A "Heat Map" for Monitoring Imbalances in the Irish Economy

Kevin Timoney and
Eddie Casey

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[1] The authors are respectively an Economist and the Chief Economist at the Irish Fiscal Advisory Council (IFAC). E-mail: admin@fiscalcouncil.ie. Views expressed in this paper are the authors' own. We would like to acknowledge the kind assistance from members of the Council and Staff of IFAC as well as the valuable input from Ciara Reid (2018 summer intern) on the final design of the heat map and how best to visualise the data.

1. Introduction

This Note introduces a new "heat map" developed by the Council, in order to help with identifying potential imbalances in the economy. The Note describes the purpose of the heat map, the data sources used and the methodology applied.

The heat map builds on the existing modular approach adopted by the Council in 2015 (Box A of the *November 2015 Fiscal Assessment Report*).[2] The modular approach is intended to identify variables which may indicate a build-up of unsustainable activity levels in various areas of the economy, which may highlight cyclical and/or structural difficulties and potential future corrections in the economy.

The modular approach and the accompanying heat map offer a useful way to supplement the information contained in estimates of the output gap: the difference between an economy's actual output level and its medium-term potential level. While the output gap is useful as a summary measure of the cyclical position of the economy, it might not sufficiently capture various sources of imbalances that can arise.

The heat map is in spirit with how Independent Fiscal Institutions have tended to concern themselves with quite a broad definition of potential output. This might better be conceived of as closer to "sustainable" output rather than the standard potential output definition. The aftermath of the financial crisis has also brought with it a broader focus in the literature. Financial cycles (Benetrix and Lane 2011; Borio, Disyatat and Juselius, 2017), absorption cycles (Lendvai, Moulin and Turrini, 2011; Darvas and Simon, 2015), and commodity price cycles (Bornhorst, et al. 2011) are among a host of candidates now considered in the estimation of potential output. Accounting for these various sources of imbalances goes beyond the simple statistical de-trending of output measures and standard Phillips curve and Okun's law definitions, where potential output refers to the

[2] The Central Bank of Ireland (2016a) put a very similar approach to good use for monitoring a variety of macroeconomic indicators under the headings of "Expenditure"; "Output"; "Trade"; "Labour Market"; and "Prices". A similar heat map approach is also helpfully applied to inflation indicators by the Central Bank of Ireland (2016b) in order to get a better feel for underlying inflationary pressures.

maximum feasible level of output absent inflationary pressures (Okun 1964). Instead, it focuses more on where the economy might be absent any imbalances that might have collectively pulled output in a particular direction.

A further advantage of the modular approach is that it recognises that each crisis may be different from the last, as discussed by Casey (2018). Drivers of imbalances may differ over time, and a single model of the economy's (dis)equilibrium may not prove useful for every time period.

Four broad modules of the economy are examined in the Council's approach at present:

- the labour market and prices;
- external balances;
- investment and housing;
- credit and financial.

The development of the modular approach and heat map is an ongoing process: indicators included may be adjusted slightly due to distortions that arise from time to time; data availability may prompt the inclusion of additional indicators or require dropping others; and new methods for assessing equilibria in some indicators may be developed. Various indicators included in each module have been discussed in the Council's recent Fiscal Assessment Reports, and also presented as charts in an appendix to those reports.

2. Data and Methodology

This section describes the data sources and methods used to produce indicators for the modular approach and the heat map.

2.1 Modules: Data and Indicators

The Central Statistics Office (CSO) and Central Bank of Ireland are the primary data sources for the indicators used in the heat map. Where available, latest official forecasts by the Department of Finance (currently *Stability Programme Update, April 2018*) are included as additional data points beyond historical series. The indicators are selected based on their perceived ability to describe salient features of each module. Additional first-difference indicators are included for the Aggregate, Labour Market and Prices and External Balances modules, including: the output gap, the unemployment rate, inflation, core inflation, wage inflation and the change in the adjusted current account as a share of modified gross national income (GNI*).[3] These are shown in order to emphasise the presence or absence of momentum in these series.

A key summary measure of economic performance is the output gap, which attempts to describe the cyclical position of the economy.

- **Output Gap**: The estimate of the output gap used in the heat map is the Department of Finance's preferred new alternative GDP-based mid-point estimate as first presented in the *Stability Programme Update 2018* (Table 1 and Figure 1). The Council believes that these estimates provide a more plausible path for the economic cycle than the output gap estimated under the EU Commonly Agreed Methodology (CAM). Issues with the CAM have been elaborated in previous Council publications (for example, Boxes B and E in IFAC, 2017).

[3] Modified Gross National Income subtracts factor income of firms that have re-domiciled to Ireland, depreciation of R&D service imports and trade in IP, and depreciation on aircraft leasing from Gross National Income.

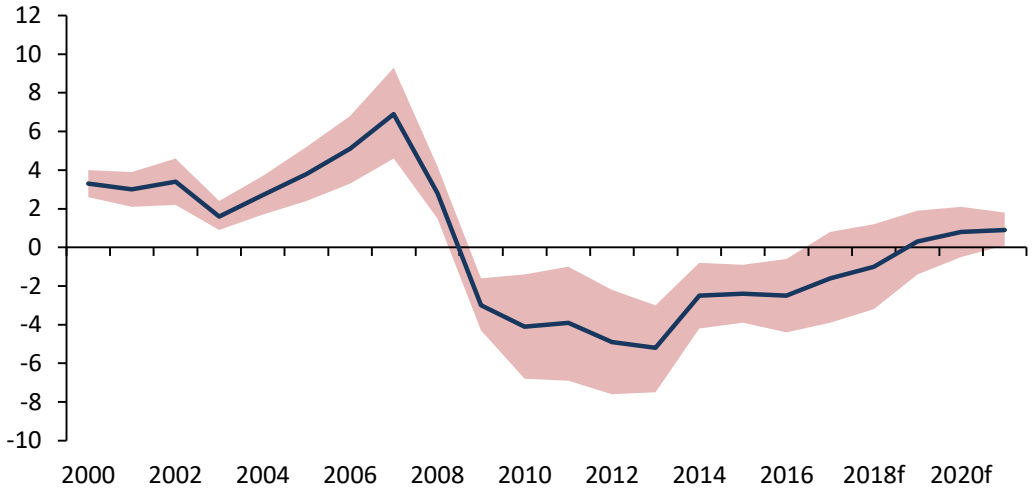
Table 1: Descriptive Statistics for the Output Gap

Indicator	*Sample Period*	*Central Value*	*Calculated As*	*Standard Deviation*	*2017*
Output Gap	2000-2017	0.0	Equilibrium	3.8	-1.6
Change in Output Gap	2001-2017	0.0	Equilibrium	2.1	0.9

Source: Department of Finance (*SPU 2018*).

Figure 1: Estimates of the Output Gap

Per cent of potential output



Source: Department of Finance (*SPU 2018*).

The Labour Market and Prices

The labour market can provide various signals of possible imbalances in an economy. Prices of goods and services can provide early-warning indication of potential future concerns for an economy. These departures from normal activity levels may represent a structural change in the economy which could be sustainable. However, the departures could also indicate a temporary change prior to a correction back towards a long-run equilibrium.

For example, a clear manifestation of a boom phase in the economic cycle is a wage-price spiral, wherein rising demand for wages of workers during periods of economic growth coincides with an increase in prices charged by firms, and vice versa (Blanchard, 1985). Periods of low unemployment and rising job vacancies can often lead to greater wage-bargaining conditions for workers. However, faced with a subsequent fall in demand,

firms may wish to protect market share by cutting prices, and to minimise any impact on profits by scaling back on labour costs (i.e. reducing salaries and/or headcounts).

We consider the following indicators for the heat map:

- **Unemployment (% of labour force):** This is the International Labour Organisation measure of unemployment as a share of the labour force. A four-quarter average for annual estimates is used back to 1998 (CSO Labour Force Survey), and annual European Commission CIRCABC data is used before then to 1970. The series is inverted for the purposes of the analysis presented in the heat map, as a lower unemployment rate typically reflects stronger economic conditions.

- **Construction (% of total employment):** This is a measure of construction employment as a share of total employment that is based on CSO labour-market data. A four-quarter average for annual estimates is used back to 1998.

- **Net Migration (% of labour force):** This measures Ireland's annual net migration (data available back to 1951) as a share of the labour force (four-quarter average data are used back to 1998 and discontinued CSO Annual Labour Force Survey data before then to 1988).

- **Inflation (HICP):** This measures annual HICP inflation based on CSO data, which are available back to 1991.

- **Core Inflation:** This is similar to the measure of HICP inflation, albeit certain volatile items (energy and unprocessed foods) are excluded to better capture underlying inflation trends. Published by Eurostat, the series is expressed in terms of annual growth rates back to 1997.

- **Personal Consumption Deflator:** This is the annual growth rate in the price index for personal consumption on goods and services (PCGS), derived from the CSO National Accounts data.

- **Wage Inflation:** A measure of wage inflation is taken as the annual growth rate in average hourly wages, derived as the CSO Institutional Sector Accounts measure of compensation of employees paid annually to households and non-profit institutions serving households (NPISH), divided by annualised employee hours. The latter is derived as the four-quarter average of annualised weekly hours worked times number of employees, each according to the CSO Labour Force Survey.

Table 2 details sample periods, central values, standard deviations and latest outturns for each indicator in the module.

Table 2: Descriptive Statistics for the Labour Market and Prices

Indicator	*Sample Period*	*Central Value*	*Calculated As*	*Standard Deviation*	*2017*
Unemployment (% of labour force)	1970-2017	10.2	Mean	4.2	6.7
Construction (% of total employment)	1998-2017	7.2	Mean	2.1	5.9
Net Migration (% of labour force)	1988-2017	0.5	Mean	1.7	0.8
Inflation (HICP)	1991-2017	1.9	Mean	1.7	0.3
Core Inflation	1997-2017	1.7	Mean	1.9	0.0
Personal Consumption Deflator	1996-2017	1.9	Mean	2.5	1.4
Wage Inflation	1999-2017	3.7	Mean	3.5	1.7

Sources: CSO; European Commission CIRCABC; and internal IFAC calculations.
Note: Preliminary net migration data for 2018 as a share of the labour force as forecast in *SPU 2018* indicate an increase in this indicator to 1.4 per cent.

External Balances

External balances can offer an important insight into the sustainability of current economic conditions. As Lendvai, Moulin and Turrini (2011) note, absorption booms (phases of buoyant domestic demand) were evident in a number of European countries before the financial crisis. These were coupled with widening current account deficits and increased government revenues. In some cases, however, the increase in absorption was "excessive", and reflected a deviation from economic fundamentals. When these external imbalances underwent a sharp correction after the crisis of 2008, the authors note that fiscal positions "abruptly shifted from

apparently sound to large deficits and, in some cases, distressed situations".

A clear sense of phases where absorption, and external positions, deviate from prudent paths should help to identify potentially unsustainable economic and fiscal positions. However, in recent years, data on the balance of international payments have been contaminated by extraordinary flows of foreign-owned multinational companies with operations in Ireland.[4] Adjustments to these series are therefore needed in order to better understand underlying trends.

- **Modified Current Account (% GNI*):** The CSO now publishes a current account measure that excludes the large and distorting flows of foreign-owned multinational enterprises, which have little-to-no impact on the sustainability of domestic economic performance.[5] The adjustments remove the impact of re-domiciled firms, depreciation of aircraft for leasing, depreciation of R&D service imports and trade in Intellectual Property (IP), and R&D-related IP exports; whereas net aircraft related to leasing, R&D-related IP imports, and R&D service imports are added back to the current account. Modified current account data are published back to 2007, and where the adjusting series are available, these are applied back to 1995. Historical current account data is available back to 1981 by the CSO, before which AMECO data is used. This series is inverted and then scaled by GNI* (which is published by the CSO back to 1995, and we extend it further to 1970 based on AMECO data).

- **Adjusted NIIP (% GNI*):** The net international investment position (NIIP) is a close relative to the current account balance. It provides a point-in-time estimate of the difference between an economy's financial assets and liabilities with respect to the rest of the world: essentially a country's external investment position. Unlike the

[4] These series are also included in the European Commission's Macroeconomic Imbalances Procedure scoreboard.

[5] The Modified Current Account series is presented in CSO (2018).

current account balance, it is a measure of stock imbalances rather than flow imbalances.

For Ireland, the unadjusted NIIP measure is also beset by similar issues that distort the current account. In particular, the trend in the non-IFSC, non-financial sector's net position since 2012 (an increase in annualised net assets of €165 billion) diverges considerably with that of the IFSC-financial sector (an increase in annualised net liabilities of €406 billion). Given the prominence of foreign-owned firms affecting the IFSC and financial sector's data, the non-IFSC, non-financial data is used as an adjusted NIIP indicator for the module. This data is currently only available back to 2012, and the significant increase since then means there is a large standard deviation around the central value, which may not reflect long-run stability for adjusted NIIP. As for the modified current account, these data are inverted and expressed as a percentage of GNI*. No forecasts are readily available for the indicator.

Table 3 summarises key features of these indicators.

Table 3: Descriptive Statistics for External Balances

Indicator	*Sample Period*	*Central Value*	*Calculated As*	*Standard Deviation*	*2017*
Modified Current Account (% GNI*)	1970-2017	-2.4	Mean	3.8	1.2
Adjusted NIIP (% GNI*)	2012-2017	-5.9	Mean	45.2	41.2

Sources: CSO; European Commission AMECO; and internal IFAC calculations.

Investment and Housing

A third module looks at investment and housing indicators. While expenditure on gross fixed capital formation in Ireland has been increasing in recent years, this comes after several years of reduced investment levels during the crisis period.

As property value is a key determinant of household wealth, rising house prices can be expected to influence consumer spending patterns. In many ways, the property/credit bubble that preceded the crisis years epitomised imbalances in the Irish economy during the mid-2000s. Building and construction levels had risen far above their historical average share of

national income, while the growth rate in house prices outstripped the growth rate in household incomes.

The property boom was also characterised by an unsustainable increase in tax-rich activities: stamp duties increased due to a large number of transactions on rising prices, and income taxes were augmented by the employment intensity of construction activity that occurred. This feature was well-documented in the Irish case, where the property/credit bubble led to a reliance on transient revenues associated with the property sector (Addison-Smyth and McQuinn, 2010).

- **Underlying Investment (% GNI*):** For investment, we focus on an underlying measure that strips out aircraft and intangibles. This is due to the fact that the latter two items are highly volatile and for the most part are imported, with less substantive net impact on the aggregate domestic economy.

- **Housing Construction (% GNI*):** Of the building and construction component of total investment, housing-related investments are those related to dwellings and improvements.

- **Non-Housing Construction (% GNI*):** Non-housing activity is comprised of transfer costs and other building and construction (including office/commercial developments). Investment data are available back to 1995 from the CSO National Accounts series.

- **New Dwelling Completions (thousands):** For this series, a four-quarter average of CSO new dwelling completions back to 2011 is combined with historical quarterly housing completions data (based on ESB connections), available back to 1970.

- **Residential Property Price Growth:** As a starting point for this series, CSO data for Ireland in 2017 indicates a national average dwelling price of just under €240,000. Combining this with the CSO's Residential Property Price Index, the ESRI/PTSB house price index and a Department of Environment series on house prices, allows us to extend the series in nominal euro levels back to 1990. Since then, compound growth in prices has been 5.4 per cent per annum, or 6

per cent simple average of growth rates. The high volatility of this series over the sample period is reflected in a large standard deviation of 11.5 per cent. Forecast growth in residential property prices, used as inputs to *Stability Programme Update 2018* supply-side estimates, extend the series from 2017 to 2021.

- **Residential Price-to-Income Ratio:** Residential property prices divided by annualised disposable income per household. Gross disposable income and the adjustment for the change in pension entitlements for households and NPISH are divided by the number of households, available from historical Quarterly National Household Survey data until the first quarter of 2016, which is held constant until the final quarter of 2017 and then grown forward using an interpolated quarterly average growth in population (from *Stability Programme Update 2018* forecasts).

- **Residential Price-to-Rent Ratio:** Residential property prices divided by annualised rent. The annualised rent series is based on a Residential Tenancies Board figure of €1,054 for the national average monthly rent as of the final quarter of 2017, multiplied by 12. The series then builds back to 2003 using the CSO private rents component of the Consumer Price Index, and back to 1959 using an OECD rental price index. No rental forecasts have been included for this indicator.

- **Household Savings Ratio:** Gross savings of the households and NPISH sector divided by gross disposable income and the adjustment for the change in pension entitlements. These data are available back to 1999, and the series is inverted for the heat map.

- **Household Net Lending/Borrowing (% GNI*):** As for the savings ratio, this series is available back to 1999 and is comprised of consumption of fixed capital, changes in capital accounts and gross savings. The series is also inverted.

Table 4 summarises relevant descriptive statistics for the third module.

Table 4: Descriptive Statistics for Investment and Housing

Indicator	*Sample Period*	*Central Value*	*Calculated As*	*Standard Deviation*	*2017*
Underlying Investment (% GNI*)	1995-2017	19.8	Mean	5.8	16.3
Housing Construction (% GNI*)	1995-2017	7.0	Mean	4.2	3.0
Non-Housing Construction (% GNI*)	1995-2017	7.4	Mean	1.6	9.0
New Dwelling Completions (thousands)	1970-2017	30.6	Mean	21.0	14.4
Residential Property Price Growth	1991-2017	6.0	Mean	11.5	10.9
Residential Price-to-Income Ratio	2000-2017	4.1	Mean	0.7	3.9
Residential Price-to-Rent Ratio	1990-2017	19.3	Mean	7.3	19.1
HH Savings Ratio	1999-2017	8.4	Mean	2.5	9.8
HH Net Lending/Borrowing (%GNI*)	1999-2017	-2.9	Mean	6.0	2.6

Sources: CSO; Department of Environment, Heritage and Local Government; ESRI/PTSB; Residential Tenancies Board; and internal IFAC calculations.

Credit and Financial

Indicators of credit and financing conditions in an economy offer another important insight into the sustainability of economic developments. An increased availability of credit and financial data in recent years has enabled more timely analysis of monetary trends in the Irish economy. We focus on the following indicators:

- **New Mortgage Lending:** This measure looks at flows of new borrowing for house purchase by households and is obtained from the Central Bank of Ireland's Private Household Credit and Deposits data. These may not fully correspond to the change in the stock of mortgages outstanding due to a number of factors, including deleveraging and revaluations.

- **Credit to Irish-Resident Private Sector Enterprises, excluding Financial Intermediation:** This is an alternative measure of domestic-facing firms' stock of monetary obligations. It is obtained from the Central Bank of Ireland's Business Credit and Deposits data.

- **Adjusted Private Sector Credit:** This is an alternative adjusted measure of private sector credit factors in household debt and Irish-resident private-sector enterprises.

- **Adjusted Private Sector Credit Gap:** The private-sector credit gap – the difference between private sector credit as a share of GDP and its long-term trend – can potentially provide advance warning of the onset of stress in a banking system, and can be used in conjunction with macroprudential tools by a central bank to mitigate banking system risk. The adjusted private sector credit gap follows a similar methodology to that in the ESRB (2014) recommendation on guidance for countercyclical buffer rates. A recursive Hodrick-Prescott filtered trend ratio is specified, with smoothing parameter lambda = 400,000 to capture the long-term trend in the behaviour of the credit-to-GDP ratio.

- **New SME Credit:** These data, available back to 2010, indicate the extent to which credit is extended to small- and medium-sized enterprises. Given the short sample length, the central value may not reflect long-run stability for new SME credit.

All indicators shown in Table 5 are scaled by modified gross national income (GNI*).

Table 5: Descriptive Statistics for Credit and Financial

Indicator (all % GNI)*	*Sample Period*	*Central Value*	*Calculated As*	*Standard Deviation*	*2017*
New Mortgage Lending	2003-2017	7.6	Mean	12.1	0.0
Total Credit to Private Sector	2002-2017	331.2	Mean	120.3	417.9
Credit to Irish-Resident Private Sector Enterprises, excluding Financial Intermediation	2003-2017	66.3	Mean	29.4	23.8
Adjusted Private Sector Credit	2002-2017	170.5	Mean	56.7	102.0
Adjusted Private Sector Credit Gap	2002-2017	0.0	Equilibrium	32.9	-60.7
New SME Credit	2010-2017	2.2	Mean	0.4	2.8

Sources: Central Bank of Ireland; CSO; and internal IFAC calculations.

2.2 Methodology

The goal of the heat map is to aid in the identification of imbalances, where imbalances are typically taken to be departures of varying magnitudes in indicators away from their central values. Scaling and other transformations to the series are carried out where appropriate to limit the extent to which series may be non-stationary. A score is obtained from comparing annual data for each indicator (X_t) to its central value (typically the long-run mean) ($\bar{X}$) and scaling by its standard deviation (σ) over the same period:

$$Imbalance\ Score = \frac{X_t - \bar{X}}{\sigma}$$

As noted previously, the series for the unemployment rate, modified current account, adjusted NIIP, household savings ratio and net lending/borrowing have been inverted to reflect consistency with other measures included in the heat map (for which higher scores may be a result of faster economic activity).

Where an indicator suggests a departure from its long-run average, allowing for usual volatility, the indicator can be considered to potentially signify a build-up of imbalance in the economy. Dividing the spectrum of outcomes below -2 and above 2 standard deviations with buckets of ¼ of a standard deviation, there are 17 distinct scores available for each indicator. An "overheating" imbalance registers in deepening shades of red, whereas an indicator consistent with below-normal activity will show as a darkening blue shade. Where data are unavailable (e.g. pre-2012 for the adjusted NIIP and pre-2010 for new SME credit, or in the case of forecasts for all of the credit and financial indicators), a shaded black cell is shown.

3. Results

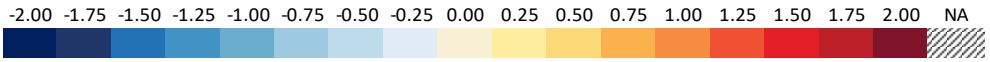
Figure 2 depicts the heat map based on data that was available as of end-August 2018. For each module, a broadly consistent pattern is apparent – dark red warnings signal overheating associated with the property and credit bubble from 2005 up to and including 2008, followed by a sustained period of predominantly negative scores corresponding to the crisis period.

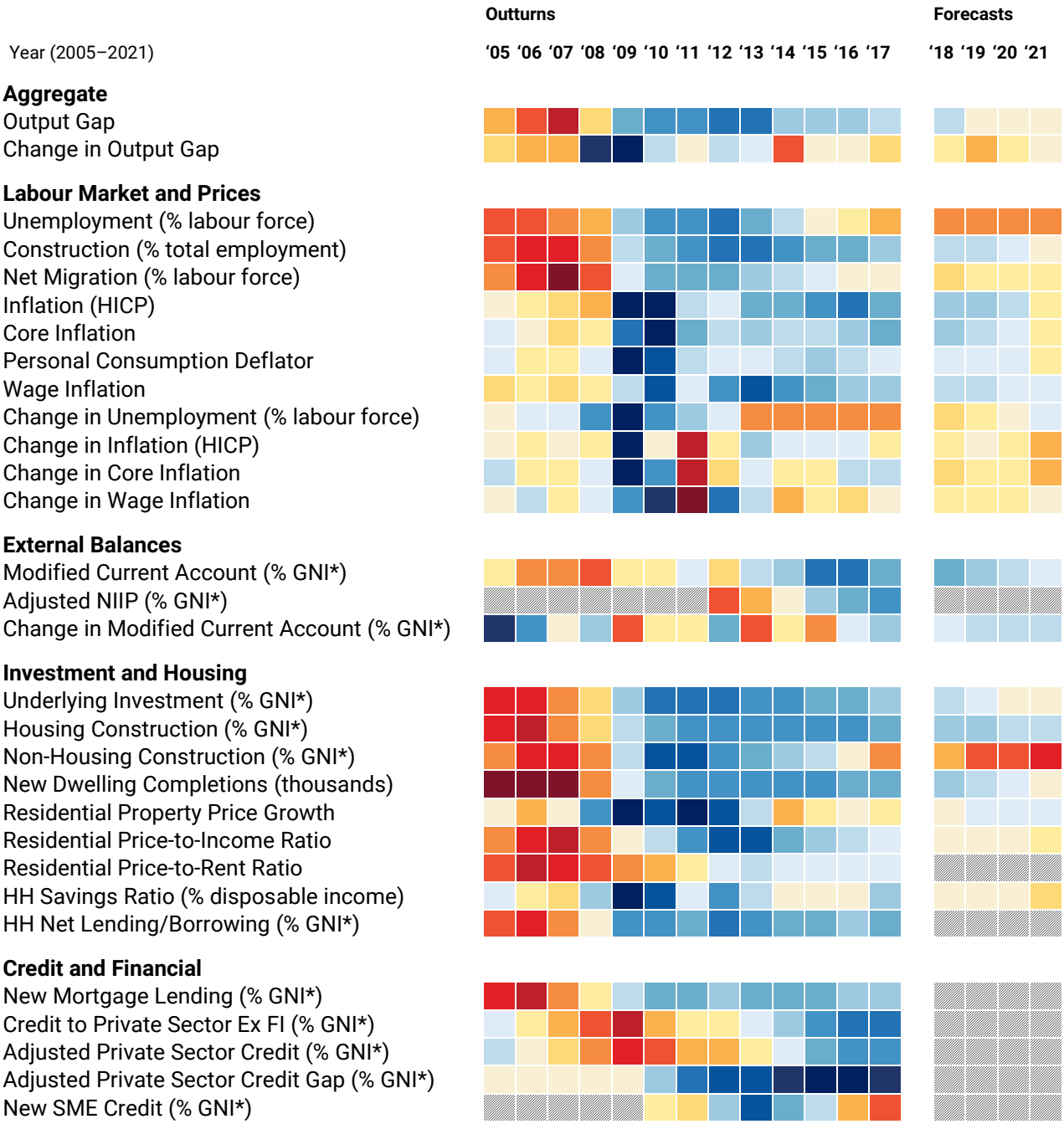
Forecasts of some indicators suggest a re-emergence of possible overheating, in particular for non-housing construction as share of GNI*, for unemployment and for net migration. Elsewhere, latest estimates and forecasts suggest a more benign landscape for inflation, the adjusted current account and underlying investment. The aggregate expectation for the output gap broadly reflects the more balanced expectation for economic growth over the forecast horizon.

Of course, there are well-known limitations to any set of forecasts, in particular with regard to predicting turning points in the economic cycle. It is therefore important to note that many of the predictions contained in the heat map could fail to materialise, plausible though such expectations may appear at the time of forecasting. As such, an indirect advantage of the heat map approach is that it can draw attention to certain forecasts that are too benign relative to the user's prior assumption, which may help to inform future forecasting processes.

Figure 2: Heat Map for Monitoring Potential Imbalances

Within specified standard deviation bands of long-term averages:





Sources: CSO; Central Bank of Ireland; Department of Finance (*SPU 2018* forecasts); Department of Environment, Heritage and Local Government; ESRI/PTSB; European Commission (AMECO and CIRCABC); Residential Tenancies Board; and internal IFAC calculations.

Some Caveats

The heat map is a useful tool and one that the Council intends to continue to develop and monitor. Yet there are a number of important caveats relevant when using the heat map, which should be highlighted.

The heat map has a number of advantages:

- It offers a useful visual summary of potential imbalances in the economy.
- It also allows one to regularly monitor and quickly identify areas that might warrant greater attention, particularly those that may have implications for the sustainability of the fiscal position.

However, there are a number of shortcomings to the heat map which should also be noted:

- It is quite a mechanical approach.
- It may not adequately account for structural shifts over time.
- Identifying central values (equilibrium values for each indicator) can be challenging and long-term values may not be the most appropriate basis on which to assume equilibria.
- An important caveat when using forecasts to inform the assessment is that macroeconomic forecasts tend to be constructed to bring the economy to equilibrium over the forecast horizon, and so are likely to understate the prospects for overheating.

It is important to stress that the heat map is just one input to Council considerations. Further work will be pursued in future to develop the Council's assessments of the various indicators considered in the modular approach.

References

Addison-Smyth, D. and K. McQuinn., (2010). Quantifying revenue windfalls from the Irish housing market. Economic & Social Review, Vol. 41, No. 2, Summer, 2010, pp. 201–223, Dublin: Economic & Social Research Institute.

Benetrix, A., and P.R. Lane., (2011). "Financial Cycles and Fiscal Cycles." EUI-IMF conference on Fiscal Policy, Stabilization and Sustainability.

Blanchard, O., (1986). "The Wage Price Spiral", Quarterly Journal of Economics, Vol. 101, No. 406, pp. 545-565, August.

Bornhorst, F., G. Dobrescu, A. Fedelino, J. Gottschalk, and T. Nakata., (2011). "When and How to Adjust Beyond the Business Cycle? A Guide to Structural Fiscal Balances." IMF Technical Notes and Manuals.

Borio, C., P. Disyatat, and M. Juselius., (2017). "Rethinking potential output: Embedding information about the financial cycle." Oxford Economic Papers vol. 69(3).

Casey, E., (2018). "Inside the "Upside Down": Estimating Ireland's Output Gap." IFAC Working Paper No. 5, January. Available at: https://www.fiscalcouncil.ie/working-papers/

Central Bank of Ireland (2016a). "Box A: A Macroeconomic Heat Map for Ireland" by Byrne, S. and D. Smyth. Quarterly Bulletin no. 2 2016. Available at: https://www.centralbank.ie/docs/default-source/publications/quarterly-bulletins/qb-archive/2016/quarterly-bulletin-no-2-2016.pdf?sfvrsn=8

Central Bank of Ireland (2016b). "Box D: An Inflation Heat Map for Ireland" by Scally, J. and D. Smyth. Quarterly Bulletin no. 3 2016. Available at: https://www.centralbank.ie/docs/default-source/publications/quarterly-bulletins/qb-archive/2016/qb3-16/gns-5-1-1-1-quarterly-bulletin-no-3-2016.pdf?sfvrsn=10

CSO, (2018). "A Modified Current Account Balance for Ireland 2007-2017". https://www.cso.ie/en/releasesandpublications/in/acabi/amodifiedcurrentaccountbalanceforireland2007-2017/

Darvas, Z., and A. Simon., (2015). “Filling the gap: open economy considerations for more reliable potential output estimates.” Bruegel Working Paper No. 2015/11.

Department of Finance, (2018). Stability Programme Update. April 2018, Dublin. https://www.finance.gov.ie/wp-content/uploads/2018/04/spu-final-final.pdf

ESRB, (2014). “Recommendation of the European Systemic Risk Board of 18 June 2014 on guidance for setting countercyclical buffer rates”. https://www.esrb.europa.eu/pub/pdf/recommendations/2014/140630_ESRB_Recommendation.en.pdf?83075f19bd8f21d8a3b8e6afe7bea49b

IFAC, (2017). Fiscal Assessment Report, November 2017. Dublin: Irish Fiscal Advisory Council. Available at: http://www.fiscalcouncil.ie/publications/

IFAC, (2015). Fiscal Assessment Report, November 2015. Dublin: Irish Fiscal Advisory Council. Available at: http://www.fiscalcouncil.ie/publications/

Lendvai, J., L. Moulin, and A. Turrini., (2011). "From CAB to CAAB? Correcting Indicators of Structural Fiscal Positions for Current Account Imbalances." European Economy, Economic Papers, 2011: 442.

Okun, A. M., (1964). Potential GNP: Its Measurement and Significance. Proceedings of the Business and Economic Statistics Section of the American Statistical Association.