Technical assessment of the Irish Fiscal Advisory Council's methodologies

Overview

The Irish Fiscal Advisory Council was established to strengthen Ireland's fiscal framework by fulfilling a work programme of analytical tasks in support of domestic budget management and the European Semester framework of the EU Stability Programme. These tasks include: (1) assessing the official macroeconomic and budget forecasts, (2) assessing the fiscal stance of government, (3) monitoring compliance with fiscal rules, and (4) endorsing the official macroeconomic forecasts. This technical assessment informs and accompanies the OECD Review of the Irish Fiscal Advisory Council. It looks in depth at the models and methods used by the Council to assess their suitability under the OECD's technical assessment framework and highlights areas for further development.

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The OECD's technical assessment framework for independent fiscal institutions (IFIs)

The OECD assessed the Council's tools according to the technical assessment framework for IFIs developed by the OECD's Directorate for Public Governance. That framework answers the question: Are the IFI's tools comprehensive and appropriate for delivering its mandate?

To assess whether the tools an IFI has developed are comprehensive, the assessment framework first identifies the range of models required to deliver the IFI's mandate and whether it has met that capacity. The framework then assesses the appropriateness of each tool or methodological decision along seven academic and practical considerations (Table 1). The former challenge whether a tool would hold up to scholarly peer review. The latter challenge whether a tool is fit to serve the pragmatic needs of an IFI's mandate and stakeholders, which can differ considerably from a university economics department in goal, timeframe, and resources.

Table 1: Summary assessment criteria

1.	**Theory**	Does peer-reviewed literature support (or not provide a strong argument against) this tool for the analysis, given the context and available data?
2.	**Accuracy**	Is this tool likely to give the most accurate results (or avoid the most systematic bias) if applied to this problem?
3.	**Communication**	Can the tool's outputs provide a coherent and intuitive narrative to stakeholders?
4.	**Transparency**	Can the tool's methodology and assumptions be provided to the IFI's stakeholders in a manner that will satisfy its requirements for transparency and accountability?
5.	**Resources and continuity**	Does the tool require a level of expertise that is appropriate to expect from IFI analysts to avoid analytical disruptions from staff turnover?
6.	**Precedent**	Is the approach used widely at other IFIs and public finance institutions?

Some criteria are complementary, while others conflict. For example, a significance test may conclude that a variable regarded as a key policy lever or source of risk should be excluded from a forecasting equation (if, for example, it adds more statistical noise than explanatory power). However, budget analysts regard accuracy as just one of their objectives. Budget forecasts are first and foremost a planning tool. Planners cannot adequately assess or communicate alternative policies or scenarios if a model does not capture key policy levers and risks in a convincing narrative, even if including such variables means accepting inferior out-of-sample forecast performance.

Analysts at IFIs must consider these trade-offs and strike a balance when choosing models. For this reason, the review framework does not issue a total score or pronouncement on whether a model is the best tool for the analysis. Instead, the framework weighs the assessment criteria to form an opinion on whether the chosen tool is appropriate or inappropriate for delivering the Council's mandate in the country's context (Table 3). If the review framework concludes that a tool is appropriate but has further

comments and recommendations to bring it in-line with best practices, a qualified opinion will be issued.

Table 2: Assessment opinions

Score	Action
Adverse opinion	The tool is not suited to the task and should be changed as soon as possible.
Appropriate, qualified opinion	The tool is consistent with the IFI's mandate and generally accepted standards for a macro-fiscal framework, but there may be room for the IFI to invest further in the tool to achieve best practice.
Appropriate, unqualified opinion	The tool is appropriate, and no further action is recommended.

The OECD's technical assessment framework is not a line-by-line audit of model code nor a complete model-selection exercise comparing candidate specifications and performing out-of-sample validation. To do so would be beyond the capability of a small group of external assessors in a short timeframe. Further, macro-fiscal forecasting and policy analysis is a human process replete with judgment. A periodic external assessment cannot take the place of an IFI's other legislated channels of accountability. For the Council, this is formal scrutiny by parliament, and informal scrutiny by peers in universities and think tanks, as well as the public. The review will nonetheless identify any models or analytical decisions by Council staff that are not suited to their purpose, fail to advance delivery of the Council's mandate, or do not adhere to the OECD Principles for Independent Fiscal Institutions.

Adapting the framework to the Council's context

IFIs fall across a spectrum of roles and responsibilities. The assessment framework must be adapted for the needs of an IFI's institutional arrangements—that is, the functions defined by its primary and secondary governing legislation, memorandums with government agencies, and the discretionary operating guidelines it sets for itself. The framework must also consider the constraints of the office—its resources and the economic and fiscal data available to it, which will drive model selection.

The OECD used stakeholder consultations and the following main references to adapt the framework to the Council's context, among others:

- *Fiscal Responsibility Act 2012* [Link]
- Stakeholder consultations on Ireland's economic and fiscal context and data limitations
- Memorandum of Understanding Between the Irish Fiscal Advisory Council and the Department of Finance relating to the "Endorsement Function" of the Council under the Fiscal Responsibility Acts 2012 and 2013. [Link]
- Corporate Governance Reports of the Irish Fiscal Advisory Council, including Annual Report and Accounts and Strategic Plans. [Link]
- "*How is the Irish Fiscal Advisory Council Performing? An Independent Evaluation of the First Years of IFAC*" (Jonung, Begg and Tutty, 2015[1]) [Link]
- *Ireland's Fiscal Framework: Options for the Future* (Kopits, 2014[2]) [Link]

Identifying the modelling requirements of the Council's Mandate

The central goal of the Council's governing legislation is to deliver four areas of analysis to support the Irish public finances: (1) Assessment of fiscal stance, (2) Endorsement and assessment of the macroeconomic forecasts, (3) Assessment of budgetary forecasts, and (4) Assessment of compliance with fiscal rules. The Council has structured the four chapters of its twice-annual Fiscal Assessment Report to reflect these areas.

(1) Assessment of fiscal stance. The Council is required by the *Fiscal Responsibility Act 2012* Section 8 (4)(b) to "Provide an assessment of whether the fiscal stance for the year or years concerned is, in the opinion of the Fiscal Council, conducive to prudent economic and budgetary management, including by reference to the provisions of the Stability and Growth Pact."

A fiscal stance consistent with prudent economic management is one that minimises procyclical fiscal policy—that is, it avoids spending cuts and tax increases during downturns and leverages boom periods to build up fiscal space for future crises.

To assess the fiscal stance first requires a view of the business cycle. An IFI's analysts can do so using one of several approaches, or a combination of them:

1. Estimating supply-side potential GDP and comparing it to actual (and forecast) GDP, resulting in the output gap. Potential GDP can be estimated using filtering functions to separate its underlying trend directly, or by estimating the trends of inputs into production such as labour, capital, and productivity and combining them with a production function.
2. Cyclical indicators including principal components analysis or simple statistical time series methods and turning point analysis to separate trend and cycles.
3. Sectoral approaches looking at individual industries and whether they are in expansion and contraction, then forming a view of the economy as a whole.
4. Relying on third-party estimates of the output gap or an independent recession dating committee such as that of the National Bureau of Economic Research in the United States (no such committee currently exists in Ireland).

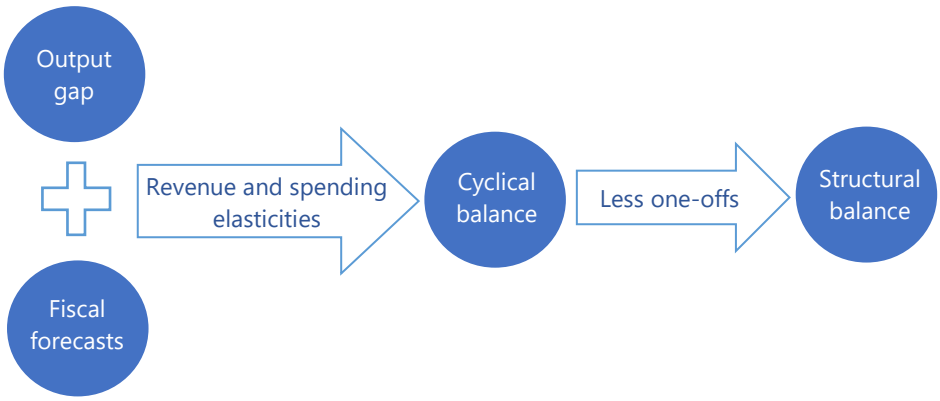
With these estimates of the business cycle in hand, there are then several ways to assess whether a government's fiscal stance is appropriate in its relation to the economy.

1. Simple calculations of the contribution of the government sector to economic growth, typically using government spending on final goods and services within expenditure-based GDP on a quarterly National Accounts basis.
2. Assessments of either the headline budgetary balance or cyclically-adjusted balance (adjusting for one-off policies and other automatic stabilisers, for example lower personal income tax revenues from slower income growth in top tax brackets or higher unemployment benefits from higher unemployment), or the structural balance (adjusting further to remove one-off policies).
3. Models that estimate fiscal multipliers to translate government spending and taxation into an effect on GDP. Fiscal multipliers estimate the ultimate impact of government activity on output, beyond the simple final demand of the government sector in the national accounts. One dollar of government spending or revenue raising may have an effect on GDP greater than or less than a dollar. Fiscal multipliers generally depend on whether there is excess capacity in the economy—that is, they are higher during downturns, and lower during expansions.

4. Models that take fiscal multipliers a step further and use Okun relationships (the relationship between the output gap and employment) to translate individual government programmes into their impact on the labour market (recognizing that not all government borrowing is created equal; for example, a dollar of government spending toward social transfers may have a different counter-cyclical impact than a dollar of foregone revenue from reducing top marginal tax brackets).

The EU's fiscal stance surveillance crucially accounts for the interaction between the cyclical state of the economy and public finances. The rules allow the headline budget balance to fluctuate around a structural measure (adjusting for the cyclical impact of the economy on revenues and social spending and any temporary one-off policies) so that in times when the economy is underperforming, larger deficits are permissible.

The EU analytical framework accomplishes this by combining several modelling components to calculate the following relationship:



Typically, the cyclical adjustment is done using an aggregate budget semi-elasticity which is estimated as a weighted average of individual revenue and spending elasticities.

The Council draws on models to assess the output gap, revenue and spending elasticities, and the cyclical and structural budget to determine if the fiscal stance is problematic under the EU framework.

All of the above assume there are no binding constraints, other than the EU's currency area rules. However, fiscal policy will necessarily be bounded during downturns if there are other constraints. Therefore, modelling capacity to address a more holistic long-run and market-oriented view of the fiscal stance might also include models such as:

1. Long-run fiscal policy and debt sustainability indicators, capturing demographics and long-run public service demand trends
2. Fiscal space assessments, including liquidity assessments such as rollover risk, of particular importance given Ireland's creditworthiness and access to financial markets has been a key issue in the past
3. Financial imbalances and stock-flow consistent macroprudential stress-testing models.
4. Other government performance-based indicators, if for example the Irish government has promised minimum service standards for health care or poverty reduction.

(2) Endorsement and Assessment of the macroeconomic forecasts. The EU framework requires that the medium-term plans and draft budgets of Member States be based on independent forecasts either produced or endorsed by an IFI. The endorsement process is coordinated through a Memorandum of Understanding between the Council and the Department of Finance. The Council posts its assessments of the fiscal plan and endorsement of the macro forecast twice annually typically in June and November, in line with the European Semester.

There are several ways an IFI can assess the official economic and fiscal forecasts of a department:

- Auditing the forecast models, which requires access to the official models, the ability to test different scenarios, and the option to request that the department prepare alternative scenarios under different assumptions.
- Compiling the forecasts of other external forecasters and calculating an average to use as a benchmark to assess the reasonableness of the government's plan.
- Preparing independent benchmark forecasts drawing on in-house models and comparing the results, noting differences, and hypothesizing on potential drivers of those differences.

Outside of verifying the correct application of the EU's commonly agreed methodology for estimating output gaps, the Council has not been empowered under its mandate to directly audit official models and assumptions (although it has some informal exchanges with the department to this end). Instead, it has been envisioned with the responsibility of providing an external assessment based on its own views of the economic and public finances and to promote transparency by encouraging the Department of Finance to publish its models.

Comparing the government's outlook with external third-party forecasts is suitable for headline economic variables such as GDP, interest rates, and commodity prices and the Council does include such comparisons on a regular basis. But forecasters in private sector banks and think tanks generally do not produce or publish sufficient breakdowns of forecasts of the type used in budget planning, which requires individual proxy tax bases such as consumer durables consumption or corporate profits. However, a form of this approach can be done by constraining an in-house model to an external average of GDP forecasts and then using it to calculate a breakdown of tax bases. This may be appropriate for an IFI in its first years, as it builds capacity.

Given its requirements to assess the fiscal stance as well, the Council's best option—and the one it has pursued since its early years—is to prepare its own independent benchmark forecasts. There are many approaches to in-house macro modelling, falling on a spectrum of empirical and theoretical structure with different forecasting and policy analysis performance.

As the Council's core responsibility is to compare the government's planning projections to their own benchmark to assess reasonableness, they are not necessarily required to communicate full forecast decompositions of the year-to-year impact of economic developments, the impact of policy changes, or other structural policy considerations. Communication can then play a lower weight in the overall assessment of a model than an IFI whose forecasts enter the government's plans directly.

They will nonetheless be required, if they do not consider the government's plans to be reasonable, to provide a narrative for the differences and what the government should adjust. The Council is therefore not entirely able to dispense with structural story-telling models. The Council will also need to have outputs that have an internally consistent and intuitive economic and fiscal narrative. That is, tax and spending forecasts must be derived from bases and beneficiaries coming out of

the macro modelling, less the two stories be inconsistent (for example personal consumption rising but VAT revenues falling, all else the same).

(3) Assessment of budgetary forecasts. The Council's mandate does not prescribe that it audits the models of the Department of Finance and the Department of Expenditure and Reform (DPER), but rather that it provides an independent assessment of the official planning provisions. Like the macroeconomic assessment, the Council has chosen to pursue independent benchmarking and scenario analysis to this end.

There is a broad range of models that IFIs use to create independent fiscal benchmarks, including:

- Estimating revenue and spending elasticities and applying them to forecasts of proxy economic bases .This approach is largely macro and backward-looking, using outturn data to estimate the sensitivity of revenues to broad economic developments.
- Estimating and projecting effective tax rates and applying them to tax base forecasts. This approach is largely forward-looking, combining statutory features of the tax system with more granular data on tax bases, deductions, and exemptions to work out a theoretical tax liability, which is then combined with observations on compliance behaviours to determine how much revenue should be expected from the future tax base.
- Using econometric forecasting techniques, both simple univariate time-series models and models with more structure to capture economic drivers and policy lever
- Microsimulation models that, although not designed for forecasting on their own, can be combined with economic growth factors to capture the dynamics of tax base growth on statutory, marginal, and effective tax rates and the implications for overall receipts.
- Using simple growth accounting models or rules of thumb.

The granularity of an IFI's fiscal modelling will depend on the demands of its mandate and its access to data. If, as in some jurisdictions, an IFI is to perform the role of an *ex ante* auditor, promoting responsible policies with a financial impact before money is spent, it would require considerable expertise in the tax code and social benefits laws with detailed accounting and financial statement models. The Council's mandate is instead interpreted by most stakeholders to be targeted at a relatively high level of aggregate fiscal policy scrutiny, rather than being concerned with the details of individual tax and expenditure programmes, which may be left to other institutions such as the Parliamentary Budget Office of the Houses of Oireachtas in its work supporting budget oversight by legislators. That said, given the tendency of specific programmes like health expenditure and individual hospitals to drive aggregate results, granular analysis is unavoidable in capturing a clear picture of Ireland's public finances and interactions with the economy.

(4) Assessment of compliance with fiscal rules. The *Fiscal Responsibility Act* requires the Council to serve as an independent arbiter of whether the government is complying with the two rules specified in the same act: the Debt Rule and the Budgetary Rule.

The Debt Rule is straightforward—when general government debt as a share of GDP exceeds 60 per cent it must be reduced until it returns to the ceiling, at an annual rate laid out according to a formula in the Stability and Growth Pact equal to around $1/20^{th}$ of the excess. Compliance with the debt rule can be assessed in a spreadsheet.

The Budgetary Rule is more complicated. It requires that the budget be balanced on a structural basis—that is, adjusted to reflect the state of the economy—with any shortfall corrected through

an adjustment path converging toward a medium-term objective. Adjusting the balance to account for the economy requires adjusting certain revenue and expenditure categories by their sensitivity to the business cycle as measured by the output gap. The Act does not specify the method by which the output gap is to be calculated in arriving at the structural balance estimate for the domestic Budgetary Rule, leaving the Council free to use its own methodology. However, the Council still uses the EU's Commonly Agreed Methodology when looking at what may be required by the EU's fiscal rules.

The Council also provides the official opinion on whether non-compliance is the result of exceptional circumstances outside the government's control, such as a severe economic downturn or the COVID-19 pandemic.

With the modelling demands of the Council's mandate identified, the framework can assess whether the level of effort and resources required to develop and maintain a model are proportionate to the modelled activity's importance to the IFI's mandate and the overall public finances.

The office's four activities can be mapped to five model requirements (Table 3). The Council has the greatest demand for a business cycle model and benchmark fiscal forecasting model, which are used across three of its four core activities. This is an imperfect assessment of the demands, as there is considerable interaction between all models. For example, benchmark macro forecasting models are required for many measures of the business cycle, and fiscal benchmark models serve as inputs to macro benchmark models.

Table 3: Activities and models

Assessment of Fiscal Stance	• Business cycle model (output gap and recession dating) • Fiscal and economic interaction (fiscal feedback) model • Benchmark fiscal forecasting model
Endorsement and Assessment of the Macroeconomic Forecasts	• Benchmark macro forecasting model • Business cycle model (output gap and recession dating
Assessment of Budgetary Forecasts	• Benchmark fiscal forecasting model
Assessment of Compliance with Fiscal Rules	• Benchmark fiscal forecasting model • Business cycle model (output gap and recession dating) • Structural budget balance model

Adapting the individual model criteria

1. Theory

This criterion asks whether a tool is grounded in a bedrock of peer-reviewed literature and would hold up to academic scrutiny. Although there is rarely a consensus on the theoretically 'best' approach for a given macro-fiscal procedure, there are often approaches that are rejected in certain contexts, for reasons such as poor performance with small open economies, limited low-frequency data with small sample sizes, or that have been shown to be fundamentally flawed (for example certain regression specifications with nonstationary data).

Ireland is a small, open economy, with the following features:

- Ireland's integration with the global economy is among the highest in the OECD.

- Ireland suffered from a severe banking and real economy crisis beginning in 2008 related to an absence of macroprudential regulation, financial and real estate asset bubbles, and speculative capital inflows followed by flight.
- Ireland's economy continues to face distortions from foreign-owned multinational enterprises.

The open nature of the economy and influence of large multinationals leads to volatile swings in GDP. This in turn makes the output gap (a measure of boom and bust calculated as the deviation of actual output from its trend) particularly challenging to estimate. These conditions will favour models that restrict the range of outcomes by imposing assumed values for key parameters such as models with Bayesian features or by using model suites that average the results of several techniques and typically perform better, primarily by reducing outlier forecasts.

Because of the volatility of GDP, it is also common among economic forecasters and commentators in Ireland to focus on measures of domestic Gross Value Added (GVA) and modified Gross National Income (GNI*) rather than GDP as the key output for potential output and the output gap. Indeed, the Council has played an active role in supplying analysis and participating in working groups to develop and promote this practice.

Ireland has been through a tumultuous period of volatile public finances, providing a challenging data history for budget planning (Jonung, Begg and Tutty, 2015[1]). Features of Ireland's public finances include:

- Ireland suffered from a fiscal crisis beginning in 2008 and entered a bailout programme by the IMF and EU in 2010. It exited the IMF programme at the end of 2017.
- Ireland is subject to the Stability and Growth Pact of the EU. The Commonly Agreed Methodology for fiscal surveillance has proven to be problematic for estimating Ireland's structural budget.
- Fluctuations in the annual budget, particularly unexpected outcomes, are largely driven by health expenditure, particularly hospitals.
- Ireland's public finances have a history of procyclicality: expansionary in good times and cutbacks in bad times.
- Ireland has volatile tax receipts, particularly corporation tax from multinationals. This makes past monthly history of limited use for common statistical time series methods used by peers.
- One-off factors are a source of uncertainty for estimating structural budgets, most recently related to support for firms for Brexit.

Theory is operationalised with data. High-frequency data can facility a greater range of models, particularly systems models such as VARs and ECMs with many lags in their specification and dynamic factor modelling. Low-frequency data is more restrictive, requiring greater assumptions about parameters and structure, which may not be able to be estimated because of small sample sizes, favouring simple approaches.

Economic data in Ireland presents some limitations, with modern quarterly national accounts data only back to 1995. Some higher frequency monthly business indicators are available that make short-run factor modelling possible. Macro monitoring of fiscal policies, including that conducted by the European Commission, is based on national accounts-based Government Finance Statistics, specifically SNA2008/ESA 2010, as well as monthly exchequer cash receipts received from the government.

Ireland is also introducing accrual public sector accounting practices and International Public Sector Accounting Standards (IPSAS) in the coming years. This reform programme will need to be considered

in the Council's work stream and will have significant implications for the skillset and models required to assess the budget and public finances.

Overall, the availability of economic and fiscal data in Ireland is comparable to other OECD countries, and the Council generally has the data it requires to deliver its mandate. However, some shortfalls have been flagged by the Council and stakeholders that guide its model choices and restrict some aspects of analysis. These include:

- The Revenue Commissioners provide limited information in key areas, with some limitations that prevent granular tax modelling.
- There is a lack of data on health spending, particularly lower-level hospital administration, which is a significant driver of the public finances.
- There is no data available on private health insurance.
- Data quality and availability on public pensions can be inadequate.
- There are ongoing transparency problems in areas that fall outside of Exchequer reporting such as the activities of non-commercial semi-state bodies and extra budgetary funds such as the Irish Strategic Investment Fund.

For fiscal forecasting, model selection will be somewhat more flexible, as there is some higher frequency exchequer and administrative data available, either sampled or from the universe of administration files or central revenue fund reports. For example, monthly statistics are available for most tax and spending series. However, the tax bases and economic determinants are generally quarterly. Therefore, monthly they can only be modelling using univariate statistical time series methods. Further, monthly financial series are preliminary and revised or adjusted with year-end accounting provisions, often having a poor relationship with final audited accounts.

2. Accuracy

This criterion draws on academic research and practitioner experience to determine whether a chosen tool is likely to be more accurate compared to other model options for the application. The framework also considers the IFI's model selection performance tests and forecast assessments where available in published research papers or provided on background.

The Council's mandate is to assess official analysis, rather than provide a fully specified model of the taxation and spending policy system as an independent basis for budget planning purposes. That is, the Council is not required to include structure for policy analysis in its forecasting models. Its model selection choices can therefore be more heavily weighted toward capturing time-series dynamics to minimise forecast errors and pursue forecast accuracy as its principal objective, even employing unconditional forecasts as benchmarks.

3. Communications

This criterion measures how easily the model and its results could be explained to stakeholders. Models that are simple, causal, and intuitive for non-specialists to interpret will score highly. Those that describe behaviour using univariate time-series methods or a black box of latent, or unobservable, forces inferred by the co-movement of many stochastic series (e.g. dynamic factor models) will score poorly.

The Council regularly appears before the Oireachtas. Council members and senior representatives from the secretariat appear most commonly before the Dáil Committee on Budgetary Oversight Joint Oireachtas Committee on Finance, Public Expenditure and Reform to discuss its Fiscal Assessment Reports shortly after publication. The Council also appears before the Joint Oireachtas Committee on European Affairs. Committees engage with the Council's reports in carrying out ex-ante and ex-post scrutiny of fiscal policy, macro developments, and risks.

The Council also has several other regular users of its products:

- Credit rating agencies rely on the Council's analysis in assessing the government's ability to pay back its market debt instruments, ultimately informing their decision on whether to upgrade or downgrade the country's rating.
- Private sector bank forecasters rely on the Council's fiscal analysis in benchmarking their own economic and fiscal analysis and in providing internal and external advice on portfolio allocations and central bank interest rate movements.
- Think tanks such as ESRI use the Council's analysis as benchmarking their own analysis and as inputs and assumptions driving their policy analysis.
- The European Union uses the Council's analysis in their surveillance programmes as part of the European Semester.
- Academics in the Irish university community.

The Council regularly presents its models at well-attended annual conferences it hosts. It also presents its analysis at conferences and workshops in Ireland and abroad hosted by the Irish Economic Association, the European Commission, the EU IFI network, and the OECD PBO Network, among others.

Although benchmark forecasting is its focus, the Council must nonetheless be prepared to defend its forecasts and credibly portray a convincing story to the legislature and other users of its products.

4. Transparency

This criterion measures how readily a model's inner workings could be published so that its results could be repeated by an external researcher, to the extent required by the IFI's legislation and operating guidelines and the degree to which the institution strives to conform to international guidelines on IFIs and budget transparency. Models of which the IFI has full intellectual ownership and understanding, that use open-source software, and that rely on little judgment, or at least structured judgment that can be readily published, will score highly.

The Council has no explicit requirements in its mandate, but values transparency in its own operations. Further, the OECD Recommendation of the Council on Principles for Independent Fiscal Institutions describes IFIs as having a "special duty to act as transparently as possible." The OECD Recommendation also states that a full account of the underlying data and methodology of reports and analysis should be published. While there is some flexibility on what this means, at the minimum it should mean data sources and sufficient descriptions of model equations so that a sophisticated analyst could recreate the work approximately, including the main areas of judgment that have been applied.

5. Resources and continuity

This criterion measures how readily a model can be maintained by the IFI's permanent staff and be handed to new or junior analysts in the event of staff turnover. Sophisticated and idiosyncratic models that require a highly specialised doctoral skillset and are likely to fall into disrepair if a key developer is no longer available to maintain it (and cannot be readily replaced) will score poorly. Models with a simple approach that use widely familiar techniques and software will score well. The criterion also asks whether modelling efforts have a sufficiently high return on investment—that is, if the underlying activity is volatile and largely unknowable, it would not be prudent to invest a great deal of resources in a sophisticated model.

One of the greatest communications challenges an IFI faces is persuading its stakeholders that its analysis is credible when there have been significant breaks and discontinuities because of changes to modelling approaches or staff turnover.

IFIs typically have a small staff with few resources compared to their peer groups at finance ministries and central banks. For their analysis to be manageable and sustainable, their choice of models should reflect this.

The Secretariat is among the IFIs with the fewest staff, with only five analysts: a Chief Economist, two economists, and two research assistants.

Table 4: Analytical resources 2020

Chief Economist/Head of Secretariat	1
Economist(s)	2
Research Assistant(s)	2
Total	5

In addition to staff numbers, staff experience and academic backgrounds are key for modelling decisions. Some IFIs are large enough to have dedicated innovation units with PhD economists seconded as in-house experts. Sophisticated models would be appropriate in their hands to maintain. For other smaller offices, there often needs to be an element of realism in matching models to analysts, and simpler approaches may be more appropriate. For now, the Council appears able to maintain top talent, due in part to the flexibility it offers for pushing modelling boundaries, publishing working papers and submitting to academic journals. Further, its expert Council and relationships with Irish universities offer a backstop of expertise. Nonetheless, the Council should be wary of relying on highly capable super-analysts to shoulder most of the analytical burden. Gearing the level of sophistication of its models to the typical competencies of an experienced practitioner economist would leave it less exposed to staff turnover.

6. Precedent

This criterion assesses whether other IFIs and research divisions in finance departments and central banks use the modelling approach for the same application. That a model is common does not mean it is appropriate; however, a widespread technique can reassure an IFI's stakeholders that they are receiving similar analysis as stakeholders in other jurisdictions.

The OECD's technical evaluation framework uses the knowledge gained through the OECD's various IFI and budget official networks and its previous IFI evaluations as useful benchmark comparisons of modelling capacity. The OECD has compiled a database documenting model selection and procedures at a wide variety of IFIs across different regions and fiscal frameworks and institutional arrangements.

Appropriate international benchmark institutions corresponding roughly to the Council's budget and mandate include the Swedish Fiscal Policy Council and the Hellenic Fiscal Council. Benchmark IFIs with greater resources include the Independent Authority for Fiscal Responsibility (AIReF) in Spain, the Portuguese Public Finance Council (CFP), and the Office for Budget Responsibility (OBR), although the OBR's mandate is much broader than the Council's.

Other institutions in Ireland also provide useful benchmarks, operating within the same economic and fiscal data environment. These include the Central Bank of Ireland, the Department of Finance, DPER, and the Economic and Social Research Institute (ESRI) think tank.

Assessment results

Comprehensiveness

As Table 4 shows, the Council has a large suite of tools devoted to endorsing and assessing the official macroeconomic forecasts with considerable effort and expertise going into developing a wide range of benchmark models. As the Council approaches a ten-year work programme of successfully building the office's modelling capacity, it can now look at consolidating and streamlining its macroeconomic suite of models, rounding out the modelling capacity across work streams, with a focus on analytical continuity and lessening the role of senior super analysts.

In particular, the Council can look to building greater capacity for assessing the budgetary forecasts for compliance with budget rules. The Council will require capacity for greater fiscal scrutiny in the coming years, particularly as the Irish government adopts accrual accounting and international public accounting standards in its financial reporting. Further, the government's greater use of balance sheet expansion and loans and guarantees through quasi-government entities to combat the economic hardships of the COVID-19 crisis will require closer monitoring at a granular programme level.

The Council could look at investing in additional fiscal modelling capacity such as:

- Better capturing the effect of the economic cycle on incomes taxes through determinants such as earning growth, employment, and hours worked provided by the macro model
- More granular modelling of each source of income that is subject to different tax regimes, such as self-employed, investment income and capital gains.
- Capturing more features of the tax code such as loss carry forwards for Corporation Tax, consumption shifts between zero-rated (necessities) and standard-rated (consumer durables) VAT goods, or secular trends in consumption for excise taxes such as the decline in smoking habits.
- Better capturing changes to the income distribution, the progressivity of the tax code, and fiscal drag using survey microdata from the Survey of Personal Income
- More detailed in-year estimate modelling using monthly data
- Capturing the behaviour of high-income taxpayers using an ad-hoc satellite model that uses the latest academic research on the mobility of taxpayers, income-shifting, and tax-motivated incorporation.

Table 4: Mapping individual models to the Council's four main activities

(1) Assessment of fiscal stance	(2) Endorsement and assessment of the macroeconomic forecasts	(3) Assessment of budgetary forecasts	(4) Assessment of compliance with fiscal rules
1. Suite of output gap models	1. Benchmark economic modelling	1. Benchmark fiscal models	1. Suite of output gap models
2. Maq risk model	2. Large Bayesian VAR (LBVAR)	2. Descriptive statistics and scrutiny of assumptions	2. Principles-based Approach spreadsheet
3. Fiscal feedbacks model	3. Suite of output gap models		3. Replica of European Commission's fiscal rules spreadsheet
	4. Nowcasting models		
	5. Heat map for monitoring imbalances		

Individual model assessments

The technical assessment concluded that each of the Council's tools are appropriate for its analysis. A summary list of the Council's tools and the OECD's assessment is provided in Table 5. A full breakdown of each criteria's outcome and discussion for each model has been provided in the appendix.

Table 5: Individual model conclusions

Model	Description	Opinion
Benchmark economic modelling	Suite of quarterly time series forecasting models, mainly estimated separately as structural error correction models constrained to national accounting identities, for endorsing macroeconomic forecasts.	Appropriate
Large Bayesian vector autoregression model.	Statistical time series estimated using a dataset of 47 variables for endorsing macroeconomic forecasts.	Appropriate
Suite of output gap models	Range of statistical filters, production function, and cyclical indicators used for the endorsement of macroeconomic forecasts and assessment of compliance with the domestic budgetary rule.	Appropriate
Fiscal feedbacks model	Spreadsheet-based macro-fiscal feedback loop tool to capture interaction between macro and fiscal modelling and ensure consistency between the Council's macro and fiscal assessments.	Appropriate
"Maq" stress testing	Small-scale macro model (32 equations: 5 behavioural and 27 identities) with calibrated fiscal multipliers for assessing the fiscal stance and applying stress tests.	Appropriate
Nowcasting models	Time series statistical forecasting model with Bayesian features focusing on underlying domestic demand and its components (personal consumption, government consumption, and investment excluding aircraft and intangibles).	Appropriate
Heat map for monitoring imbalances	Descriptive statistics, benchmarks, and comparison of trends over time.	Appropriate

Fiscal benchmarking	Policy-adjusted elasticity estimates applied to economic tax bases from the Council's forecasting suite.	Appropriate
Budgetary rule assessment spreadsheet	Simplified methodology for assessing compliance with the domestic budgetary rule by adjusting the budgetary balance for the business cycle using aggregate budgetary semi-elasticities.	Appropriate
Long-term fiscal sustainability modelling	Cohort-component model for demographic projections, production function with capital and labour for long-run steady-state growth (GNI*) projections, prices, and wage growth. Official fiscal medium-term outlook (extended by the Council from 2022 given the unique circumstances of the most recent Stability Programme update which only had two years, 20201-21) linear convergence from medium-term outlook (which the Council calls short term) to long-term modelling, revenue constant as a share of GNI*, spending varies with demographic-driven beneficiaries.	Appropriate

On **theoretical justification**, the Council's approaches have a firm basis in the economic and forecasting literature and would hold up well to academic peer review given the modelling context. The models are supported by well-developed working papers that detail extensive supporting literature and provide a strong evidence base for their use.

The Council's suite of macroeconomic models and stress tests are appropriate for its mandate and institutional decision to pursue in-house benchmarking as the main path to assessing the official outlooks for reasonableness. Both structured econometric approaches and unstructured statistical approaches such as Bayesian vector autoregression are used. Theory suggest that the partial error correction modelling suite and model combination/averaging is well suited for benchmark forecasting.

The Council's fiscal forecasting benchmarks are prepared using high-level revenue elasticities applied to economic proxy bases. This approach has a firm justification in the literature and international best-practice guidance; however, it is only one approach of many that are typically tried and tested. Other approaches include effective rates models and structural econometric models.

On **accuracy**, the Council's reliance on suite modelling and averaging for its macroeconomic benchmarks has been demonstrated to greatly increase accuracy in Ireland's challenging modelling environment. It is likely to continue to do so in the future.

Often a model's predictive value comes not from the model's unconstrained output itself, but the framework it provides for generating discussion and debate. In this spirit, the suite of many different approaches the Council uses to produce its macro forecasts are likely to foster productive discussions and challenge meetings and improve overall accuracy. That said, the level of diversity and sophistication in the Council's models could also hinder the challenge process: if models are diverse and complex to the point that only its authors understand the results, it may limit productive debate. Simple approaches, with more eyes and voices involved in the process can act as a check on any one individual's tuning and judgment.

The Council's fiscal forecasting revenue elasticities applied to economic proxy bases approach is suited to the Council's mandate as many stakeholders interpret it: high-level aggregate fiscal analysis concerned principally with the interaction of fiscal policy with the macro economy. However, unlike many economic forecasting applications, capturing more structure in public finance models can improve fiscal forecasting accuracy even from a macro lens. The Council has identified considerable bias in the

Government's forecasts as well as its own (although it has improved upon the Government's results). For example, the elasticity approach tends to over-predict then under-predict Corporation Tax following a recession. While the council has undertaken a more sophisticated elasticity estimation approach to attempt to improve upon these biases, they may be better addressed by more structural econometric modelling that incorporates defining characteristics of underlying tax law and tax bases. For example, a Corporation Tax model that includes a term for corporate loss pools that companies can carry forward and apply against future profits could capture when those loss pools are exhausted, leading to a significant rebound in tax receipts that would be missed by a more blunt elasticity approach. Similarly, a VAT model with greater structure capturing effective rates on consumer expenditure shares, input tax credits, and compliance and enforcement activities may be better able to anticipate the shift in revenues from luxury goods subject to a high standard rate of VAT to zero-rated basic necessities during a recession. The Council may benefit from exploring such options.

On **communication**, the Council's focus on benchmarking using suites of models and averaging is likely to make communicating precise drivers of changes between forecasting rounds somewhat difficult, as models could have conflicting narratives. Consistency between macro and fiscal modelling may also suffer by using model averaging as macro inputs. The reliance on high-level tax elasticities applied to bases for fiscal forecasting also allows little consideration of underlying micro developments in the movement of large sources of tax revenue. But given the Council's appropriate focus on benchmarking as a means of assessing reasonableness of forecasts, communications considerations do not take a large weight in the overall model pipeline design. The Council's main role is not to provide policy simulations or tell stories for decision makers, but rather to assess and endorse the reasonableness of assumptions. Its models are well-suited as purely forecast-driven benchmarks for reasonableness against the Government's more policy-driven models. Testing various scenarios of different assumptions is complicated by the suite of models approach, but remains possible, as demonstrated by the Council's recent COVID 19 analysis.

On **model transparency**, the Council leads its international peers in producing polished, journal-quality working papers for each of its main models. The papers include not just stylised equations but also in many cases the parameters and model estimation information that would easily allow outsiders to recreate the results. Further, the Secretariat is willing to engage with interested outside analysts to share code and assist further with replicability. The Council's transparency practices generally exceed those of many other IFIs. However, a clear picture of the Council's modelling workflow in relation to its mandate and each model's link with working papers would be difficult given the organisation of information available online. As mentioned earlier, this could be remedied through an additional explainer or table linking models to their mandate motivation and working papers on the Council's website. Where publication of assumptions or code is not proactive, the Council could be more explicit in stating its willingness to provide additional information.

On **resources and continuity**, the Council's diverse and sophisticated approaches could leave it exposed to the loss of any one senior secretariat member. The available pool of experts in Ireland who could step in to maintain the current suite of models is limited to the point of potentially threatening the ongoing viability of the Secretariat's work. The current suite was an appropriate exercise in building the Council's capacity and exploring approaches, and the Council's analysts should be commended for their efforts. But now, as the Council has reached a level of maturity, it would be appropriate to consolidate approaches, look at simplifications and streamlining where possible, and to focus on business continuity. The Council could even proactively look at building the talent pool by incorporating practical modelling sessions into its annual conference or by participating in temporary exchanges with

government analysts as a way of both developing capacity in departments and building the talent pool.

On peer **precedent**, the suite of partial macro models approach is not widely practiced (large-scale macroeconometric models with Keynesian short-run dynamics and supply side driven medium-run dynamics are the most common); however, this is largely because many other IFIs are constrained to structural systems modelling because of requirements for policy analysis and for providing narratives to stakeholders. The Council's high-level elasticity methodology for forecasting tax revenues is common at other institutions as one approach among many, with other IFIs also relying on bottom-up methodologies using effective tax rates, structural econometric methods, or time series autoregressive integrated moving average methods. The elasticity method is common among Irish institutions such as the Department of Finance.

Conclusion

The review framework concluded that each of the Council's tools are appropriate for producing macroeconomic and fiscal benchmarks and assessing the fiscal stance and fiscal rule compliance of Ireland's budget given the Council's mandate and the context in which it operates.

The Council's overall balance of modelling is tipped heavily in favour of assessments of macroeconomic forecasts, although its mandate is spread more evenly between macro and fiscal analysis. Now that it has explored many different tools and approaches to macro analysis, it could therefore consider consolidating its approaches and shifting resources into further developing its fiscal analysis. Moving beyond elasticity approaches and capturing more detailed policy elements could improve forecasting performance and offer a useful alternative to the elasticity-based forecasts of the Department of Finance that have shown consistent bias. The value of more structural policy modelling has been shown in the Council's recent work on the Pandemic Unemployment Payment and Temporary Wage Subsidy Scheme.

Where the Council excels

- The Council uses model combinations well, employing suites of models to tackle Ireland's volatile economic data. The Council's research has influenced the work of the Department of Finance, DPER and others.
- Because government forecasting for fiscal planning relies in part on structural modelling to achieve objectives such as communicating consistent narratives to the public and providing alternative policy simulations for decision makers, it is useful to have the Council's external voice testing the outlook with models and methods geared toward purely forecasting specifications.
- The Council stands out among IFIs in having academic journal-quality working papers to support virtually every model in use. Further, the documentation is highly transparent with full equations, and even estimated parameters and statistical test results.
- The Council's model suite has excelled during the uncertainty of the COVID-19 pandemic, providing useful scenarios during a gap in official analysis.

Areas for future consideration

- The Council may wish to consider streamlining its diverse range of macro forecasting models to invest in fiscal models for a better distribution of analytical capacity across its mandate.

- The Council could invest in models that capture more aspects of the tax code, such as loss carry forwards for corporation tax and separate standard-rated, exempt, and zero-rated sectors for VAT. These approaches could limit the bias observed in both the government and Council's forecasts coming out of recessions.
- As the government introduces International Public Sector Accounting Standards, the Council will require building greater capacity in public sector accounting and financial statements analysis and more granularity in its fiscal modelling.
- The Council could consider presenting more detailed cyclically adjusted budget balance calculations explicitly showing how individual revenue and expenditure items are driven by the output gap—that is, using individual tax base and unemployment benefit elasticities rather than an aggregate budgetary balance semi-elasticity.
- Although the Council presents a snapshot of fiscal gap summary statistics (the immediate and permanent reduction in spending or increase in revenues that would be required to return debt to the same ratio of GNI* at the end of the projection as at the beginning), it may benefit from putting greater emphasis on such summary statistics as a communication device and promoting them as a barometer of the government's future efforts toward fiscal sustainability.

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Appendix: individual model assessments

Benchmark economic modelling

Type	Suite of time series forecasting models, mainly separately estimated structural ECMs, national accounting identities
Description	Quarterly models run biannually in advance of the endorsement of the Department of Finance and DPER's macroeconomic forecasts in Spring and Autumn. Inputs updated with Datastream and other domestic data sources, mainly Central Statistics Office and Central Bank of Ireland. Estimated from Q1 1995 (Q1 1998 for labour market data and Q1 1999 for income data) and forecast to T + 5 years.
Mandate justification	Assessment and endorsement of macroeconomic forecasts
Outputs	Detailed expenditure-side forecasts of GNP in current and constant prices by components. Labour market and incomes forecasts, inflation and core inflation forecasts, and modified gross national income and modified current account forecasts. Used as inputs to the Council's supply-side models.
Working papers	https://www.fiscalcouncil.ie/wp-content/uploads/2015/03/Producing-Short-Term-Forecasts-of-the-Irish-Economy.pdf
Reports	Fiscal Assessment Reports: https://www.fiscalcouncil.ie/fiscal-assessment-reports/
Key judgments	Following initial estimation and based on consultation with the Council and external forecasters (e.g. see footnote 20 describing the Secretariat's interactions with external forecasters and statisticians) https://www.fiscalcouncil.ie/wp-content/uploads/2019/06/FAR-June-2019-Chapter-2-Endorsement-and-Assessment-of-the-Macroeconomic-Forecasts-.pdf
Software	Eviews and Excel
1. Theory	Good. ECMs are the gold standard of macroeconometric modelling. Suited to twin goals of capturing data and dynamics with enough structure to trace effects of policies and shocks.
2. Accuracy	Good. Because of its theoretical underpinnings and reliance on medium-run equilibrium conditions (closing of the output gap) and use of levels and dynamics via error correction models, these models are likely to improve upon naïve forecasts for the medium run.
3. Communication	Good. This type of macroeconometric modeling can produce coherent, intuitive narratives in-line with economic theory. Coefficients and directions are meaningful.
4. Transparency	Good. Equations provided, complete with parameters and statistical test tables. Detailed data and sourced. Could be replicated by an experienced external analyst. That said, judgment plays a significant role in tuning and combining the models and introduces some obscurity.
5. Resources and continuity	Fair. Once developed, experienced analysts with a degree in economics or a numerate field could support and run the models. Maintenance and development are likely to require a PhD economist or analyst with an MSc-level background and equivalent experience.
6. Precedent	Good. The Council's suite of benchmark economic models is somewhat comparable to large-scale IS/LM and supply-side structural econometric models, but with better forecasting properties and arguably more suited to benchmarking. Large-scale macroeconometric modelling is the most common at other IFIs and institutions in Ireland (COSMO, for example, at the Central Bank of Ireland, Department of Finance and DPER, and ESRI).
Verdict	Appropriate, unqualified. The tool is appropriate, and no further action is recommended.

Large Bayesian Vector Auto-Regression (VAR)

Type	Statistical time series
Description	LBVAR estimated using a dataset of 47 variables from Q1 2000 to Q4 2018.
Mandate justification	Assessment and endorsement of macroeconomic forecasts
Outputs	Employment growth, personal goods consumption growth, others macro variables.
Working papers	https://www.fiscalcouncil.ie/wp-content/uploads/2020/09/Forecasting-Irelands-Macroeconomy.pdf
Reports	https://www.fiscalcouncil.ie/wp-content/uploads/2019/11/FAR-Nov-2019-Box-F-Using-a-Large-Bayesian-VAR-for-short-run-forecasting-of-Ireland%E2%80%99s-macroeconomy.pdf
Key judgments	Significant assumptions imposed on parameters. Considerable tuning of results.
Software	R
1. Theory	Good. Sargent and Sims promoted VARs as an alternative to large-scale macroeconometric models. They criticised macro models for the strong assumptions they imposed on the dynamic relation between macroeconomic variables and for not accounting for the forward-looking behaviour of economic agents.
2. Accuracy	Good. VARs are often found to perform better than univariate time series and more complex theory-based models for forecasting first 8 quarters. VARs with Bayesian parameters allowing for larger information sets have been shown to have superior forecasting performance to other VARs and DSGE models.
3. Communication	Poor. By not imposing a strict theoretical structure, VARs allow the data to drive the forecast. Although this makes for a better forecast, it makes interpretation difficult. The complex lag structure (and contemporaneous impacts of variables if so specified) makes it difficult or impossible to isolate the influences of variables on each other to tell a story. A VAR may have trouble being made consistent with other budget forecasts and the economic narrative, depending on the specification. By conditioning the model on exogenous variables, this is improved to a degree.
4. Transparency	Good. Model code available by request. VAR specifications likely to change frequently and would need to be published frequently. External budget scrutiny and testing of equations would be limited to specialists. However, the limited judgment involved with running a VAR model adds to its transparency.
5. Resources and continuity	Fair. VARs can be implemented quickly and programmatically in statistics software packages. Unlikely to require significant resources or specialist. Maintenance and development are likely to require a PhD economist or analyst with an MSc-level background and equivalent experience.
6. Precedent	Good. BVARs frequently serve as a yardstick against which to measure the forecasting performance of other more resource-intensive models, such as large-scale macroeconometric models. More often used in Central Banks than budgeting and IFIs, but precedent in AIReF and others.
Verdict	Appropriate, unqualified. The tool is appropriate, and no further action is recommended.

Suite of output gap models

Type	Suite of time series models
Description	Range of statistical filters, production function, and cyclical indicator methodologies. Run biannually in advance of the endorsement of the Department of Finance and DPER's macroeconomic forecasts in Spring (late March) and Autumn (late September). Run again afterwards using the Department's macroeconomic forecasts rather than the Council's own benchmarks as inputs. The inputs excel file is updated using Datastream and other domestic data sources, mainly the Central Statistics Office.
Mandate justification	Assessment and endorsement of macroeconomic forecasts, assessment of compliance with the domestic budgetary rule.
Outputs	Potential output and a range of estimates for the output gap.
Working paper	Journal paper here: https://www.esr.ie/article/view/1117
Reports	Fiscal Assessment Reports: https://www.fiscalcouncil.ie/fiscal-assessment-reports/
Key judgments	The models mainly reflect the choice of inputs and model specifications, described in the paper above.
Software	EViews and Excel
1. Theory	Good. Filtering and production function for potential adheres to principles in academic literature and supranational guidance. Although recent literature on filtering, potential, natural unemployment, natural rates etc. is generally not positive, output gap modelling is a necessary component of an overall macro framework. Suite modelling is suited to Ireland's volatile data.
2. Accuracy	N/A. Output gap is unobserved, does not lend itself to assessments of accuracy. Sources for error typically include fertility and immigration assumptions on supply-side labor inputs. Provided assumptions are reviewed regularly, should not lead to systematic bias.
3. Communication	Good. For individual models, can produce consistent, intuitive narratives in-line with economic theory. Straightforward to explain to economists and stakeholders. With suite modelling, lose some ability to tell a narrative if conflicting results.
4. Transparency	Good. Considerable judgment and subjectivity in choosing filtering parameters. But Council has made assumptions readily available for academic commentators and the public. Data vintages and model iterations are readily archivable, but judgment and subjective decisions would need extensive documentation each round to be completely transparent.
5. Continuity	Fair. Now that it is developed, can be run by experienced economists with a background that should be part of the average economist's tool kit. Maintenance and development are likely to require a PhD economist or analyst with an MSc-level background and equivalent experience.
6. Precedent	Good. Although few other IFIs use suite modelling, each individual methodology is widely used. Many alternative measures of the output gap popular in central banks. Other institutions in Ireland have followed the Council's lead.
Verdict	Appropriate, unqualified. The tool is appropriate, and no further action is recommended.

Fiscal feedbacks model

Type	Excel-based macro-fiscal feedback loop tool
Description	Run biannually following the publication of the Stability Programme and Budget documents. The inputs excel file is updated using Datastream and other domestic data sources, mainly the Central Statistics Office and the National Treasury Management Agency (some confidential data obtained from them). The model is annual and uses latest-available details on amounts outstanding and coupon rates for government bonds to derive accrued interest costs for a given year. Changes to fiscal policy or economic growth are reflected in a two-way relationship. The model has recently been updated to be based on modified gross national income rather than gross domestic product.
Mandate justification	Assessment of the fiscal stance
Outputs	Scenario analyses of fiscal outcomes based on alternative economic growth and/or tax/spending policies.
Working paper	https://www.fiscalcouncil.ie/wp-content/uploads/2020/01/FAR-OCT-2011-Box-3.2-Fiscal-Feedback-Model.pdf
Reports	Fiscal Assessment Reports: https://www.fiscalcouncil.ie/fiscal-assessment-reports/ and Pre-Budget Statements: https://www.fiscalcouncil.ie/pre-budget-statements/
Key judgments	Marginal interest rate on new borrowing, assumed repurchase schedule for floating rate notes held by the Central Bank of Ireland.
Software	Excel
1. Theory	Good. Algebraically derived reduced-form expressions from established economic identities and rule of thumb parameters.
2. Accuracy	N/A. Not testable. Weak evidence base supporting a general primary deficit multiplier relationship. Nonetheless, a useful exercise to explore scenarios while calibrating to Stability Programme Update baseline.
3. Communication	Good. Designed specifically for storytelling. Grounded in clear economic relationships.
4. Transparency	Good. Simple equations, Excel software, all equations and parameters published for easy replication.
5. Resources and continuity	Good. Simple spreadsheet model using undergraduate math and economics.
6. Precedent	Good. Most offices with in-house modelling use some form of these equations to link borrowing, interest rates, and output to capture interactions between economic and fiscal forecasts, albeit typically embedded within macro model.
Verdict	Appropriate, unqualified. The tool is appropriate, and no further action is recommended.

Maq stress testing

Tool name	Maq
Type	Small-scale macro model (32 equations: 5 behavioural and 27 identities) Calibrated Fiscal multipliers for assessing the fiscal stance.
Description	The "Maq" is a fiscal stress testing model for Ireland. Maq is primarily inspired by OECD fiscal modelling work but uses work by the Fiscal Council on potential output, debt sustainability analysis, and fiscal multipliers. This allows the Council to better specify a fiscal model tailored to Ireland's economy, cycle, and public finances. The Council also developed several key stress tests relevant for Ireland based on wider research by the IMF. Data comes from the CSO, DataStream, Department of Finance and the National Treasury Management Agency
Mandate justification	Assessment of the fiscal stance
Outputs	Standard DSA outputs including stochastic debt ratios, gross financing needs, interest projections, growth outcomes, scenarios, etc.
Working paper	[Forthcoming – available on request]
Reports	Intended for Fiscal Assessment Reports and Pre-Budget Statements
Key judgments	Fiscal Multipliers, monetary policy exogenous
Software	EViews
1. Theory	Good. Working paper provides ample literature to support the model, including Sorbe (2012), Rawdanowicz, (2012), Fall and Fournier (2015), and Botev, Fournier and Mourougane (2016). Monetary policy exogeneity sensible given economic context (rare assumption, but good practice). Marginal issuance rate innovative. Exogenous interest rate environment sensible. High level tax elasticities on total revenues instead of by individual tax line.
2. Accuracy	N/A – scenario and risk analysis
3. Communication	Good. Outputs are intuitive with scenario charts and impulse diagrams.
4. Transparency	Good. Well-supported in the forthcoming working paper, although some black box elements that would be difficult to replicate.
5. Resources and continuity	Fair. Now that it is developed, can be run by experienced economists. Maintenance and development are likely to require a PhD economist or analyst with an MSc-level background and equivalent experience.
6. Precedent	Good. Inspired by models in use at OECD.
Verdict	Appropriate, unqualified. The tool is appropriate, and no further action is recommended.

Nowcasting

Tool name	Nowcasting models
Type	Time series statistical forecasting model with Bayesian features
Description	Based on Solberger and Spanberg (2017) methodology, the models focus on underlying domestic demand and its components (personal consumption, government consumption, and investment excluding aircraft and intangibles).
Mandate justification	Endorsement of macroeconomic forecasts
Outputs	Forecasts based on high-frequency data and previous forecast errors.
Working paper	https://www.fiscalcouncil.ie/nowcasting-to-predict-data-revisions/
Reports	Daily updates are included in a daily online Dashboard for internal Council use.
Key judgments	Choice of input variables and model specifications as described above.
Software	Eviews, Excel, Google Data Studio
1. Theory	Good. Well suited for forecasting. No strong priors on economic relationships (lets the data speak for itself). Overcomes theoretical drawbacks (degrees of freedom problem) of VARs. Large set of information in compact model.
2. Accuracy	Good. Tests in peer institutions suggest high accuracy. Research suggests dynamic factor analysis may provide best short-run forecasts.
3. Communication	Poor. Can provide a benchmark for the government's forecast but reconciling differences and communicating 'why' the government's forecast is biased is difficult (that is, the model may not have an easy causal interpretation).
4. Transparency	Good. Proprietary software but not prohibitive license fees and more accessible than the more commonly used Matlab. Working paper has detailed equations and parameters, including estimation tables.
5. Resources and continuity	Fair. Dynamic factor modelling requires a specialized skillset and software that is likely to prove problematic for continuity. However, the 'push button' code free from judgment may counteract this to a degree. Maintenance and development is likely to require a PhD economist.
6. Precedent	Good. AIReF's MIPRed
Verdict	Appropriate, unqualified. The tool is appropriate, and no further action is recommended.

Heat map for sectoral imbalances

Tool name	Heat map for monitoring imbalances
Type	Descriptive statistics, benchmarks, comparison of trends over time.
Description	The approach uses normalised data for four sectors of the macroeconomy: (1) the labour market and prices, (2) external balances, (3) investment and housing, and (4) credit/financial. The intention is to supplement the output gap as a means of monitoring imbalances that may not be captured by estimates of the output gap. A score is obtained from comparing annual data for each indicator (Xt) to its central value (typically the long-run mean) ($\bar{X}$) and scaling by its standard deviation (σ) over the same period
Mandate justification	Endorsement of macroeconomic forecasts
Outputs	Heat map data visualisation
Working paper	https://www.fiscalcouncil.ie/wp-content/uploads/2018/09/A-Heat-Map-for-Monitoring-Imbalances-in-the-Irish-Economy.pdf
Reports	Fiscal Assessment Reports and Pre-Budget Statements
Key judgments	Choice of input variables and choosing what a central value for a variable should be, e.g. assuming zero rather than the long-run average for the current account balance.
Software	Excel
1. Theory	Good. Simple. Largely descriptive statistics. Perhaps limited by small historical sample that is not a great indicator of "balance" for Ireland.
2. Accuracy	N/A
3. Communication	Good. Simple intuitive story of sectors departing from their long-run mean, what should be monitored.
4. Transparency	Good. Historical averages simple and easily provided compared to current values. Data sources provided and obvious. Readily recreated by external analysts.
5. Resources and continuity	Good. Easy for research assistant to quickly assume responsibility.
6. Precedent	Good. Published by several European IFIs including Latvia, Estonia, and Finland.
Verdict	Appropriate, unqualified. The tool is appropriate, and no further action is recommended.

Benchmark fiscal modelling

Type	Revenue: policy-adjusted elasticities applied to proxy tax bases, short and long-run elasticities estimated from error-correction models Spending: stand-still estimates, simple growth rates
Description	Using an internally compiled dataset for tax policy changes, the approach uses policy-adjusted revenue to obtain cleaner estimates of tax elasticities. These are estimated separately for long-run and short-run impacts, and expanded to include Pay Related Social Insurance and VAT, of the cost of maintaining today's level of public services and benefits in real terms over the medium term, other discretionary spending projections.
Mandate justification	Assessment of Budgetary Forecasts
Outputs	Benchmark elasticities and forecasts for assessing the official budget forecasts and providing alternative scenarios.
Working paper	https://www.fiscalcouncil.ie/wp-content/uploads/2019/06/Estimating-Irelands-Tax-Elasticities-Niall-Conroy-Irish-Fiscal-Advisory-Council-Working-Paper.pdf https://www.fiscalcouncil.ie/wp-content/uploads/2019/06/FAR-June-2019-Box-I-Forecasting-Tax-Revenue-a-Reassessment-of-Elasticities-.pdf https://www.fiscalcouncil.ie/stand-still-scenario/ https://www.fiscalcouncil.ie/wp-content/uploads/2016/11/Box-D-Stand-Still-Expenditure-Scenario-2.pdf https://www.fiscalcouncil.ie/wp-content/uploads/2018/11/Box-A.pd https://www.fiscalcouncil.ie/wp-content/uploads/2020/05/FAR-May-2020-Appendix-C-Tax-Forecasts-Decomposed.pdf https://www.fiscalcouncil.ie/wp-content/uploads/2015/03/Website-AN3.pdf
Reports	Fiscal Assessment Reports: https://www.fiscalcouncil.ie/fiscal-assessment-reports/ Pre-Budget Statements: https://www.fiscalcouncil.ie/pre-budget-statements/
Key judgments	Elasticities used are those estimated using policy-adjusted revenue in Conroy (2019). combining short-run and long-run.
Software	Excel and Eviews
1. Theory	Good. Standard practice, one of several methods described in manuals such as the IMF Fiscal Programming handbook. But a more comprehensive suite of other approaches may be appropriate.
2. Accuracy	Fair. Error-correction models can provide best-in-class forecast properties for determining elasticities. However, the elasticity approach suffers in out-of-sample performance tests. The Council has tested the historical performance of elasticity models, especially following the 2008 crisis as an expectation of how they will perform over the coming years following the COVID-19 crisis. Systematic bias is expected in personal income tax (overestimation), VAT (overestimation), and Corporation Tax (underestimation). More elaborate capturing of policy factors such as the progressive tax code distribution for personal income tax, loss carry-forwards for Corporation Tax, and standard-rated, exempt, and zero-rated sectors for VAT could reduce the systematic bias from simple elasticity approaches. However, for high-level macro analysis the techniques are acceptable.
3. Communication	Fair. Can tell a story through the policy adjustments to tax elasticities, but not connected well enough to the structure and underlying tax code.
4. Transparency	Fair. Estimates of high-level tax elasticities can be made available, but many moving parts buried in elasticity estimates. Judgment likely to be substantial and non-transparent over coming years of recovery.
5. Resources and continuity	Good. Readily taken over by a research assistant with minimal experience and a general analyst background.
6. Precedent	Fair. Elasticities are one of four different approaches for modelling taxes widely employed in IFIs and finance departments. However, many other approaches are generally used depending on the tax rate.
Verdict	Appropriate, unqualified. For many interpretations of the Council's mandate by stakeholders, this is as deep as the Council should go. However, given the Department of Finance and DPER does not appear to go much deeper, it is not clear that detailed policy forecast models for revenue benchmarks are available for decisionmakers in Ireland. This is a particular problem given the structural biases in taxes like Corporation Tax and VAT that have been identified by the Council. The Council would benefit from engaging with the IFI community particularly at the OBR and AIReF to build alternative capacity for fiscal forecasting that moves beyond the elasticity models.

Principles-based budget rule assessment spreadsheet

Tool name	Principles-based approach budget rule assessment spreadsheet
Type	Semi-elasticity business cycle adjustment
Description	A simplified methodology for assessing compliance with the domestic budgetary rule, using more plausible supply-side estimates and core principles of rules assessment rather than adhering to the European Commission approach in all cases. Historical data and calculations used for assessing Ireland's domestic fiscal rules Aggregate budgetary semi-elasticity applied to primary balance to get Structural primary balance.
Mandate justification	Assessment of compliance with the domestic budgetary rule.
Outputs	Structural budget adjustment requirements, overall debt rule met, Cyclically adjusted Rule met, MTO met, etc.
Working paper	Some description, here: https://www.fiscalcouncil.ie/wp-content/uploads/2019/08/Box-A-Principles-Based-Approach-to-the-Budgetary-Rule.pdf
Reports	Assessment of Compliance with the Domestic Budgetary Rule
Key judgments	The budgetary semi-elasticity was previously estimated by the Commission and is currently set at 0.522. However, the budgetary semi-elasticity is estimated based on the Commission's CAM-based estimates of potential output. To be consistent with the choice of potential output used by the Council, the Council has re-estimated the budgetary semi-elasticity based on the Department's GDP-based estimates of potential output. The new budgetary semi-elasticity that the Council will use is 0.588.
Software	Excel
1. Theory	Good. Grounded in the Commonly Agreed Methodology, adjusted and improved for Ireland's context
2. Accuracy	N/A. Based on unobservable output gap.
3. Communication	Good. Common to the EU's surveillance programme and consistent story easily told relating economy to public finances.
4. Transparency	Good. Spreadsheets published online. Some underlying estimates of the components of the aggregate budget semi-elasticity could be explained in greater detail.
5. Resources and continuity	Good. Spreadsheet based. Underling elasticities readily updated by experienced economist. Large talent pool familiar with the framework.
6. Precedent	Good. Common among EU IFIs to go their own way on fiscal rules assessments. Commonly discussed methodology approach at Network of EU IFIs.
Verdict	Appropriate, unqualified. The tool is appropriate, and no further action is recommended.

Long-term fiscal sustainability model

Type	A collection of several methods for projecting demographics, the economy, and the public finances.
Description	A cohort-component model for demographic projections, production function with capital and labour for long-run steady-state growth (GNI*) projections, prices, and wage growth. Official fiscal medium-term outlook (extended by the Council from 2022 given the unique circumstances of the most recent SPU which only had two years 20201-21), linear convergence from medium-term outlook (the Council refers to the first five years as short term) to long-term modelling, revenue constant as a share of GNI*, spending varies with demographic-driven beneficiaries. Also draws on a gravity model of migration developed in house (Osés-Arranz, A., 2019).
Mandate justification	Appropriateness of the fiscal stance.
Outputs	General government balance, gross debt, interest expense, GNI* growth, education, health and social spending, among others. Time series to 2050.
Working paper	Long-term Model Methodology Report: https://www.fiscalcouncil.ie/wp-content/uploads/2020/10/LTM-Methodology-Report.pdf
Reports	Long-term Sustainability Report, July 2020 https://www.fiscalcouncil.ie/long-term-sustainability-report/
Key judgments	Assumptions for productivity growth (TFP), health expenditure as a share of income, revenue remains a constant share of GNI*.
Software	Eviews, Excel.
1. Theory	Good. Well-grounded in established methodologies with a large peer-reviewed evidence base, which the council presents in detail in its working paper.
2. Accuracy	N/A. Long-term projections are a thought exercise to identify whether immediate policy action is required and are therefore not intended or expected to be a most-likely scenario.
3. Communication	Good. Easy to communicate moving parts and assumptions. A summary statistic would improve communication.
4. Transparency	Good. Excellent working paper which would allow an experienced analyst to closely replicate the Council's results.
5. Resources and continuity	Good. As constructed, the model would not be hard to maintain for a relatively junior analyst.
6. Precedent	Good. Demographics, cohort model, supply side GDP are all standard. Gravity model of migration flows innovative. Typically, with all of these pieces in place, a summary statistic would be calculated.
Verdict	Appropriate, unqualified. The tool is appropriate. The Council could look at adding a summary statistic such as the fiscal gap in the future.