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An Oifig Buiséid Pharlaiminteach
Parliamentary Budget Office
**PBO Debt Sustainability Analysis
Calculator Explainer Guide**

Publication 18 of 2022

Séanadh

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1 Debt Sustainability Analysis

1.1 Links to the DSA Calculator and Interest Rate Risk Tableau Dashboard

- [PBO Debt Sustainability Analysis Calculator SPU 2023](#)
- [Interest Rate Risk - DSA Calculator SPU 2023](#)
- [PBO Debt Sustainability Analysis Calculator Budget 2023 Fiscal Feedback](#)
- [Interest Rate Risk - DSA Calculator Budget 2023](#)
- [PBO Debt Sustainability Analysis Calculator SPU 2022](#)
- [Interest Rate Risk - DSA Calculator SPU 2022](#)

1.2 Disclaimer

This tool constitutes a calculator and data visualisation dashboard to aid people in seeing visually the hypothetical impact on Ireland's debt statistics of changes to the input variables of primary spending, revenue, GDP growth and interest rates. The PBO accepts no responsibility for the accuracy of the output of the tool and in no way does this tool constitute a forecast by the PBO. The tool is a "beta" version and is designed using a PBO deterministic DSA model and a modified version of the IMF Debt Dynamics framework model to verify results.¹

In particular, the baseline input figures that the calculator uses are merely placeholders. For the SPU (Stability Programme Update) 2022 calculator, the SPU 2022 is used for figures out to 2025 and from 2025, a straight line extrapolation is applied using simplifying assumptions. The debt calculations in this tool are modelled such that all new and "rolled over" debt uses a single input interest rate for a given year. In reality for Ireland, the different debt items in different debt categories, such as individual "Short Term Paper", would be unlikely to be using a modified version of the interest of Fixed Rate Treasury Bonds for a given year.

Likewise the tool assumes that there is a one-to-one relationship between the General Government deficit and the amount borrowed. As such there is no stock flow adjustment factor affecting the debt to GDP ratio as the Government changes the size of its outstanding assets, though there is an option to manually enter one's own stock flow adjustment figures. Many assumptions of the tool are modular with settings, such as being able to change what proportion of new debt is short-term paper and the maturity of newly issued Government bonds.

This calculator builds upon previous work presented in *The PBO analytical model for public debt sustainability analysis* and other PBO publications have discussed fiscal rules, *Ensuring Medium-Term Fiscal Sustainability*. This tool was prepared as part of a capacity building exercise by the PBO's Modelling and Costings Unit and will be updated over time.

¹ IMF, *Staff Guidance Note for Public Debt Sustainability Analysis In Market-Access Countries*, (May 2013).

1.3 What is Debt Sustainability Analysis

Debt Sustainability Analysis (DSA) is a study of a country's medium-term to long-term debt situation. DSA assesses how a country's current level of debt and prospective borrowing affect its present and future ability to meet debt service obligations. It is primarily measured by the debt-to-GDP ratio, and its projected trajectory.

The debt-to-GDP ratio is the metric comparing a country's gross Government debt to its gross domestic product (GDP). The EU fiscal rules encourage moving towards a debt-to-GDP ratio of below 60% for member states.

Under the baseline figures the SPU (Stability Programme Update) 2022 model calculates for 2050 a debt to GDP ratio of roughly 33% and a debt to GNI* ratio of 63%, with figures stabilising after 2030 towards a long-term trend of a small General Government deficit.

- The input figures assume that from 2026 to 2050, the average nominal GDP growth is 2.5% while the average market interest rate is 2.2%.
- The average debt to GDP ratio would be 34%, while the average debt to GNI* ratio would be 66%.
- Debt dynamics is the breakdown of what causes the debt to GDP/GNI* ratio to change in a given year. For example if in 2030 the Interest Rate Effect is 0.54%, the Nominal GDP Effect is -0.75%, the Primary Balance Effect is -0.24% and all other factors being zero, then the debt dynamics is -0.45%. This means that the debt to GDP ratio has been reduced by 0.45% in comparison to the previous year.
- The average interest spending would be €5 billion a year, while the average primary balance would be a positive of €0.5 billion a year.
- As a proportion of how this would be a factor in changing the debt to GDP/GNI* ratio per year in terms of debt dynamics, it is 0.6% for average interest spending and 0.1% for average primary balance, while for GNI* it would be 1.23% and 0.19%.
- The average change in the debt to GDP/GNI* ratio per year (the debt dynamics), would be -0.3% a year for GDP and -0.6% a year for GNI*. Most of the changes to the debt to GDP/GNI* ratio would occur before 2030.

1.4 The EU Fiscal Rules²

The EU Fiscal Rules of the Stability and Growth Pact (SGP) constitute the main institutional framework shaping fiscal policy in Ireland (i.e. Government tax and expenditure decisions). The SGP, which was initially established in 1997 and has evolved significantly since then,³ is made of two Arms: the Corrective and the Preventive Arm. The Corrective Arm, which Ireland was subject to during the crisis period, aims to correct large fiscal imbalances (i.e. high deficit and debt), with the 3% deficit-to-GDP ratio and the 60% debt-to-GDP ratio representing the key fiscal constraints.

The DSA Calculator models compliance with the rules set-out under the Corrective Arm, specifically. It tests against the the 3% deficit and 60% debt ratio targets only and does not include the further rules laid out in the Preventative Arm.

The Preventive Arm has a different purpose to the Corrective Arm. The focus is on promoting prudent fiscal policy and maintaining stable and sustainable public finances. The Preventive Arm is characterised by two main rules: a Structural Budget Balance rule and a Spending rule limiting annual growth in Government Expenditure (i.e. the Expenditure Benchmark).

The Structural Budget Balance is the actual General Government budget balance net of the effects of the economic cycle and one-off and other temporary measures. The structural balance gives a measure of the underlying trend in the budget balance.⁴ The structural balance rule requires that it be above the medium-term budgetary objective (MTO) or moving towards the MTO at an adequate pace.⁵

The Expenditure Benchmark at its simplest states that spending increases which go beyond a country's medium-term reference rate of potential GDP must be matched by additional discretionary revenue measures. This encourages a move towards or maintaining of the MTO.⁶

The EU Fiscal Rules are currently suspended in 2022, first due to COVID-19 and then due to the crisis in Ukraine.⁷ Notably the EU Fiscal Rules are based off of GDP (Gross Domestic Product) not GNI* (Modified Gross National Income) in the case of Ireland. Ireland's GDP being significantly higher than its GNI* would make it easier to meet EU fiscal rules compliance.

In relation to Fiscal Rules, the Fiscal Council plays an important role in measuring and ensuring compliance with the budgetary rules, as set out in the Fiscal Responsibility Act.⁸ Its purpose as an independent statutory body is to provide an independent assessment of official budgetary forecasts and proposed fiscal policy objectives.⁹

² This section draws from PBO Briefing Paper 6 of 2018: *Potential Output, the Output Gap and Associated Key Issues for Fiscal Policy-making in Ireland*

³ The EU fiscal rules were further expanded by the so called "6 pack" changes in 2011 and "2 pack" changes in 2013.

⁴ *European Commission, Glossary - Economic and Financial Affairs.*

⁵ *Fiscal Council, Fiscal Assessment Report, (May 2021).*

⁶ *Fiscal Council, The EU Expenditure Benchmark, (January 2020).*

⁷ *European Commission, European Semester Spring Package: Sustaining a green and sustainable recovery in the face of increased uncertainty, (May 2022).*

⁸ *ISB, Fiscal Responsibility Act 2012 - Number 39 of 2012.*

⁹ *Fiscal Council, About the Council.*

2 Tableau Dashboard Guide

2.1 What does the dashboard do?

The Interest Rate Risk - DSA Calculator shows what effect a change in interest rates would have on interest spending, the debt to GDP ratio, the debt to GNI* ratio, the borrowing requirement and the gross national debt. This facilitates an assessment of the impact of interest rate changes on the sustainability of Ireland’s borrowing.

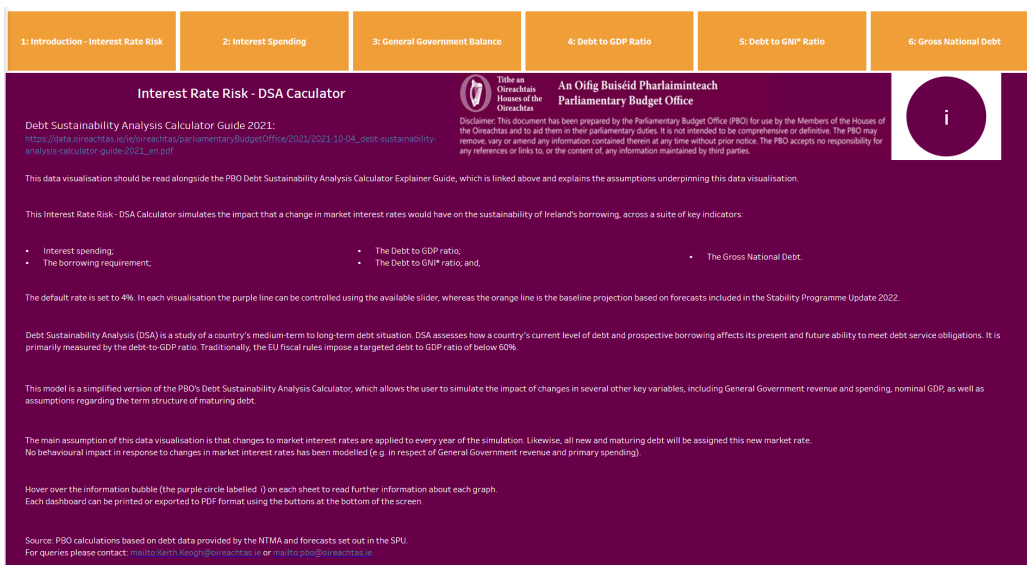
The default interest rate of the calculator slider is 4%. The purple line is controlled by the slider, the orange line shows the projections based on the SPU baseline for the SPU 2022 calculator. This model is a simplified off-shoot from the Excel-based DSA calculator that is designed to be more focused and user friendly. The baseline of the tableau is identical to the baseline of the Excel calculator. At its simplest, if the interest rate increased to a fixed 4% year-on-year, starting in 2022 and maintained for the entire projection horizon, in the long term it would cause Ireland’s debt to GDP to increase continually upwards due to the interest cost of servicing the debt.

2.2 - 1: Introduction - Interest Rate Risk

This is the introductory slide of the dashboard. It explains what the dashboard does and a little of the background and assumptions. The page of the dashboard can be changed using the orange tabs at the top of the screen. Selecting the picture of the PBO name and logo opens a link to this explainer guide. Selecting, by clicking on, the disclaimer image below it opens up the list of PBO publications.

Refreshing the page will reset the calculator. You can print or download as PDF by selecting the download button in the bottom right hand corner of the screen. Also at the bottom right hand corner of the screen there is an option to display the dashboard in fullscreen.

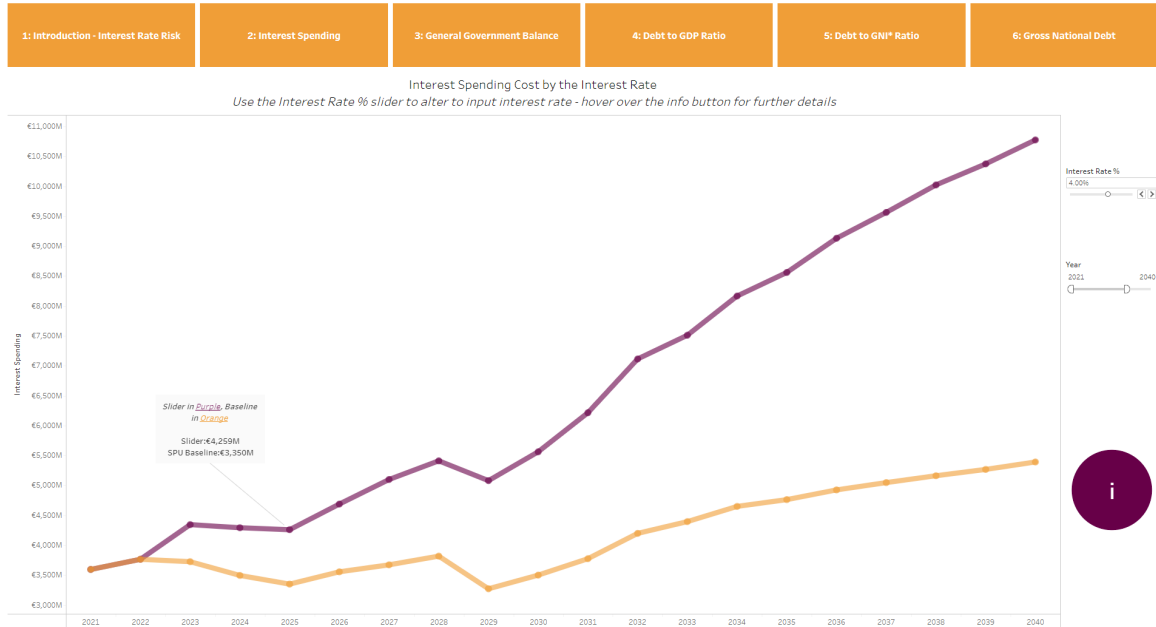
Figure 1: Page 1 - Introduction



2.3 - 2: Interest Rate Spending

This page shows for a given interest rate, what the interest spending would be. Control the interest rate with the slider. The interest rate is used for new debt issued due to a Government deficit or every tranche of Ireland’s debt that is maturing and rolling over. The baseline is shown in orange for comparison.

Figure 2: Page 2 - Interest Rate Spending



To read more information about a page, hover over the info bubble. The info button is the purple circle labelled “i” on the right hand side of the screen.

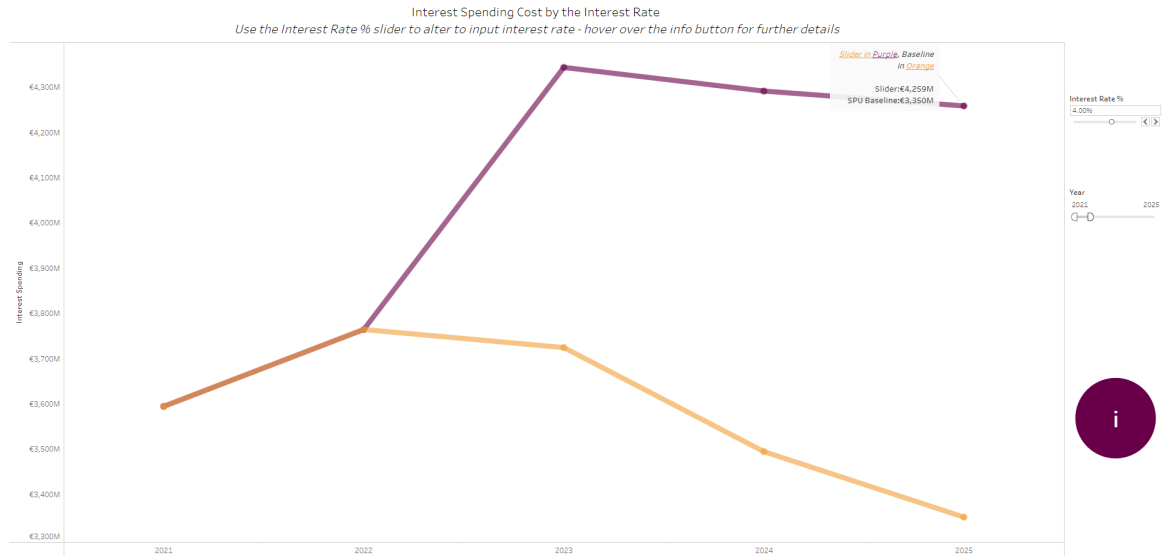
Figure 3: How to use the info bubble



Interest spending is the amount spent yearly to service Ireland’s debt. New debt is issued due to a budget deficit or when existing debt matures and is rolled over on a new interest rate. As the interest rate increases, the cost of Ireland’s debt increases with a lag, depending on the maturity profile of that particular tranche of the debt. Roughly 60% of Ireland’s debt is held in Government bonds which tend to have ten-year maturities.

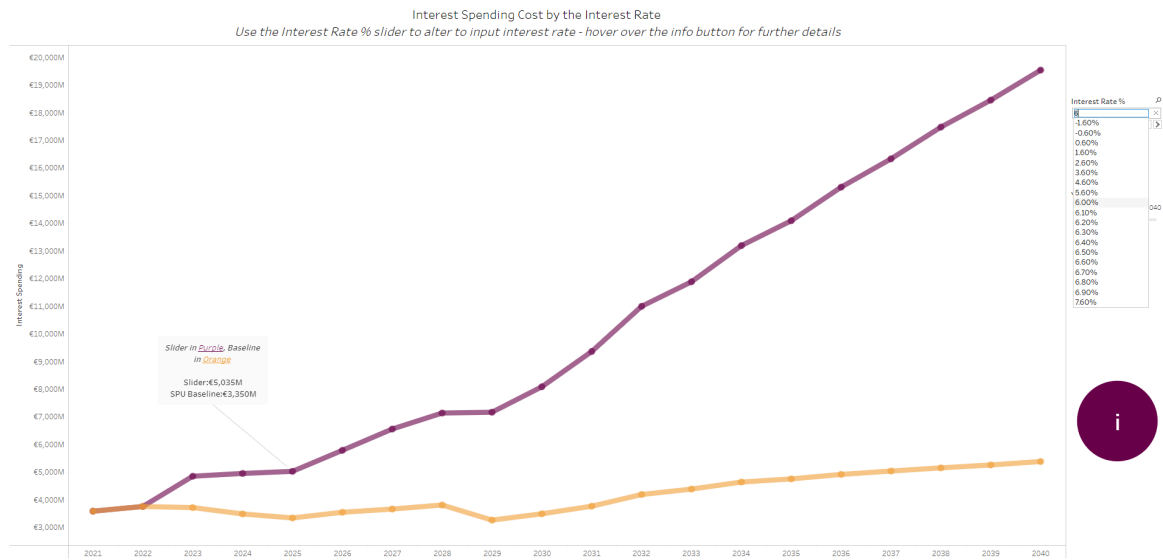
To change the years graphed, use the year slider. You can change both the maximum and minimum year graphed. The years 2022 to 2050 are modelled. The year slider syncs across pages.

Figure 4: How to change the year graphed



Rather than using the slider, you can click on the search icon on the top right hand corner of the “Interest Rate Risk %” slider and type in what interest rate you want. Hover over the slider box to make the symbol appear. The dashboard operates under increments of 10 basis points (0.1%). Below you can see the interest rate being changed to 6% through the search box. The interest setting syncs between pages.

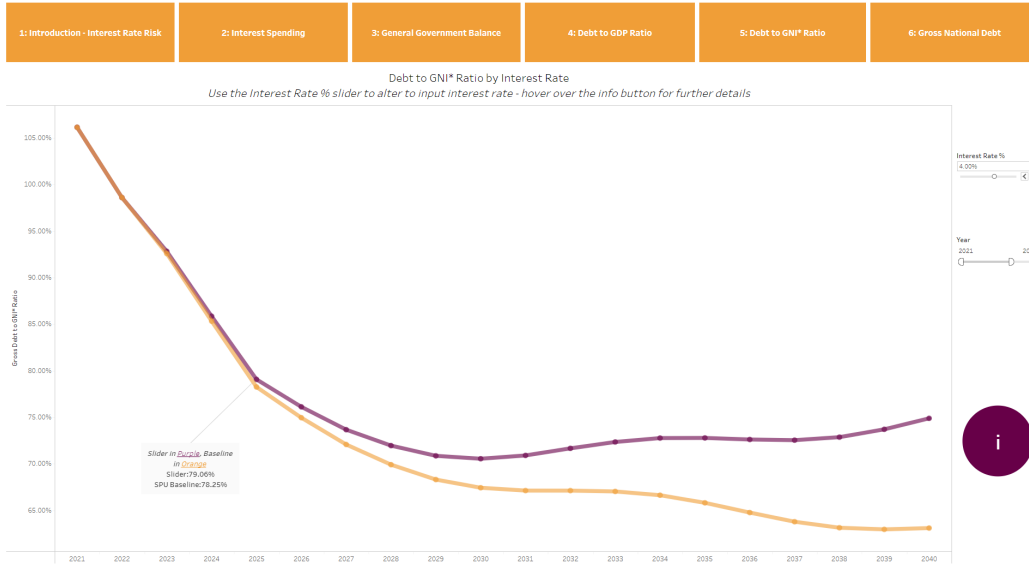
Figure 5: Using the input box to increase interest rates to 6%



2.4 - 3: General Government Balance

At its simplest, the General Government balance is the balance of finances for the Government of Ireland. It is General Government revenue less General Government spending. The primary balance excludes debt servicing costs.

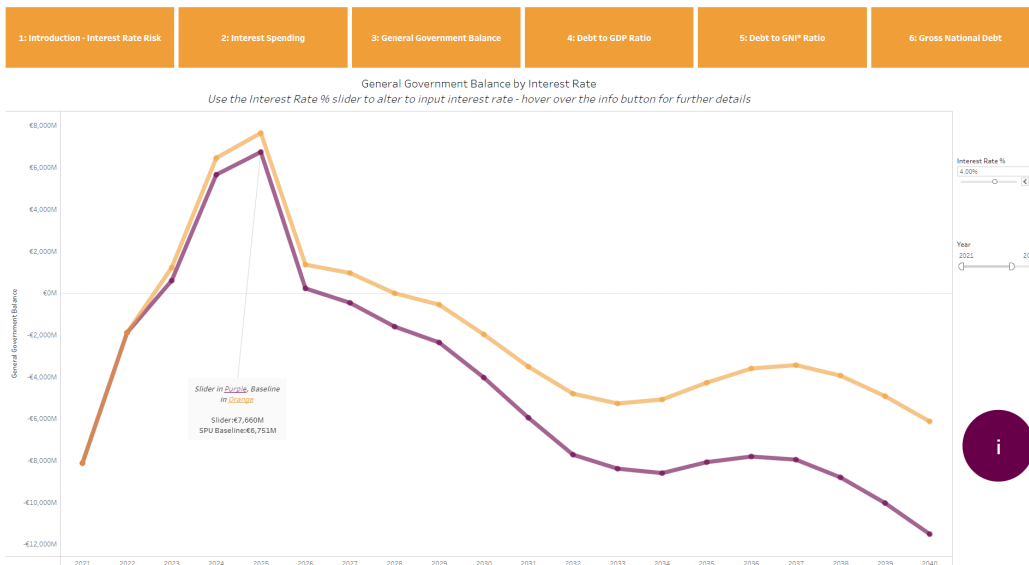
Figure 6: Page 3 - General Government Balance



2.5 - 4: Debt to GDP Ratio

This graph displays the debt to GDP (gross domestic product) ratio, the primary measure of debt sustainability. The EU fiscal rules at their simplest state that this ratio should remain below 60%.

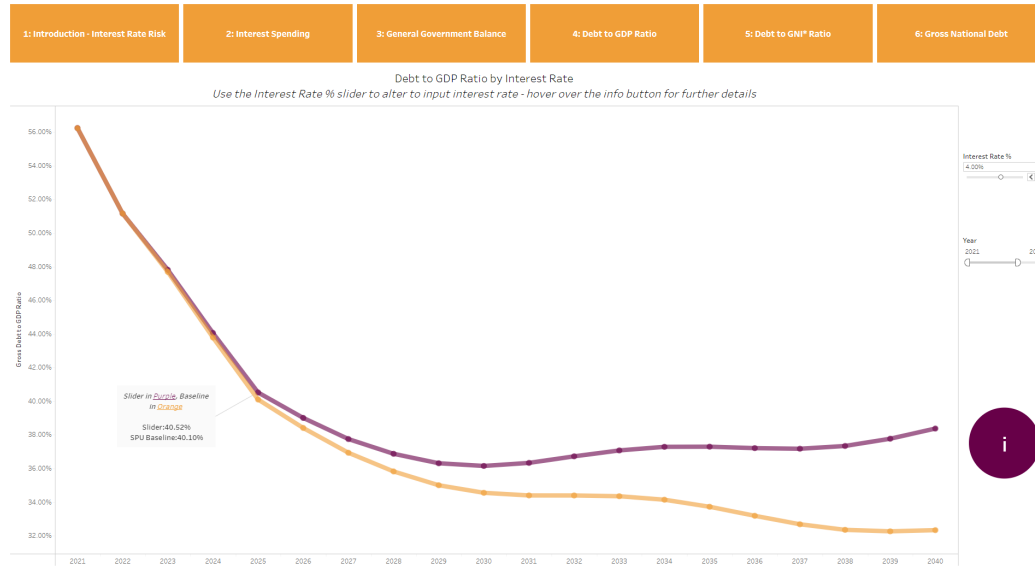
Figure 7: Page 4 - Debt to GDP Ratio



2.6 - 5: Debt to GNI* Ratio

This graph displays the debt to GNI* (Modified Gross National Income) ratio. GNI* was collaboratively created by the Central Bank of Ireland in 2017¹⁰ to better account for the actual size of the Irish economy and lessen the distortions of the activities of MNEs (multinational enterprises). There is a significant difference between Debt to GDP and Debt to GNI* in the Irish economy.

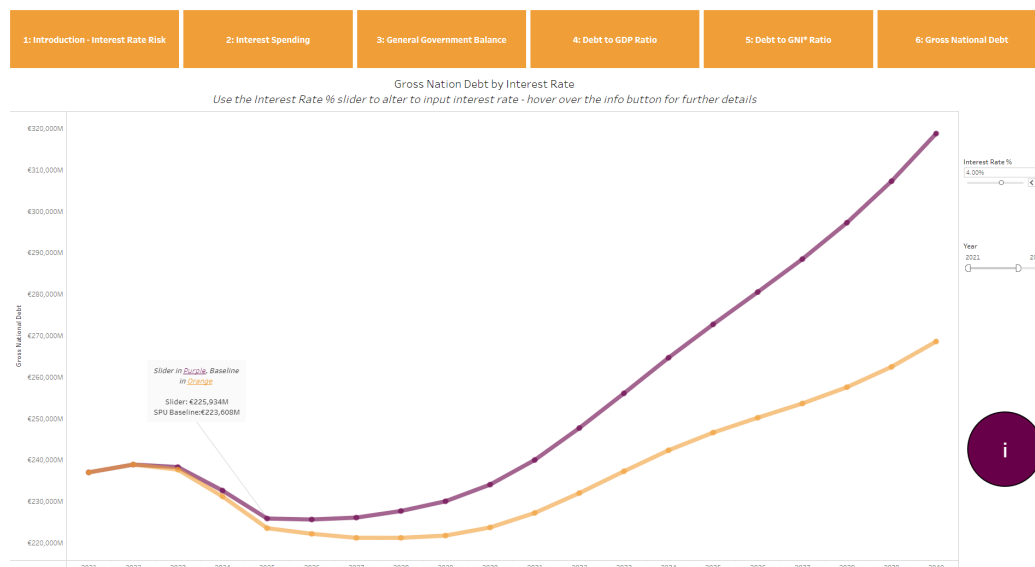
Figure 8: Page 5 - Debt to GNI* Ratio



2.7 - 6: Gross National Debt

General Government debt (GGD) is a measure of the total gross consolidated debt of the State compiled by the Central Statistics Office (CSO). It is the measure used for comparative purposes across the EU.¹¹ The gross national debt is the gross debt incurred by the Exchequer after taking account of other financial assets. Notably it is divided into a number of debt products, from Fixed Rate Treasury Bonds to State Savings Prize Bonds. Gross National Debt is the principal component of GGD. For end-2021 the GGD was €235.9 billion while the GN debt was €237.2 billion.

Figure 9: Page 6 - Gross National Debt



¹⁰ CSO, REPORT OF THE ECONOMIC STATISTICS REVIEW GROUP (ESRG), (December 2016).

¹¹ General Government Debt and National Debt

3 Excel Calculator Guide

3.1 What does the calculator do?

The core purpose of the calculator is to allow a user to explore graphically how differing fiscal policies and budgetary choices would affect debt sustainability and compliance with the EU fiscal rules in the coming years.

The Debt Sustainability Analysis Calculator allows users to make their own revenue and spending projections from 2022 to 2050. It highlights how changes to fiscal plans would directly affect the debt to GDP trajectory and whether or not the core EU fiscal rules are being met.

In addition, the calculator can be used to model Ireland's exposure to uncertain GDP growth and interest rate risks. With sliders and dropdown boxes, it allows the user to see for themselves how different interest rates and other inputs would affect projected debt servicing costs and budget balances. Users can input their own data into the calculator.

The core EU fiscal rules mandate a debt to GDP ratio below 60% and public deficits below 3% of GDP. While the fiscal rules are currently suspended, Ireland must prepare to return to being fiscally compliant in preparation for their eventual reintroduction as the COVID-19 crisis ebbs.

The pre-set model values are based on the Department of Finance's forecasts, for either the SPU (Stability Programme Update), the SES (Summer Economics Statement) or the Budget depending on the name of the particular calculator release.

Funding new policy initiatives means that choices need to be made between raising taxes or reprioritising spending to keep debt on a fiscally prudent and compliant path. The Debt Sustainability Analysis Calculator allows users to evaluate different projected budget packages and investigate the feasibility of changing future spending.

The primary calculator inputs include:

- Primary spending (excludes interest)
- Revenue
- Nominal GDP growth
- Market interest rate

The primary calculator outputs, among many others, include:

- Gross national debt to GDP ratio
- Borrowing requirement
- Interest spending
- Primary balance
- Gross national debt
- Nominal GDP

3.2 - 1 Introduction

This introductory slide explains how to use the calculator as well as some of the background and assumptions.

Figure 10: Page 1 - Introduction

PBO Debt Sustainability Analysis Calculator SPU 2022 [Guide Link](#)

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Calculator Guide & Model Assumptions

PDF Calculator Guide Link

[Debt Sustainability Analysis Calculator Guide 2021 \(oieachtas.ie\)](#)

Excel Sheets of the DSA Calculator

- 1 Introduction - The sheet explains the basics of the calculator. The detailed user guide is found in the link above
- 2 DSA Simple Dashboard - This dashboard allows you to view the main outputs on one graph managed by a dropdown box. It is controlled by the inputs sliders
- 3 DSA Calculator - The main DSA calculator. The dropdown boxes which control the settings of the calculator are found here. Here you can also input new figures directly into the model
- 4 DSA Additional Graphs - additional graphs and output data from the model, such as fiscal rules and demographics, can be found here. In addition there are also the 4 sliders

Graph Explanations - DSA Calculator

- Graph 1 displays the primary spending (excludes interest spending) and revenue, this is changed directly by the slider
- Graph 2 displays the nominal GDP/GNI* growth and the market interest rate, this is changed directly by the slider
- Graph 3 displays the gross national debt to GDP ratio, this is the primary comparative focus for debt sustainability analysis
- Graph 4 displays the interest spending
- Graph 5 displays the breakdown of the debt dynamics effect on the debt to GDP/GNI* ratio

Graph Explanations - DSA Additional Graphs

- Graph 1 General Government Balance
- Graph 2 Primary Balance
- Graph 3 Gross National Debt
- Graph 4 Nominal GDP
- Graph 5 Debt Per Working Age
- Graph 6 Interest Cost to GDP
- Graph 7 General Government Balance to GDP
- Graph 8 Gross National Debt to GDP

What is Debt Sustainability Analysis

Debt Sustainability Analysis (DSA) is a study of a country's medium-term to long-term debt situation. DSA assesses how a country's current level of debt and prospective borrowing affect its present and future ability to meet debt service obligations. It is primarily measured by the debt-to-GDP ratio. The debt-to-GDP ratio is the metric comparing a country's gross government debt to its gross domestic product (GDP). The EU fiscal rules encourage moving towards a debt-to-GDP ratio of below 60% for member states.

Background Information

The EU Maastricht Treaty of 1992 required that member states keep public debt below 60% of GDP and public deficits below 3% of GDP. Directive 2011/85/EU, the '6 pack' and the '2 pack' directives, further expand on the EU fiscal rules. EU Fiscal Rules are currently suspended but are based on GDP alone, not GNI*.

GDP (Gross Domestic Product) is a measure of the size of the economy, the total economic activity in a country.

GNI* (Modified GNI) is an indicator that was recommended by the Economic Statistics Review Group and is designed to exclude globalisation effects that are disproportionately impacting the measurement of the size of the Irish economy.

Ergo Ireland's GDP figure may not directly correlate with standards of living and the level of economic development actually experienced by individual citizens in different regions.

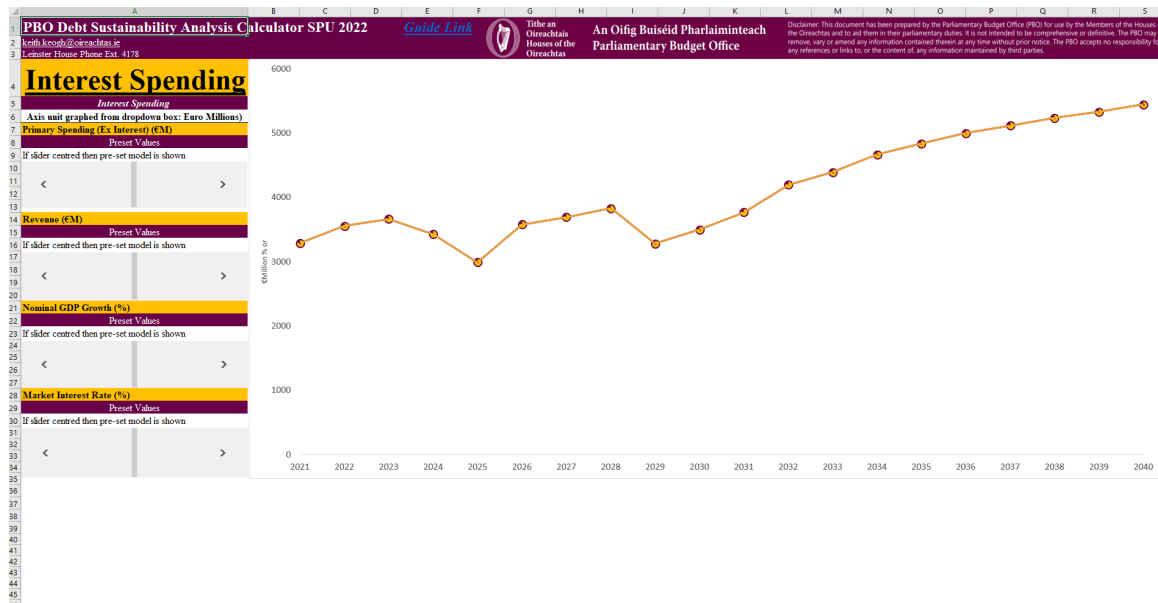
Ireland's MNE situation results in a significantly inflated GDP figure in comparison to GNI*, the PBO has published papers discussing this.

The PBO has published previous papers outlining the theory for DSA (though this calculator uses a different model and assumptions) and other matters such as fiscal rules [https://data.oieachtas.ie/oieachtas/parliamentary/BudgetOffice/2021/2021-03-11_the-pbo-analytical-model-for-public-debt-sustainability-analysis_en.pdf](#)

3.3 - 2 DSA Simple Dashboard

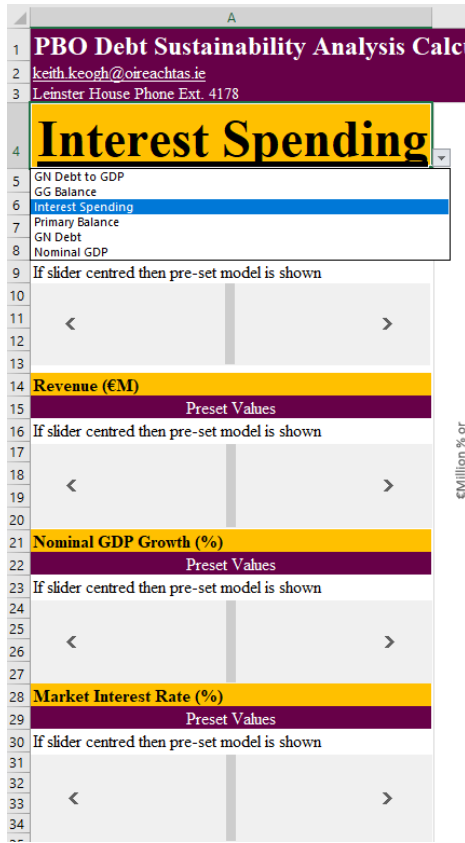
Here you can use a streamlined version of the DSA calculator. This allows one to use the sliders to affect the graph that is currently displayed. Notably the dropdown options from the main DSA calculator, such as max year, affect the graph here. It contains the baseline graphed in orange, allowing a comparison of the scale of any changes. Notably the axis of the graph is dynamic.

Figure 11: Page 2 - DSA Simple Dashboard



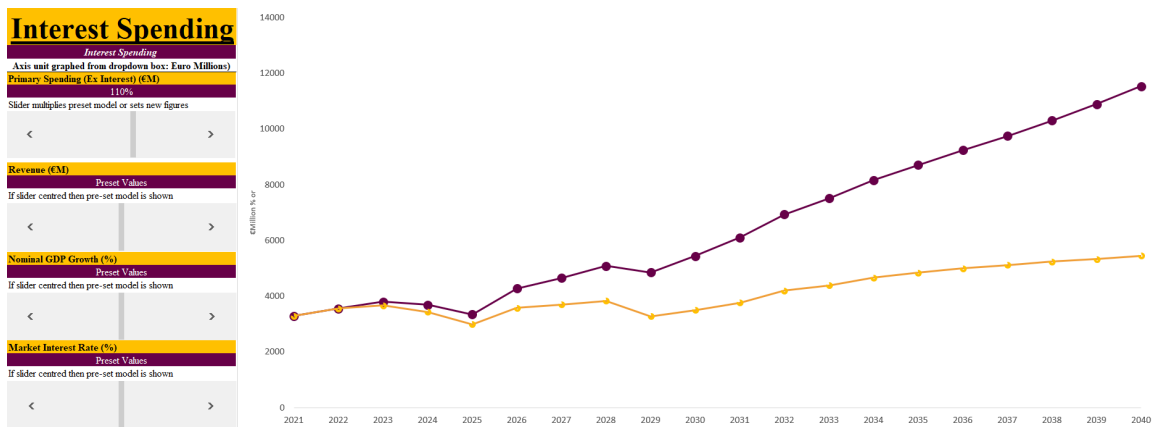
To change the graph displayed, click the dropdown box and select your preferred graph.

Figure 12: Use the dropdown box to change the graph



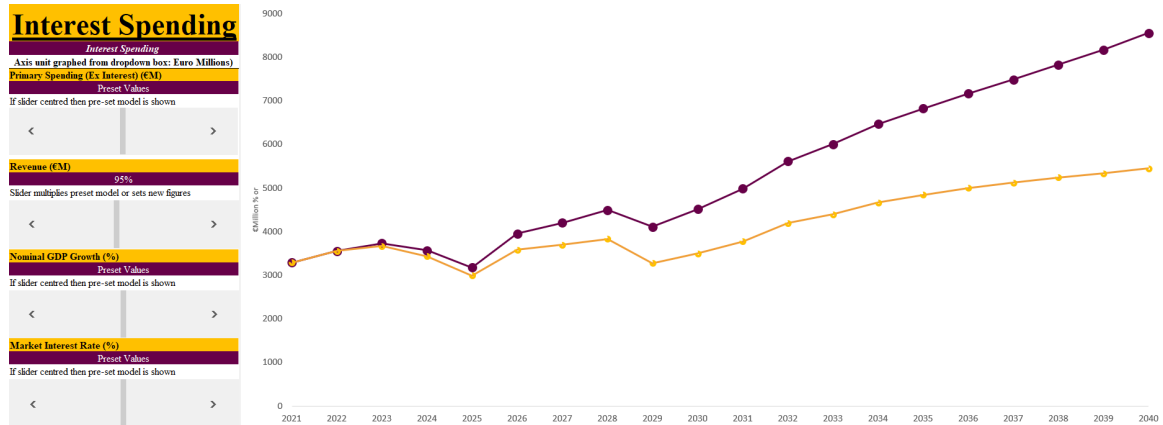
You can use the sliders to increase or decrease the input variables, such as revenue and primary spending. These are based off of the values of the baseline figures for revenue and primary spending and are applied equally for every year. Primary spending does not include interest costs. In contrast, increasing the market interest rate and GDP growth slider applies a new interest rate to every year, such as 4%.

Figure 13: Increase primary spending by 10%



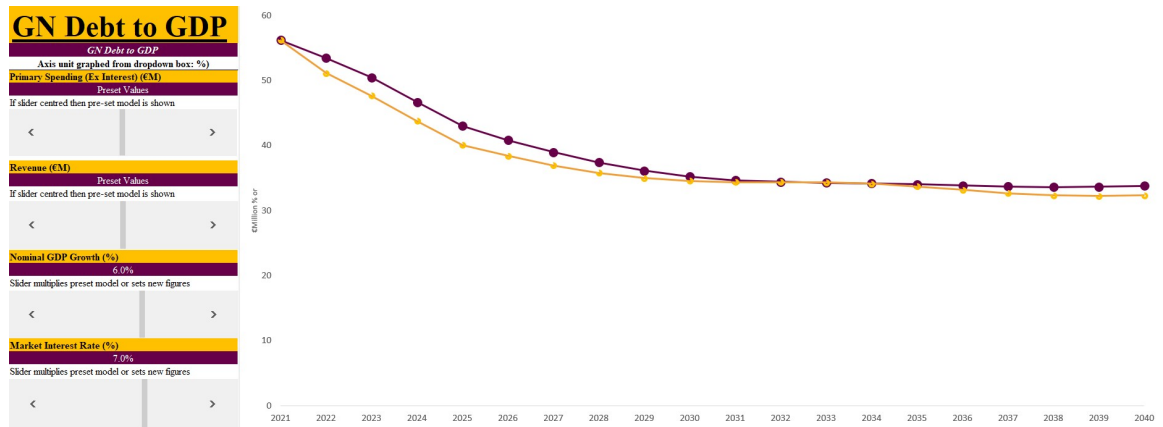
Here revenue is being reduced permanently by 5% compared to the baseline, therefore driving up the size of the Government debt and debt servicing costs.

Figure 14: Reduce revenue by 5%



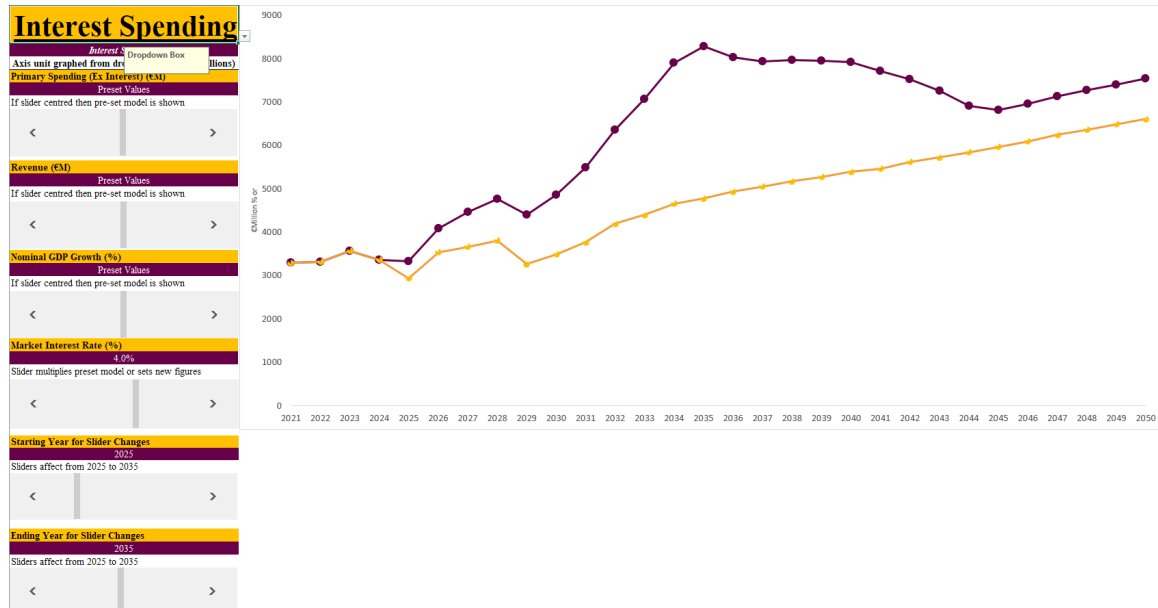
Here a scenario where interest rates increase and GDP growth decreases occurs and it is graphed on the debt to GDP graph.

Figure 15: Decrease GDP growth and increase the interest rate



You can use the two bottom sliders to set the start and end dates for the simulation. In this case the interest rate for the years from 2025 to 2035 is set to 4% year-on-year, while the figures outside of this range remain at the default baseline figures.

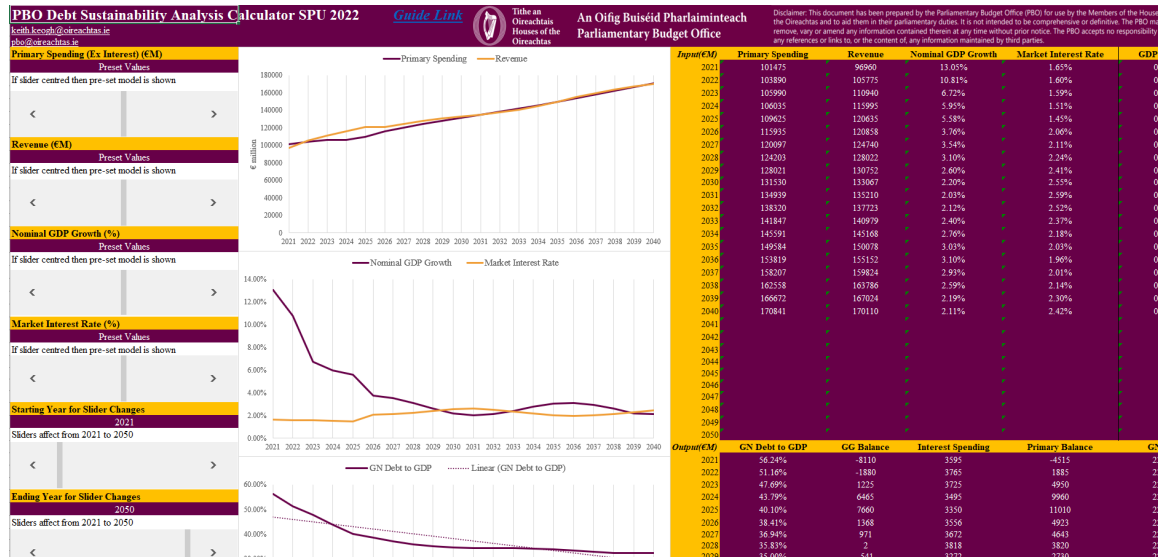
Figure 16: Increase the interest rate to 4% from 2025 to 2035



3.4 - 3 DSA Calculator

This is the main body of the calculator. It is split between, the input sliders, the option dropdown boxes, the input figures, the output figures and the graphs.

Figure 17: Page 3 - DSA Calculator



Rather than relying on the sliders, you can input the exact input figures here. For example, you can copy in your own spending figures to test what effect they would have on Ireland’s debt level and debt servicing cost. Notably if you put in a new figure, the calculator sliders no longer affects that cell and you will need to open and close the calculator to reset it.

Here you can also input the stock flow adjustment if you so wish. For simplicity all figures are nominal so the GDP deflator is not included.

Figure 18: Interactive input figures

Input(€M)	Primary Spending	Revenue	Nominal GDP Growth	Market Interest Rate	Stock Flow Adjustments
2021	101475	96960	13.05%	1.65%	0
2022	103890	105775	10.81%	1.60%	0
2023	105990	110940	6.72%	1.59%	0
2024	106035	115995	5.95%	1.51%	0
2025	109625	120635	5.58%	1.45%	0
2026	115935	120858	3.76%	2.06%	0
2027	120097	124740	3.54%	2.11%	0
2028	124203	128022	3.10%	2.24%	0
2029	128021	130752	2.60%	2.41%	0
2030	131530	133067	2.20%	2.55%	0
2031	134939	135210	2.03%	2.59%	0
2032	138320	137723	2.12%	2.52%	0
2033	141847	140979	2.40%	2.37%	0
2034	145591	145168	2.76%	2.18%	0
2035	149584	150078	3.03%	2.03%	0
2036	153819	155152	3.10%	1.96%	0
2037	158207	159824	2.93%	2.01%	0
2038	162558	163786	2.59%	2.14%	0
2039	166672	167024	2.19%	2.30%	0
2040	170841	170110	2.11%	2.42%	0
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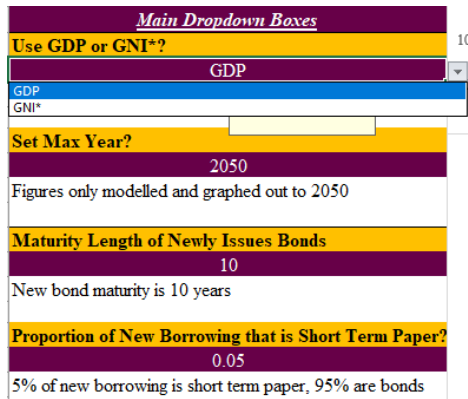
Here are the primary output figures.

Figure 19: Output figures

Output(€M)	GN Debt to GDP	GG Balance	Interest Spending	Primary Balance	GN Debt	Nominal GDP
2021	56.27%	-8110	3290	-4820	237200	421525
2022	51.19%	-2000	3555	1555	239072	467075
2023	47.72%	1180	3665	4845	237892	498475
2024	43.83%	6425	3430	9855	231467	528125
2025	40.14%	7625	2990	10615	223842	557600
2026	38.48%	1213	3580	4793	222629	578593
2027	37.02%	848	3696	4545	221781	599062
2028	35.92%	-89	3834	3746	221869	617628
2029	35.11%	-609	3279	2670	222478	633673
2030	34.66%	-2015	3500	1485	224493	647612
2031	34.51%	-3542	3772	230	228036	660740
2032	34.51%	-4828	4198	-630	232864	674718
2033	34.47%	-5284	4392	-892	238148	690929
2034	34.26%	-5107	4667	-440	243255	709974
2035	33.85%	-4356	4841	485	247610	731455
2036	33.32%	-3671	5001	1330	251281	754103
2037	32.82%	-3502	5119	1617	254783	776226
2038	32.50%	-4012	5240	1228	258795	796342
2039	32.41%	-4983	5334	351	263778	813783
2040	32.49%	-6183	5449	-734	269961	830925
2041						
2042						
2043						
2044						
2045						
2046						
2047						
2048						
2049						
2050						

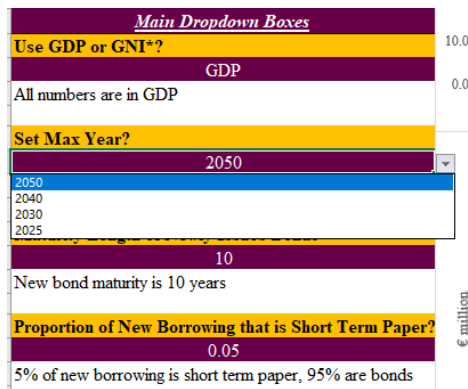
To change between GDP and GNI* figures, use this dropdown. It changes the figures, graphs, and description text. Notably it is assumed that GDP and GNI* grow at the same rate past 2025. If you click on the cell of a dropdown box a popup comes up to highlight that it is a dropdown box you selected.

Figure 20: Dropdown for GDP and GNI*



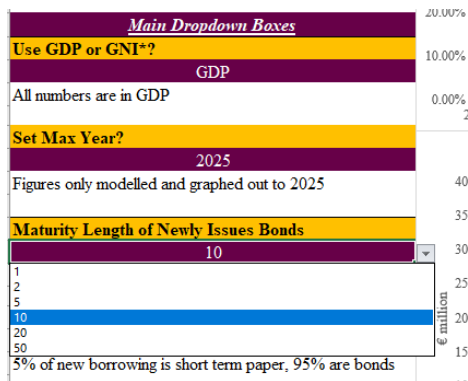
Here you can set the max year that is calculated and displayed. This is especially useful if you want only a shorter time frame graphed or if you only want to use the SPU projections out to 2025.

Figure 21: Dropdown to set max year



Here you alter the maturity of newly issued Government bonds. By default it is set to ten-year Government bonds, though you may wish to see what effect setting it to 2 or 100 years may have depending on interest rate volatility over time.

Figure 22: Dropdown to set new bond maturity



Here you can alter what proportion of new Government borrowing is allocated between bonds and short term paper. By default it is split between 95% ten-year Government bonds and 5% short-term paper which reflects historical trends. You can change the settings to instead use a 100% or 0% short-term paper proportion to bonds if preferred.

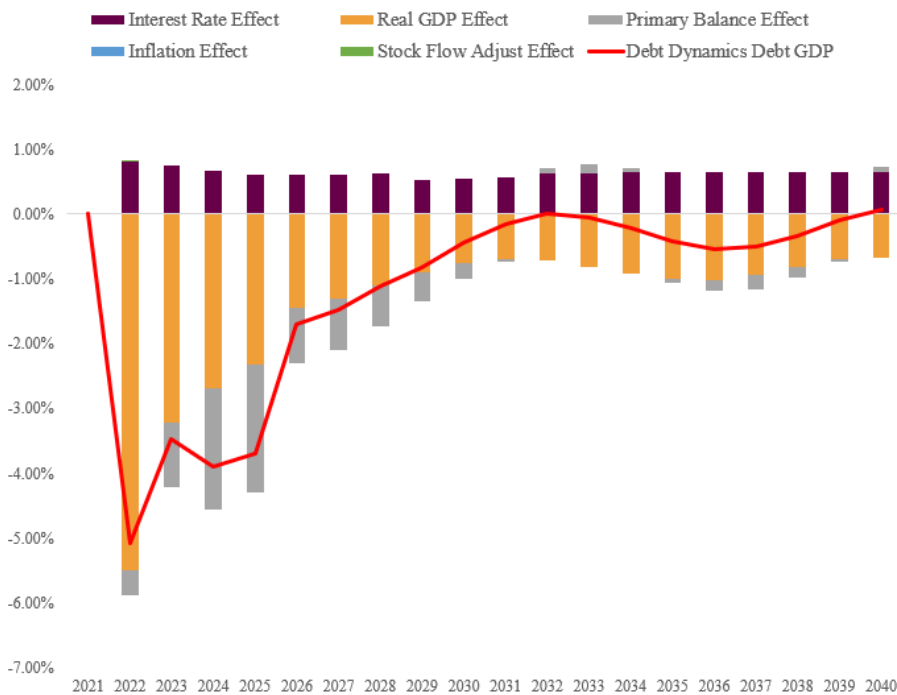
Figure 23: Dropdown to set proportion of new borrowing as short-term paper



The debt dynamic effects show how the changes in the debt to GDP/GNI* ratio can be broken down to their constituent parts and is useful for measuring changes as a proportion of GDP. These are the Interest Rate Effect, the Real GDP Effect, the Inflation Effect, the Primary Balance Effect and the Stock Flow Adjustment.

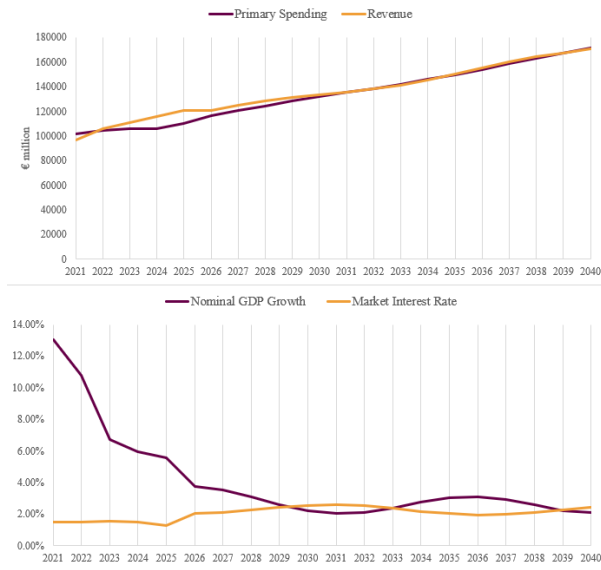
The graph shows that the baseline figures result that in the long-term the proportion of interest rate spending trends towards 0.65% in terms of debt dynamics for the debt to GDP/GNI* ratio. For the 2022 to 2030 period, the reduction in the debt to GDP ratio is largely caused by economic growth rather than a change in interest costs or the General Government balance.

Figure 24: Debt Dynamics Effect on the Debt to GDP/GNI* Ratio



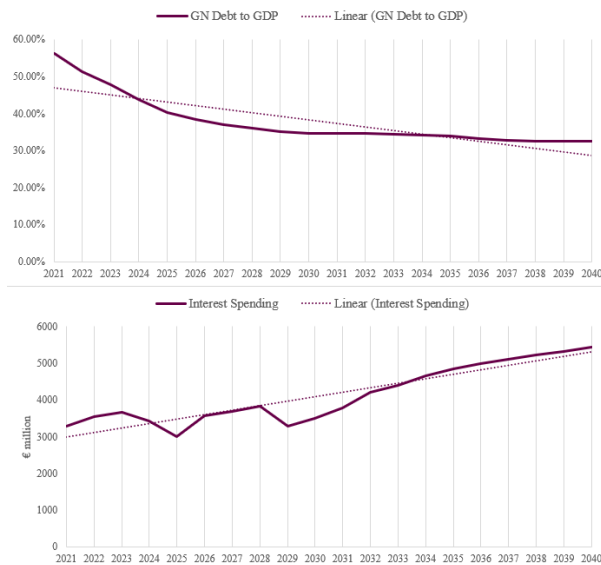
Here are the graphs of the input figures, which is useful for comparing them.

Figure 25: Graphs of input figures



Here are the main output graphs, that of the debt to GDP ratio and the debt servicing cost.

Figure 26: Graph of Debt to GDP and Interest Spending



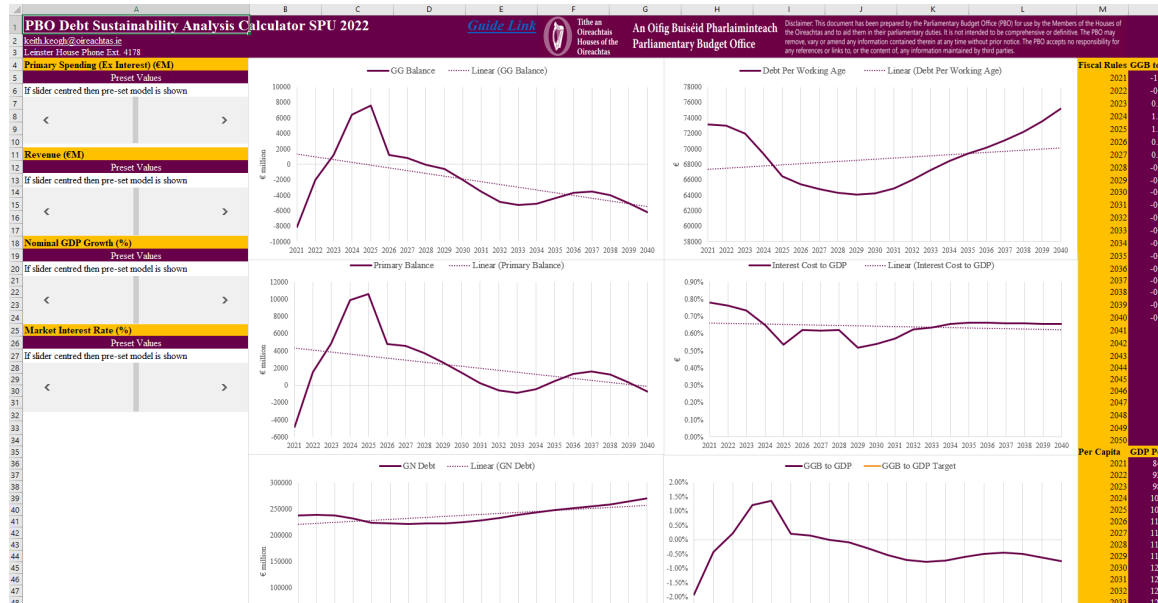
Graph Explanations - DSA Calculator

- Graph 1 displays the primary spending (excludes interest spending) and revenue, this is changed directly by the slider
- Graph 2 displays the nominal GDP/GNI* growth and the market interest rate, this is changed directly by the slider
- Graph 3 displays the gross national debt to GDP/GNI* ratio, this is the primary focus for debt sustainability analysis
- Graph 4 displays the interest spending
- Graph 5 displays the breakdown of the debt dynamics effect on the debt to GDP/GNI* ratio

3.5 - 4 DSA Additional Graphs

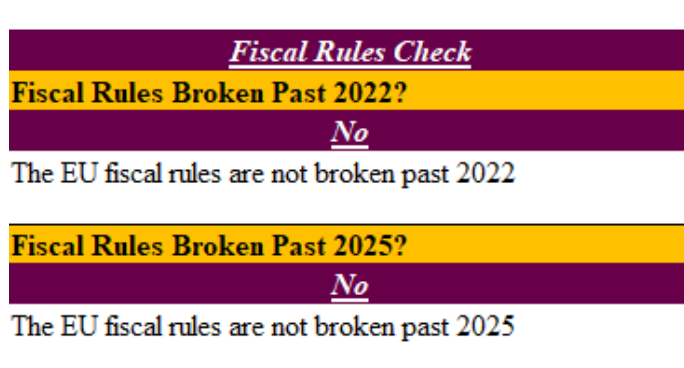
These are additional output graphs and tables of figures from the DSA calculator, though split off to a separate sheet for ease of use. It also contains sliders and the input sliders sync across all sheets. Graphs here include the General Government balance, primary balance, gross national debt, nominal GDP, debt per working age, interest cost to GDP, GGB to GDP (Fiscal Rules) and gross national debt to GDP (fiscal rules).

Figure 27: Page 4 - DSA Additional Graphs



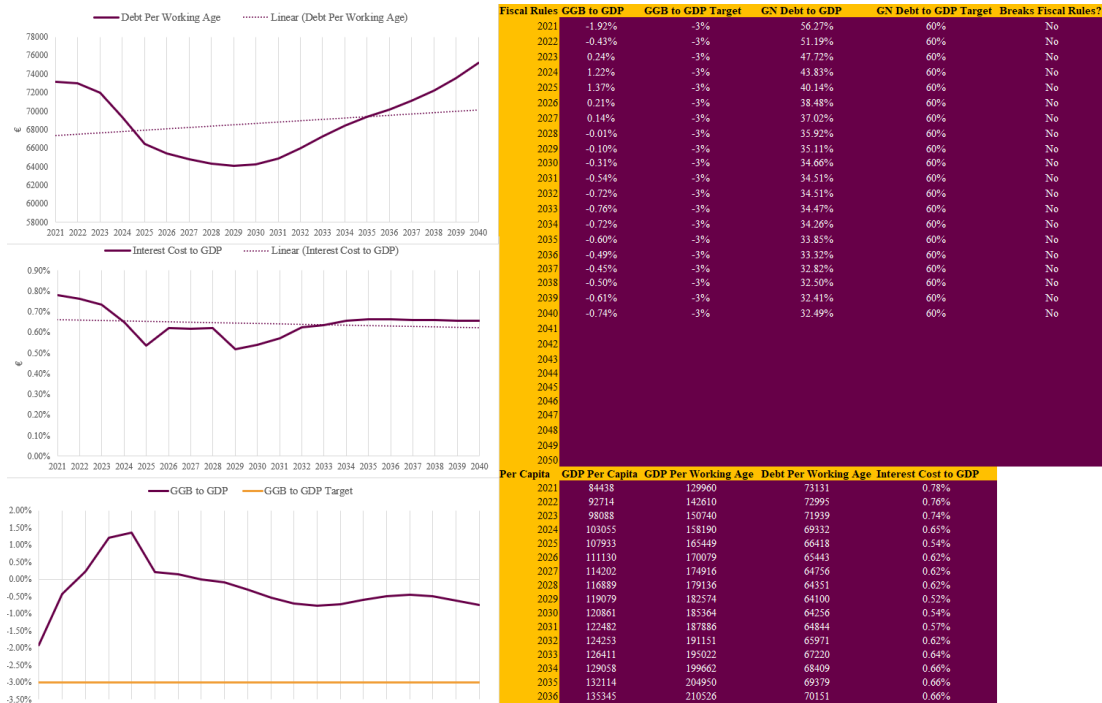
Here is a small box under the sliders to easily check if the core EU fiscal rules are being broken.

Figure 28: Fiscal Rules Check



Here are the additional output figures of the calculator, at the top there are dedicated metrics on Fiscal rules compliance, that of a GGB to GDP target of less than -3% and debt to GDP target of less than 60%. At the bottom are metrics per capita and per working age from the CSO population projection figures, as well as the interest cost to GDP figure.

Figure 29: Additional output figures



Finally, here is the graph of the primary balance and gross national debt, two of the main outputs of the calculator but not graphed on the main page.

Figure 30: Graph of primary balance and gross national debt



Graph Explanations - DSA Additional Graphs

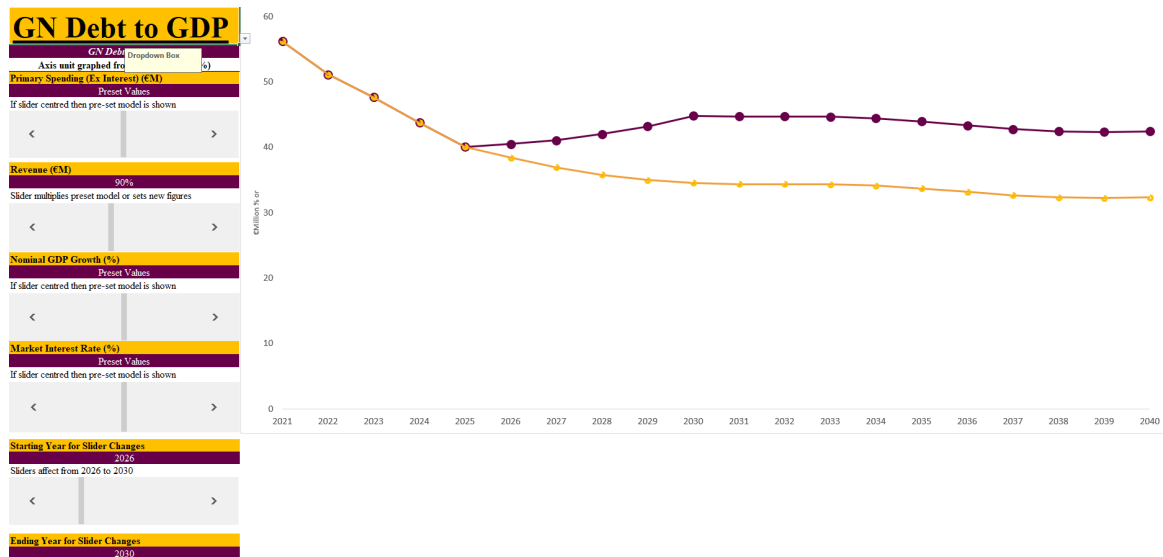
- Graph 1 General Government Balance
- Graph 2 Primary Balance
- Graph 3 Gross National Debt
- Graph 4 Nominal GDP
- Graph 5 Debt Per Working Age
- Graph 6 Interest Cost to GDP
- Graph 7 General Government Balance to GDP
- Graph 8 Gross National Debt to GDP

3.6 Worked Scenario Example

This section contains a hypothetical scenario where the DSA calculator is used to simulate a shock for the years 2026 to 2030. This shock is characterised by a 10% reduction in general government revenue (e.g. this might arise in the event of a significant reduction in Corporation Tax revenues compared to baseline projections).

In the chart below, we can observe the impact of this shock scenario on the debt to GDP ratio.

Figure 31: A shock to General Government revenue for 2026 to 2030



To expand on this scenario, suppose as well the market interest rate was to increase for the period 2026 to 2030, to 4%. Notably the EU fiscal rules would not be broken in this scenario due to Ireland’s high nominal GDP (which we hold constant to the baseline for the purposes of this shock scenario). That being said, in 2030, the General Government deficit to GDP ratio comes close to the 3% threshold set under the EU fiscal rules.

In the chart below, we can observe the impact of this shock scenario on interest spending.

Figure 32: A shock to General Government revenue and market interest rates for 2026 to 2030

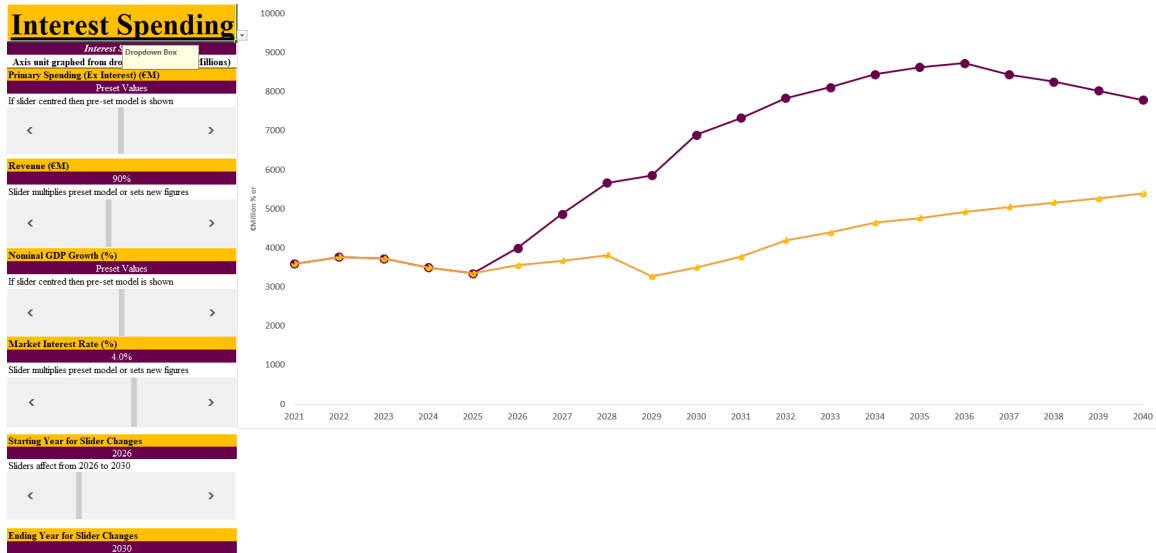
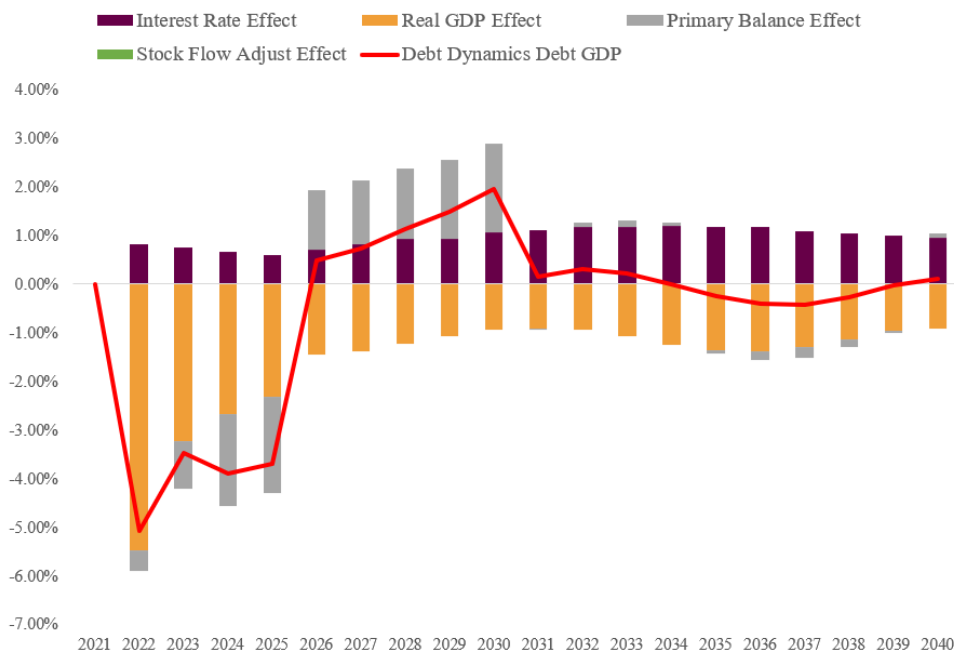


Figure 33: Debt dynamics associated with the shock to General Government revenue and market interest rate



4 Model Assumptions

4.1 General Calculator Information

- The calculator may be best viewed on a large monitor.
- All figures are in millions of Euro.
- To reset the calculator, it is easiest to open and close the calculator.
- Primary Spending is General Government Spending excluding interest costs.
- The dotted line labelled Linear is automatically generated as a linear regression by Excel based off the data.
- A positive borrowing requirement means that the state is beginning to pay off its debt.
- For simplicity, all figures are nominal.
- The baseline figures assume no shocks or black swan events.
- All figures past 2025 for input data are merely placeholders and do not constitute a forecast. In general, forecasts for these figures tend to only be done for the short-term to the medium-term, given the uncertainty involved.

4.2 Input Data Assumptions

- Input figures from 2022 to 2025 are taken from the SPU 2022 for the SPU 2022 calculator.
- The starting debt is taken from detailed end year 2021 NTMA data for the SPU 2022 calculator.
- Debt data is calculated per individual tranche of debt, such as each government bond each having its own interest rate and maturity.
- Interest cost from 2022 to 2025 has a reduction modification factor of around 85%, so as to bring the model figures to be a one to one of the SPU 2022 projected interest rate cost. The gross "National Debt Cash Interest" figures are used.
- All figures past 2026 to 2050 are rough baseline figures and would not constitute a forecast in their own right.
- By default the calculator only shows out to 2040 due to the dropdown option. This is because the graphs tend to be more readable over a shorter period.

4.3 Debt Technical Assumptions

- Once a debt product matures, the principal then becomes a collated part of a new debt item the year it matures.
- All new debt is treated either as a Government bond or short-term paper.
- The model assumes that only one new Government bond is issued a year.
- Short-term uses the market interest rate which changes every year.
- Government bonds use the market interest rate for the year they are issued.
- You can change the proportion of new debt issued as short-term paper and also the maturity length of Government bonds in the dropdown sliders.
- Upon maturity, variable rate bonds, inflation linked bonds and amortising bonds are assumed to become short-term paper rather than be converted to ten-year Government bonds.
- If hypothetically in a given year there is a budget surplus, and hence a negative borrowing requirement, and it is not cancelled out by rolling over debt, the model assumes that the Government would issue out bonds to other Governments, at the market interest rate and with the maturity length set by the dropdown settings. It is not possible for a Government to pay down any debt not matured.
- The model calculates short-term paper separately and assumes that short-term paper will always exist as a proportion of debt.
- For 2022 the model assumes between 5 to 7.5% of debt is short term paper.
- If debt is being repaid due to a Government surplus, short-term paper is paid down in a proportion that short-term paper is issued. For example, if short-term paper is set to be 5% of borrowing, then for a surplus of €100 million, the new bond for that year will be reduced by €95 million and the short term paper will be reduced by €5 million.

4.4 Modelling Technical Assumptions

- The calculator does not model inflation as everything is set to nominal. The GDP deflator is not included in the calculator and is set to zero.
- The Tableau version of the calculator operates under the same principles of the Excel model and would give the same result and be replicated by the calculator.
- The model assumes there is a one to one relationship between the General Government balance and what is borrowed. If there is a deficit of €100 million, then the gross national debt is increased by €100 million. The stock flow adjustment is set to zero for the calculator.
- At its simplest the model deterministically calculates out the amount of outstanding debt, the interest cost and the primary government balance for each year and uses that to calculate out the next year. While by default the model calculates out to 2050, it can be expanded out indefinitely.
- By 2050, roughly in the range of 90% of initial debt has matured to be newly issued Government bonds or short-term paper.
- For the baseline figures, simplistic year-on-year extrapolations are used from 2025 onwards.
- GNI* in the model uses the same growth figure as GDP beyond 2026 rather than having its own separate projection. For 2022 to 2025 GNI* growth is GDP growth by a multiplier to bring it in line with SPU figures for the SPU 2022 calculator.
- For interest it is assumed that it will keep in line with historical trends, with an adjustment factor for time and mild market cyclicity.
- For GDP growth it is assumed that it will converge and fluctuate around 2%, with a strong adjustment factor for time and market cyclicity. Nominal GDP growth in 2050 is assumed to be roughly 2%, though given long term uncertainty it is impossible to say how reasonable this figure would be.
- For primary spending and revenue, it is assumed that Revenue will grow in line with GDP growth. In contrast Primary Spending is expected to grow in line with both GDP growth as well as a weighting to grow by a flat 3% a year in line with historic trends, so as to represent that in a downturn revenue will decrease while spending may not to the same extent, especially due to social spending demands like pensions. Both Revenue and Primary Spending have an adjustment factor of market cyclicity and a trend towards a balanced budget. The weighting for a balanced budget represents that if there is a gross imbalance between revenue and primary spending the Government will raise or cut taxes and spending accordingly.
- For revenue and primary spending, the baseline input data ultimately assumes that the primary balance to GDP ratio trends to roughly around 0%, while GGB to GDP ratio trends towards roughly -0.7%. The baseline input data of the model means that the Debt to GDP ratio plateaus at around 33% after 2030 due to the Government running a permanent small deficit.
- It should be noted that the current input figures of the model result in the Government of Ireland always maintaining a debt to GNI* ratio that is higher than 60% and that after 2030 the debt to GDP ratio stabilises due to a running a continuous mild deficit with a General Government Balance averaging -0.65% of GDP.



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