as an instrument to build up counter-cyclical fiscal buffers and mitigate the adverse budgetary implications of revenue volatility. We complement existing research by providing a comprehensive analysis of the RDF (including an overview of the relevant literature) and by proposing potential mechanisms for governing allocations to the fund.

Historically, Irish fiscal policy has been pro-cyclical. We note that an adequately capitalised RDF can support counter-cyclical fiscal policy. Revenue buoyancies would be saved in periods of strong economic growth, while in a recession, these funds would be deployed to offset transient revenue shortfalls and maintain public spending.

We find that Ireland has a comparatively high level of macroeconomic and fiscal volatility. This is particularly evident for CT receipts that have seen sizeable revenue surprises. An RDF can help in managing the risks of excessive tax revenue volatility, by transferring to the fund, volatile and potentially transient tax revenues as and when they are realised.

We also identify trade-offs influencing the decision by the State to capitalise an RDF. The most important of these, include the macroeconomic outlook; existing public debt levels; the interest rate environment; opportunity costs; and, in the EU context, the interactions of the RDF with the fiscal rules. We present a simple theoretical model to explore some of these factors and their implications for decision-making by an incumbent.

The main contribution of this paper is the design of a set of rules for identifying and governing allocations to the RDF. We explore the US approach, which for the most part entails allocating a proportion of the year-end budget surplus, and review proposals by domestic bodies for identifying and setting aside excess receipts from CT. We then propose three alternative rules:

- The use of medium-run rolling average shares;
- The calculation of volatility minimising shares; and,
- Contributions linked to a cyclical indicator of Irish economic activity.

These rules have an overarching objective to link public spending to some equilibrium or volatility minimising level of revenue (and therefore reduce the link between public spending and volatile or transient revenues). However, at the same time, they also better address some issues specific to the Irish context. For example, compared to the use of long-term average tax shares, medium-run rolling average tax shares more accurately reflect gradual changes to the tax base over time. Volatility minimising shares are best in managing the volatility of the tax base, with the goal of avoiding linking public spending to unstable revenue sources. Finally,

when we link revenue allocations to our proposed cyclical indicator, built by way of Principal Component Analysis, we envisage the RDF as a tool to help manage the economy.

We have touched on issues related to withdrawal and replenishment in respect of RDFs. Rules that would determine how and when to withdraw from, and replenish, the RDF could be explored in future research. This work could be based on the same key principles applied in our rules determining RDF allocations (e.g. withdrawals could happen when the actual tax shares are below estimated equilibrium levels, or they could be linked to tax volatility or based on observed negative macroeconomic developments).

We have also mentioned the importance of adequately capitalising the fund. Balassone et al. (2007) show that due to the lack of sufficient reserves accumulated in good times (combined with balanced budget rules), RDFs did not solve the issue of running pro-cyclical fiscal policy in the US. At present, Ireland's RDF is capped at €8 billion. Future research could investigate analytical methods to estimate the optimal size of the fund in the Irish context, and provide a robust base for decision-making. For example, Cornia and Nelson (2003) apply Value at Risk techniques from financial risk management to determine the optimal size of RDFs in US states.

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Annex – Factors affecting the decision to capitalise an RDF

To assess the implications of some of these factors for the decision-making of an incumbent, we employ a simple theoretical model that consists of a government's intertemporal budget constraint.

In general, a single period budget constraint for government takes the form:

$$B_t = G_t - T_t \qquad (1)$$

B_t is essentially a flow variable that captures the gap between government revenue (T_t) and expenditure (G_t). In this formulation, B_t captures the size of the budget deficit in period t.

In the event of a revenue shortfall (i.e. $G_t > T_t$), the incumbent must issue debt equal to B_t (the size of the deficit). We assume that debt is issued for a single period only. If revenue exceeds expenditure (i.e. $G_t < T_t$), B_t will be negative, implying a budget surplus. This surplus may be used to pay-down outstanding debt (i.e. cover past deficits), or invested/transferred to an RDF. In this way, the establishment of an RDF depends on the occurrence of budgetary surpluses (i.e. $B_t < 0$).

Any outstanding debt is carried forward into the next period, with interest paid at a rate of r:[21]

$$B_{t+1} = G_{t+1} - T_{t+1} + (1 + r)B_t \qquad (2)$$

Now, consider the budget constraint facing the government of a four-period economy. We assume that government prefers a balanced budget (i.e. $G_t = T_t$ or $B_t = 0$) under normal conditions. However, we assume that there is a risk of a future crisis (specifically in Period 2), to which government assigns a non-zero probability (denoted P_C). This crisis is only fully observable in the period in which it hits (i.e. Period 2). Policies that influence G_t and T_t must be chosen at the beginning of each period (e.g. as part of the annual budget process).

We associate a crisis with higher government spending ($G_C > G_N$), lower government revenue ($T_C < T_N$), and a higher cost of borrowing ($r_C > r_N$). Debt issued in the current period to fund spending must be fully repaid (with interest) in the next period. As this is a four-period economy, no debt can be issued in Period 4 (the final period), at which point all outstanding debt must be repaid.

This scenario can be expressed as:

$$B_1 = G_1 - T_1 \qquad \text{[Period 1]}$$

$$B_2 = B_1 + r_N B_1 + (1 - P_C)(G_N - T_N) + P_C(G_C - T_C) \qquad \text{[Period 2]}$$

[21] Ultimately, B_t must equal the sum of previous deficits, and the present value of future surpluses:

$$B_t = (1 + r)^t B_0 + \sum_{j=0}^{t} (1 + r)^j G_{t-j} - T_{t-j} = \sum_{j=1}^{\infty} \left(\frac{1}{1 + r}\right)^j (T_{t+j} - G_{t+j})$$

$B_3 = B_2 + P_C(r_C B_2) + (1 - P_C)(r_N B_2) + G_3 - T_3$ [Period 3]

$B_3 - r_N B_3 = G_4 - T_4$ [Period 4]

The government's budgetary strategy in Period 1 will depend on the value of P_C (that is, the probability it assigns to a crisis occurring in Period 2).

Suppose $P_C = 1$, in which case the government is certain that a crisis will occur. As $G_C > T_C$, and assuming the budget is balanced in Period 1 (i.e. $B_1 = 0$), the budget constraint in Period 2 reduces to: $B_2 = G_C - T_C > 0$. In effect, this means that a deficit will be realised in Period 2, requiring borrowing equal to B_2. As $r_C > r_N$, this additional borrowing will be costly. The borrowed amount must be paid back in Period 3, at a total cost of $B_2 + r_C B_2$.

We can show that the level of the deficit in Period 1 (B_1) falls as the probability of a crisis in Period 2 (P_c) increases. Focusing on the Period 2 budget constraint:

$B_2 = B_1 + r_N B_1 + (1 - P_C)(G_N - T_N) + P_C(G_C - T_C)$

We can rearrange this, so that:

$B_2 = B_1(1 + r_N) + G_N - P_C G_N - T_N + P_C T_N + P_C G_C - P_C T_C$

From this, we can derive:

$$B_1 = \frac{B_2 - G_N + T_N + P_C G_N - P_C T_N - P_C G_C + P_C T_C}{(1 + r_N)}$$

Therefore, assuming that government targets a balanced budget in a non-crisis period (i.e. $G_N = T_N$) and knowing that spending exceeds revenue in the crisis period (i.e. $G_C > T_C$), we find:

$\frac{dB_1}{dP_C} = G_N - T_N + T_C - G_C < 0$, whereas

$$\frac{dB_2}{dP_C} = T_N - G_N + G_C - T_C > 0$$

This suggests that, as the probability of a crisis in Period 2 rises, the government targets a lower deficit in Period 1 (i.e. reduces spending and/or increases tax revenue); while this rising probability motivates an increase in the level of the deficit for Period 2 to cover the revenue shortfall resulting from the crisis in that period.

To avoid costly borrowing (particularly in a high interest rate environment), the government could establish an RDF in the period preceding the crisis (i.e. Period 1) equal to: $\frac{B_2}{(1+r_N)}$. This is the present (or Period 1) value of the deficit in Period 2. This means that $G_1 < T_1$ must hold in Period 1, by an amount equal to $\frac{B_2}{(1+r_N)}$. In other words, it is necessary that $B_1 = \frac{B_2}{(1+r_N)}$.

Without an RDF, the deficit amount must be borrowed (B_2), and this debt must be repaid in the next period (Period 3). The total amount to be repaid would be: $B_2 + r_C B_2$. The Period 1

present value of this amount is: $\frac{B_2+r_C B_2}{(1+r_N)^2}$. Comparing this to the amount that must be set aside in an RDF in Period 1 to offset the Period 2 deficit when it arises: $\frac{B_2+r_N B_2}{(1+r_N)^2}$, we know that it is cheaper to create and use the RDF (as $r_C > r_N$).

While borrowing is clearly the more costly option, an incumbent government will be guided by their preferences for current versus future spending (e.g. in the Irish context, there has been a persistent deficit bias). Furthermore, the opportunity cost from establishing the RDF in Period 1 (e.g. in terms of spending foregone) may exceed the cost differential between establishing the RDF and borrowing. This means that: $OC_1 + \frac{B_2+r_N B_2}{(1+r_N)^2} > \frac{B_2+r_C B_2}{(1+r_N)^2}$. In this case, the increase in the interest rate in the crisis period ($r_C - r_N$, in Period 2) is not substantial enough to offset the opportunity cost of creating the RDF in the preceding period (OC_1, in Period 1). In this event, borrowing could be the more appealing option.