Government of the
Cook Islands

Estimating the output gap in the Cook Islands – preliminary analysis

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1 Summary

This working paper presents a range of methods to estimate the Cook Islands economic output gap – that is the gap between potential economic output and observed output – measured in terms of Gross Domestic Product (GDP).

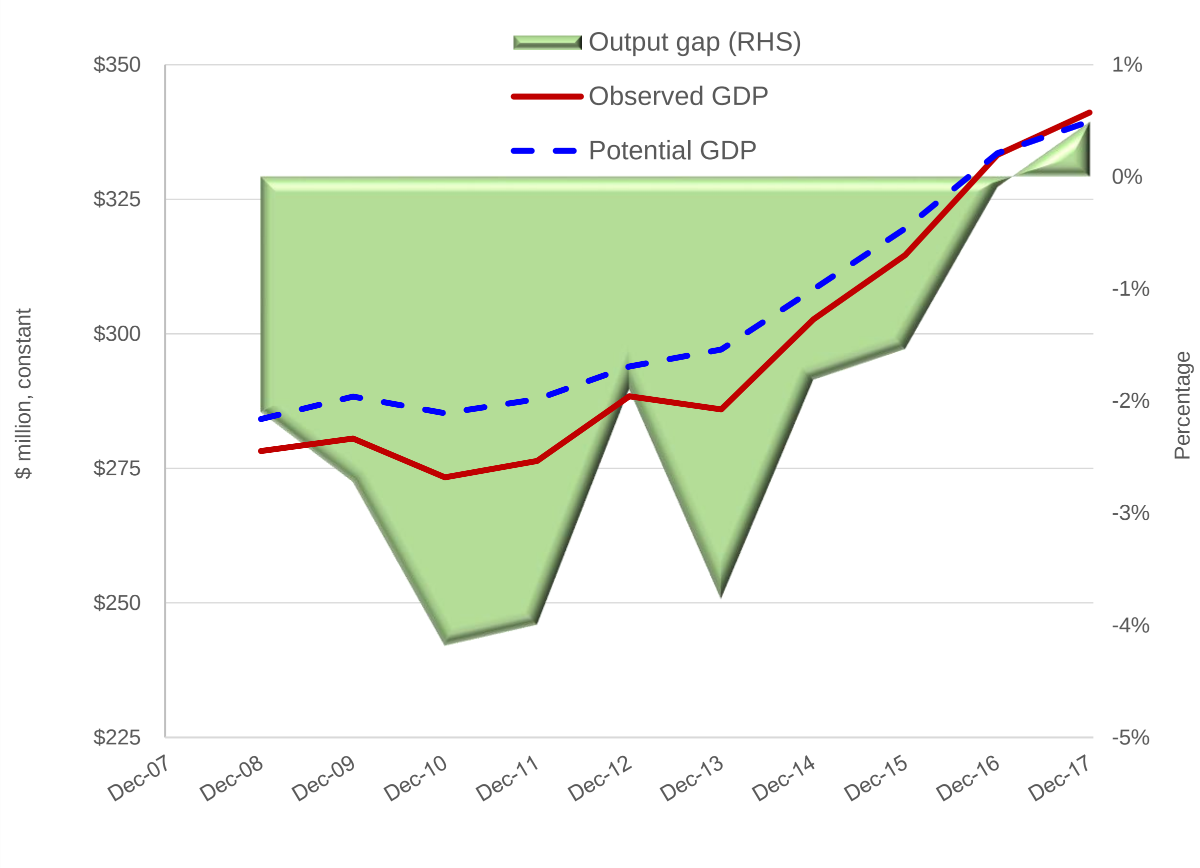
The output gap is a measure of the overall level of slack in the economy. A positive output gap means the economy is operating above full capacity. If maintained for an extended period of time, this leads to the build-up of inflationary pressure. A negative output gap means that there is spare capacity, or slack, in the economy due to weak demand for goods and services. An extended period under this situation can lead to deflation and economic recession

The conventional univariate output gap measures applied in this paper – Hodrick-Prescott, Baxter-King and Kalman filters, imply that the Cook Islands has maintained a positive output gap over an extended period, for the previous 4 years using the Kalman filter estimate. However, apart from anecdotal evidence – for example, the construction sector facing constraints finding skilled tradespersons, the tourism sector facing unskilled labour shortages and house rents rising – there appears to be little evidence of economic overheating in the leading economic indicator – the Cook Islands consumer price index.

There are two potential explanations for this outcome. The first is that as a small import-intensive open economy, the Cook Islands CPI may be influenced more by external supply-side factors than domestic demand-pull forces. A second possible explanation is that the univariate measures utilised in this paper are not realistically characterising the business cycle in the Cook Islands.

In contrast to the univariate results, the multivariate Kalman filter result suggests that the Cook Islands economy has only been performing above potential output for about a year, a much shorter period than the 4 years implied by the univariate measures (see Figure 6-3). It also suggests that the positive output gap is smaller in magnitude than that implied using the univariate measures.

Figure 1-1: Annual output gap, multivariate Kalman filter estimate[1]



Source: MFEM analysis.

The key conclusion of this this paper is, irrespective of whether one applies a univariate or multivariate measure, that the Cook Islands is currently confronting a positive output gap. While there is no evidence of overheating showing up in the CPI data, should the positive output gap continue for an extended period of time, inflationary pressure and other overheating impacts such as labour and skills shortages are likely to eventuate and strengthen.

Following the Keynesian model, when faced with a positive output gap and the potential for the economy to overheat, government may consider implementing contractionary fiscal policy – in particular decreasing government expenditure. In the case of the Cook Islands, it may be worth considering either decreasing, or at least limiting the growth in, the future level of Cook Islands Government expenditure, both operating and capital.

[1] The output gap is calculated as a percentage of potential output.

2 Introduction

2.1 The Cook Islands economy

The Cook Islands is a small open economy that is dominated by the tourism sector, with around 164,000 tourist arrivals in the year to May 2018. Strong growth in tourism in recent years has seen the Cook Islands experience reasonably high rates of economic growth.

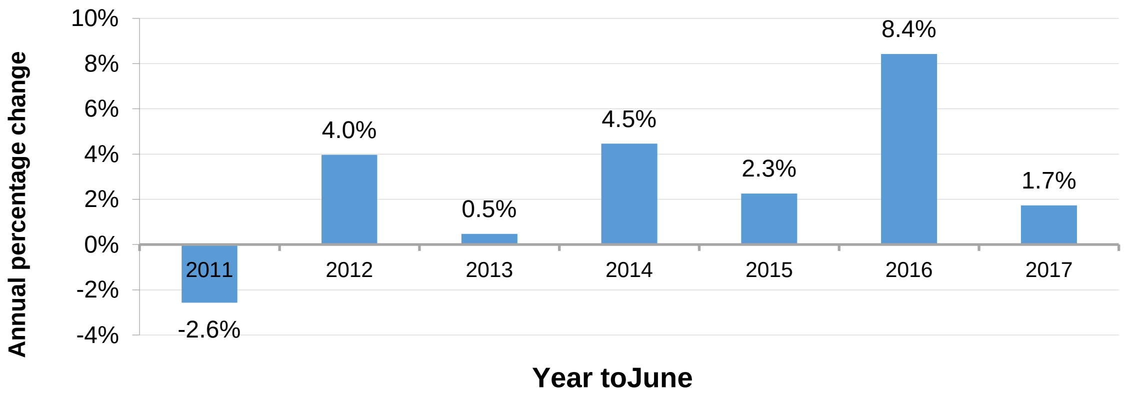
Box 2-1: What is Gross Domestic Product?

Gross Domestic Product (GDP) is the measure of the value-added from all economic activities in the Cook Islands. Quarterly current price and constant 2006 price estimates of GDP are produced by the Cook Islands Statistics Office using the production approach. GDP estimates are disaggregated by major industry classifications, including institutional sectors.

Industry value-added is the contribution that an industry makes to the economy. A particular industry's value-added is equal to the difference in value between the goods and services inputs to the sector and the final value of the goods and services produced by the sector – or Gross Value of Production (GVP). The GVP is the total value of the goods and services produced by an industry sector. It therefore includes the value of the inputs plus the industry value-added by the sector.

Cook Islands economic output – measured in terms of real annual Gross Domestic Product (GDP) – grew by 1.7 per cent over the year to June 2017 compared to the year to June 2016, increasing from $329.7 million to $335.5 million (Figure 2-1). Although expanding at a slower rate than recent years, this continues the strong run of annual economic growth since 2014.

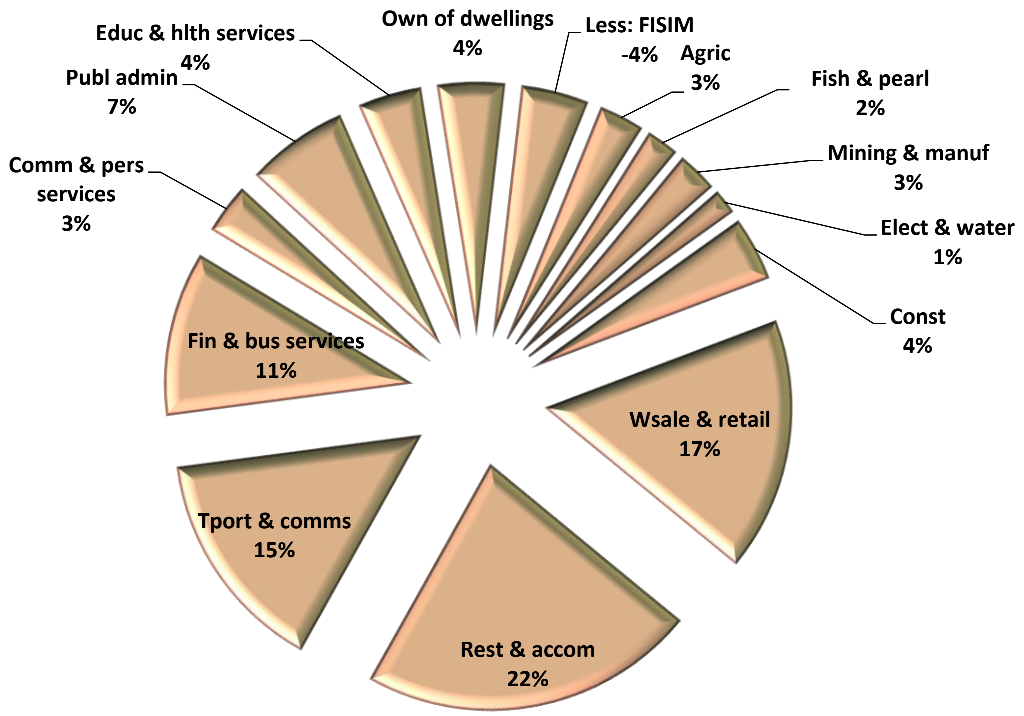
Figure 2-1: Real annual GDP growth (percentage change)



Source: Cook Islands Statistics Office, National Accounts Statistics, December Quarter 2017.

Figure 2-2 shows the breakdown of the economy by industry in 2017. The three largest industries, Restaurants & accommodation, Wholesale & retail trade and Transport & communications account for more than half of total economic output.

Figure 2-2: Cook Islands economy by industry, 2017

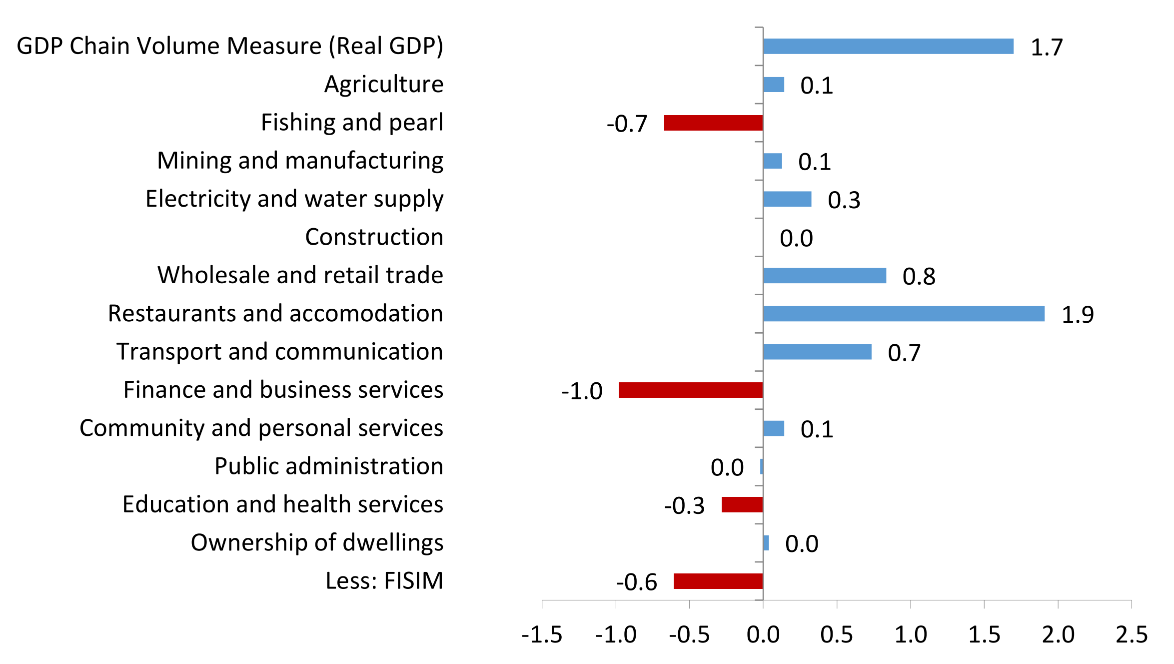


Source: Cook Islands Statistics Office, National Accounts Statistics, December Quarter 2017.

In 2016/17, high tourist arrivals drove strong growth in the economy, with the tertiary sector contributing 2.4 percentage points to economic growth. The strongest contributions were from restaurants and accommodation (1.9 percentage points), wholesale and retail trade (0.8 percentage points) and transport and communication (0.7 percentage points). Finance and business services and education and health services contracted in 2016/17. During this period, restaurants and accommodation grew by 8.4 per cent to $82 million, transport and communication grew by 4.9 per cent to $52 million and wholesale and retail trade grew by 4.6 per cent to $63 million.

The secondary sector, which includes construction, electricity and manufacturing, contributed 0.5 percentage points to growth, while the primary sector, agriculture and fishing contracted, with a negative 0.5 percentage point contribution.

Figure 2-3: Industry contribution to real annual GDP growth, year to June 2017 (percentage points)



Source: Cook Islands Statistics Office, National Accounts Statistics, December Quarter 2017.

2.2 The output gap

The output gap refers to the state of the economy in its business cycle and is a measure of the overall level of slack in the economy. The IMF defines the output gap as follows:

> The output gap is an economic measure of the difference between the actual output of an economy and its potential output. Potential output is the maximum amount of goods and services an economy can turn out when it is most efficient—that is, at full capacity. Often, potential output is referred to as the production capacity of the economy.[2]

$$Output\ gap = Y - Y_p$$

where:

- Y is actual output; and
- Y_p is potential output.

A **positive output gap** ($Y > Y_p$) means the economy is operating above full capacity. If maintained for an extended period of time, a positive output gap leads to an overutilisation of an economy's productive resources through excess demand for goods and services resulting in the build-up of inflationary pressure. A positive output gap is often associated with a tight labour market, leading to intensification of wage pressures that can also spill over to higher prices.

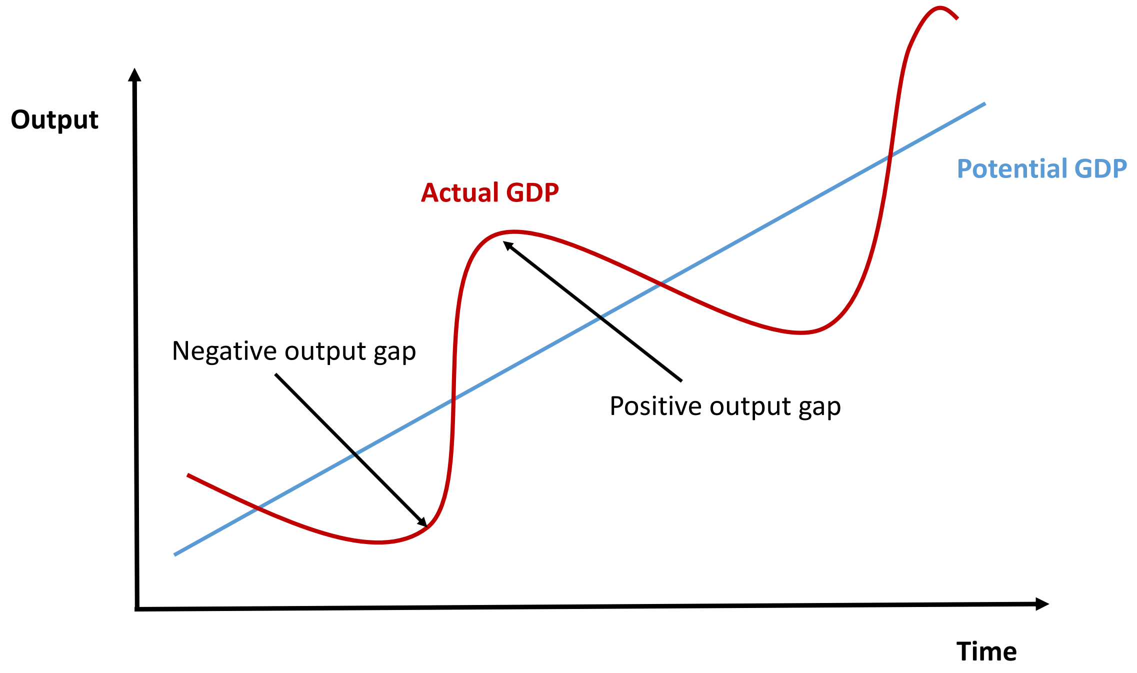
A **negative output gap** ($Y < Y_p$) occurs when actual output is less than what the economy could produce at full capacity. This means that there is spare capacity, or slack, in the

[2] IMF, 2013: 38.

economy due to weak demand for goods and services. An extended period under this situation can lead to deflation and economic recession.

Figure 2-4 shows a stylised output gap.

Figure 2-4: Stylised output gap example



Source: RBNZ, 2018b.

Output gap estimates are commonly used to inform monetary and fiscal policy decisions.

On the monetary front, central banks tend to use the output gap to gauge the degree of inflationary pressure in the economy, and then respond accordingly by adjusting the official cash rate up or down– which in turn influences market interest rates. According to the IMF:

> All else equal, if the output gap is positive over time, so that actual output is greater than potential output, prices will begin to rise in response to demand pressure in key markets. Similarly, if actual output falls below potential output over time, prices will begin to fall to reflect weak demand.[3]

For example, the Reserve Bank of New Zealand in its May 2018 Monetary Policy Statement, utilised a range of output gap measures to inform its decision to apply stimulatory monetary policy:

> Our suite of indicators of capacity pressure suggests that the level of GDP is broadly in line with the level of potential output and the output gap is around zero …... Over the projection, stimulatory monetary policy is expected to support an increase in the output gap to 0.9

[3] IMF, 2013: 38.

> percent of potential output in 2020, generating a pick-up in inflationary pressure and returning inflation to the 2 percent mid-point.[4]

On the fiscal front, output gap estimates provide a framework for governments to make fiscal policy – also known as demand management – decisions. The primary fiscal policy tools available to government to influence aggregate demand and therefore economic output are government expenditure and tax rates (government revenue).

Following the Keynesian model, when faced with negative output gap and potential for a recession, government may choose to launch an expansionary fiscal policy – for example by increasing government expenditure and reducing tax rates.

Alternatively, when faced with a positive output gap and the potential for the economy to overheat, government may set in motion a contractionary fiscal policy, perhaps with a combination of lower government expenditure and higher tax rates.

Government's stance on fiscal policy can be judged by examining changes in the fiscal balance (budget surplus or deficit).

The Cook Islands has no central bank mechanism to undertake monetary interventions, and as such the Cook Islands Government is reliant on its fiscal levers to influence aggregate demand.

2.3 Measuring the output gap

Potential output, and therefore the output gap, is not directly observable and has to be inferred from other observable variables, such as actual output, using statistical, econometric or modelling techniques.

A wide range of measurement techniques have been developed, that, following Micallef (2014), can be grouped into three categories:

- statistical and econometric techniques to extract the trend and cyclical components of output;
- production function methods based on a comprehensive economic framework to estimate potential out; and
- dynamic stochastic general equilibrium (DSGE) micro-economic models that estimate alternative model-based notions of potential output encompassing the level of output obtained under flexible prices and wages.

The first category, which is the focus of this paper, can be further sub-divided into univariate and multivariate methods. These methods are based on the concept that economic output, or GDP in this case, can be decomposed into a trend (potential output) and cycle (deviations from trend) components.

[4] RBNZ, 2018a: 22.

2.3.1 Univariate approaches

These are methods that are based on a particular statistical procedure and motivated by the fact that, relying solely on the output variable, they require less information than economic theory-based methods.

Commonly-used methods include the Hodrick-Prescott filter (HP filter) and band-pass filters, such as the Baxter-King band-pass filter. The HP filter extracts a trend component by trying to balance a good fit to the actual series with a certain degree of smoothness in the trend. Band-pass filters aim to extract frequencies corresponding to the length of the business cycle, normally two to eight years, using a weighted moving average of past and future observations.

2.3.2 Multivariate approaches

These approaches, based on multivariate time series techniques and can be considered an extension and improvement of the univariate non-structural ones. They generally attempt to extract the trend using information in the output series together with information contained in other economic variables. These techniques commonly attempt to apply empirical relationships, such as the Phillips curve[5] and Okun's Law.[6]

> In general, these methods assume that the output gap influences inflationary pressures of domestically produced goods and services and that there is a relationship between labour market tightness and the output gap.[7]

2.4 Paper structure

The remainder of this paper is structured as follows:

- Chapter 3 analyses time series GDP and other relevant economic data for multivariate methods, including seasonal adjustment of relevant time series;
- Chapter 5 estimates the output gap using a range of univariate models;
- Chapter 6 estimates the output gap using a multivariate model;
- Chapter 7 considers the policy implications of the output gap analysis.

MFEM used the following open source software in the development and operation of the ARIMA model:

- the R statistical package[8]; and
- the RStudio interface.[9]

[5] The Phillips Curve describes an inverse relationship between the level of unemployment and the rate of inflation.

[6] Okun's Law relates to a relationship between the United States unemployment rate and its gross national product.

[7] Micallef, 2014: 8.

[8] R Core Team (2018).

[9] RStudio Team (2016).

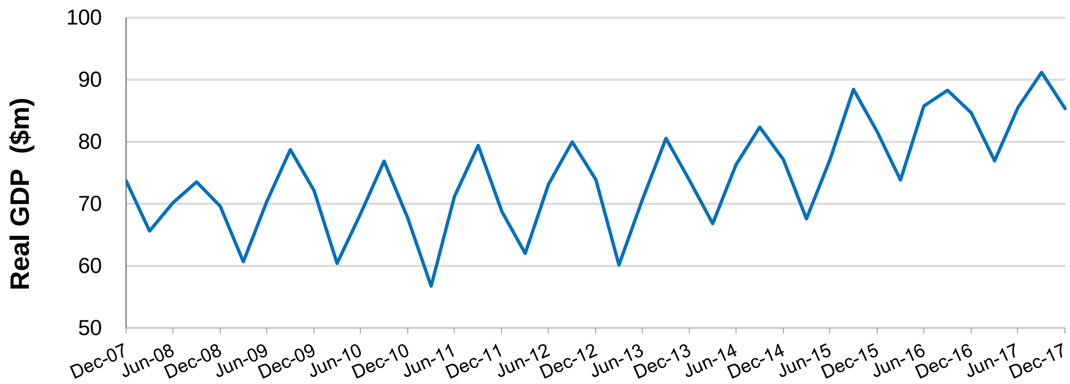
3 Time series analysis

3.1 Output – GDP

The Cook Islands Statistics Office publishes current and constant price GDP on a quarterly basis. The 2006 calendar year is used as the base year, with current prices adjusted using an implicit price deflator.

Real quarterly GDP from December 2007 to December 2017, the latest available, is shown in Figure 3-1. There is clear indication of a seasonal pattern and an increasing trend in the data,

Figure 3-1: Total real quarterly GDP, $m

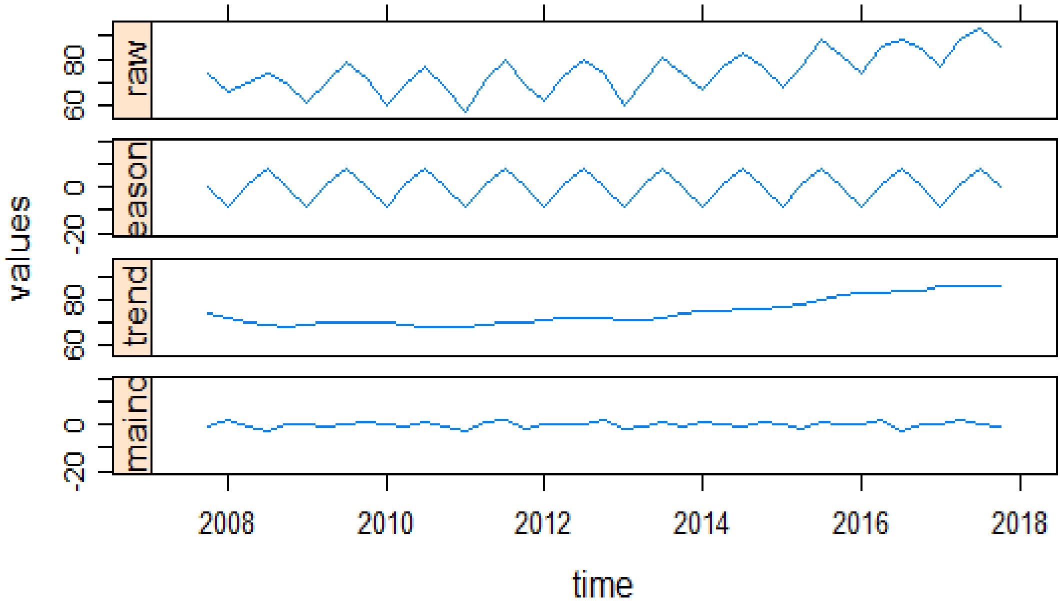


Source: Cook Islands Statistics Office.

Seasonal Trend Decomposition using Loess (STL) is an algorithm that was developed by Cleveland et al. (1990) to decompose a time series into trend, seasonal and remainder components. STL consists of a sequence of applications of the loess smoother.

Decomposing the time series GDP data into its trend, seasonal and remainder components, using the ‘stlplus’ function in R, confirms a seasonal and trend pattern (see Figure 3-2).

Figure 3-2: Real GDP – decomposed



Source: MFEM analysis, R Studio output.

The seasonal GDP pattern reflects the tourist season – peak tourist season is from May to September which matches GDP peaks in the June and September quarters, and troughs in December and March.

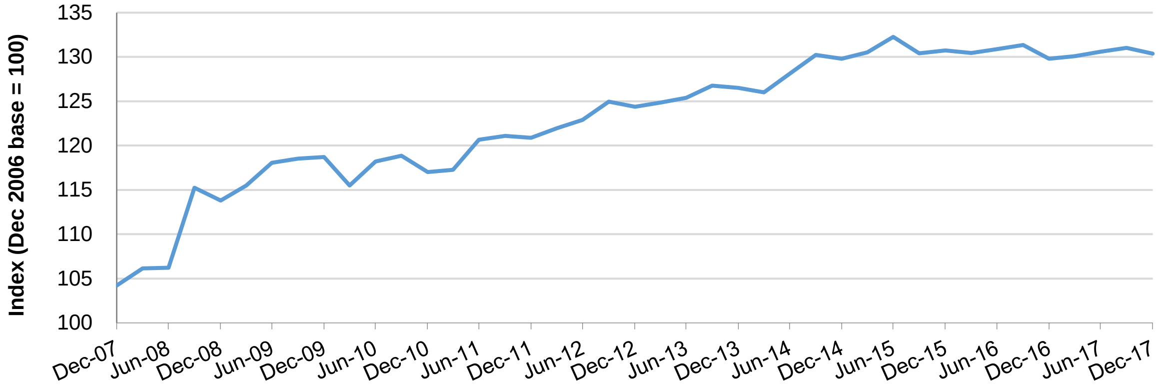
3.2 Explanatory variables

A number of explanatory variables were assessed for the purposes of developing a multivariate model. The final choice was limited to data available in quarterly (or monthly) frequency over the 10-year period from December 2007 to match the quarterly GDP time series. For example, one key potential explanatory variable, the unemployment rate, was excluded on this basis.

3.2.1 Consumer Price Index

The Cook Islands Statistical Office publishes a Consumer Price Index (CPI) each quarter that measures changes in prices on Rarotonga. The CPI for the period December 2007 to December 2017 is shown in Figure 3-3. The CPI data shows an inclining trend from December 2007 until June 2015, and remained relatively flat since then.

Figure 3-3: Consumer Price Index

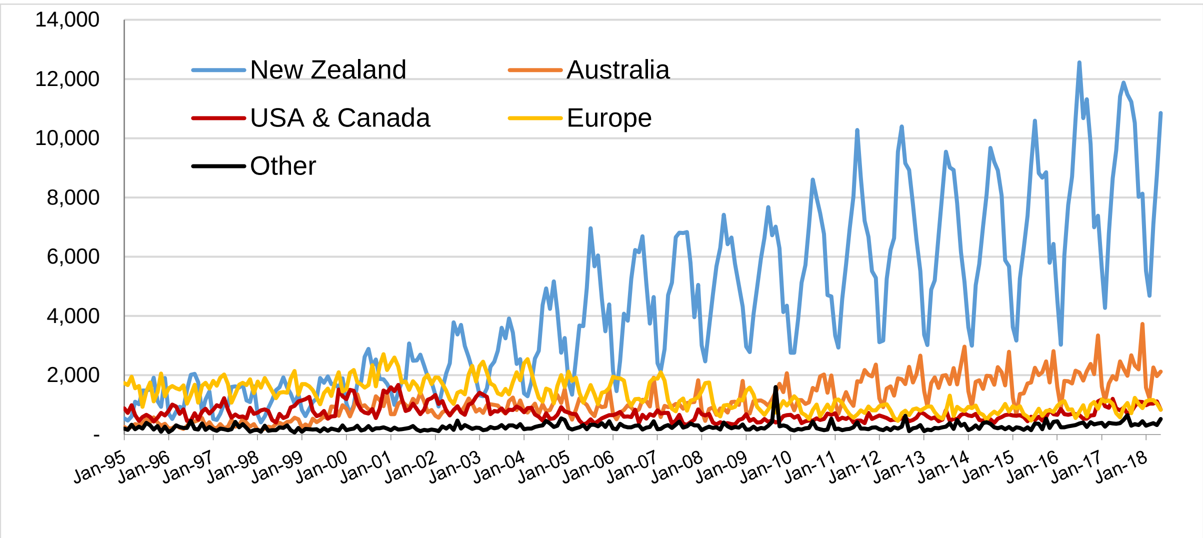


Source: Cook Islands Statistics Office.

3.2.2 Visitor arrivals

The Statistics Office publishes monthly data on visitor arrivals in the Cook Islands, disaggregated by country of usual residence. Figure 3-4 shows monthly arrivals data from January 1995 to June 2018. The data shows a strong inclining trend and a very clear seasonal pattern, with peaks in the cooler 'dry' months from May to September, and troughs in the warmer and wetter period from October to April.

Figure 3-4: Visitor arrivals by country of residence

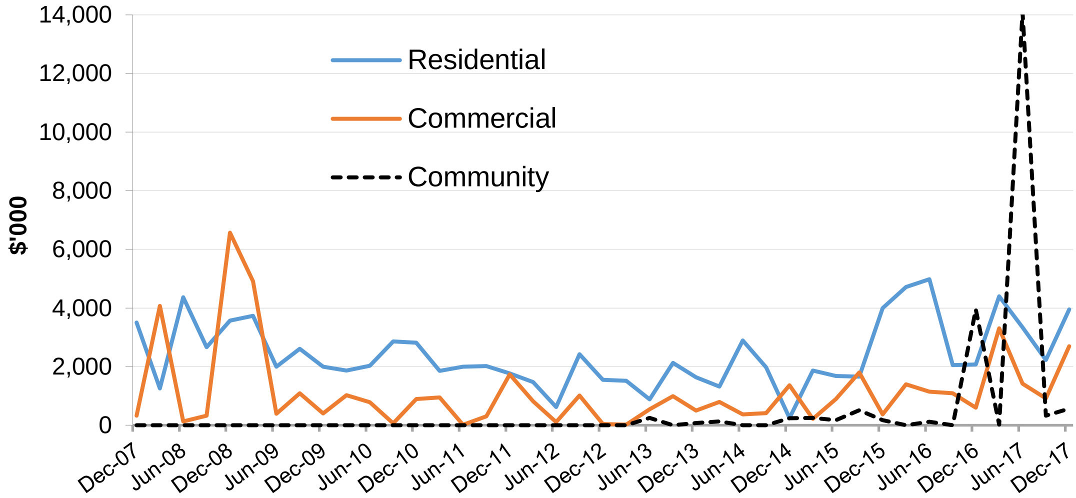


Source: Cook Islands Statistics Office.

3.2.3 Building approvals

The Statistics Office publishes quarterly data on the value of building approvals in the Cook Islands, disaggregated into residential, commercial and community categories, as shown in Figure 3-5.

Figure 3-5: Building approvals, $'000



Source: Cook Islands Statistics Office.

4 Seasonal adjustment

4.1 Introduction

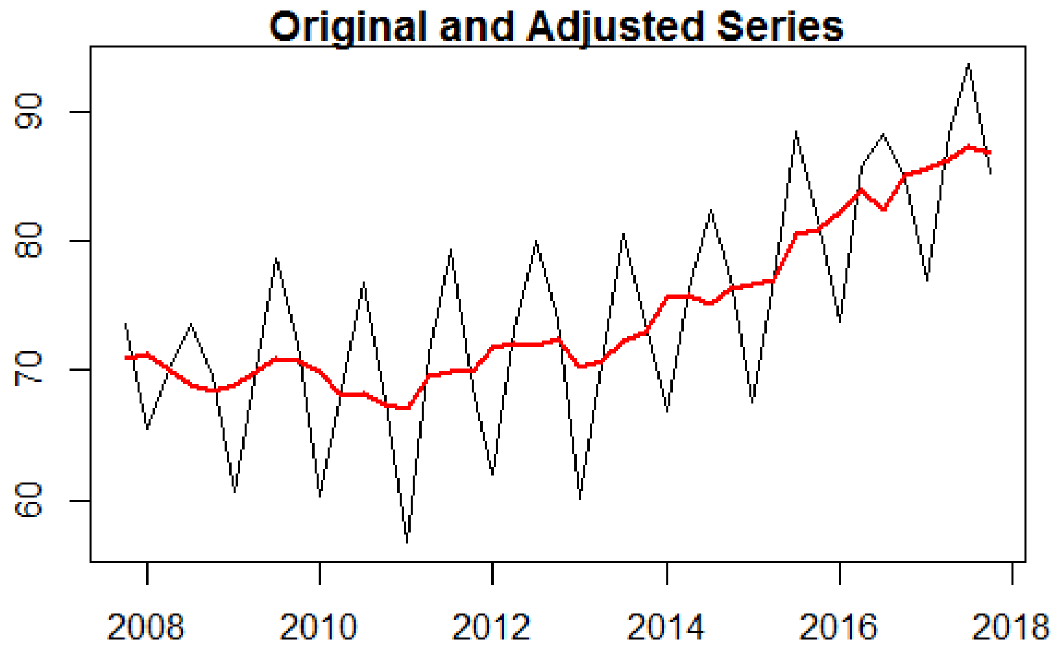
The starting point for the output gap analysis is to seasonally adjust the variables of interest that display a seasonal pattern. This includes the GDP and arrivals time series.

The seasonal adjustment is accomplished using the 'seasonal' package in R which provides an interface to X-13 ARIMA-SEATS, the seasonal adjustment software developed by the United States Census Bureau. The software estimates seasonality primarily by applying moving average filters to a possibly modified version of the input series. The modifications might include adjustments for extreme values, trading day effects, or holiday effects also estimated by the program. The filters are chosen from a fixed set of filters automatically, on the basis of certain signal-to-noise ratios.[10]

4.2 Adjustment

The original and adjusted series are shown in Figure 4-1 and Figure 4-2.

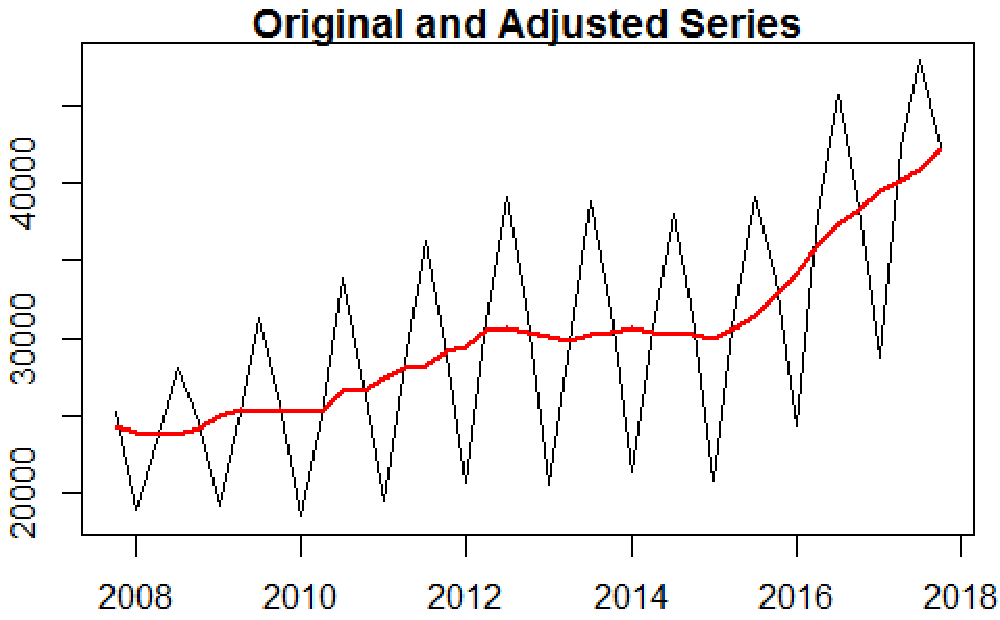
Figure 4-1: Seasonally adjusted real GDP, $m



Source: MFEM analysis, R Studio output.

[10] More information on the the X-13 ARIMA SEATS Seasonal Adjustment Program is available at: https://www.census.gov/srd/www/x13as/.

Figure 4-2: Seasonally adjusted total visitor arrivals



Source: MFEM analysis, R Studio output.

5 Univariate approaches

5.1 Univariate methods

Three univariate techniques were applied to the seasonally adjusted real GDP data to estimate potential GDP over the period December 2007 to December 2017:

- Hodrick Prescott (HP) filter;
- Baxter-King bandpass filter; and
- Kalman filter.

5.1.1 Hodrick-Prescott filter

The HP filter, one of the most commonly used univariate methods, estimates potential output by minimizing the sum, over the time series, of squared distances between actual and potential output at each point in time, subject to a restriction on the variation of potential output.

> The restriction parameter λ captures the importance of cyclical shocks to output relative to trend output shocks, and thereby controls the smoothness of the series of potential output: a smaller value of λ indicates a smaller importance of cyclical shocks and yields a more volatile series of potential output.[11]

Although the HP filter has become the standard method for removing trend movements in the business cycle literature, it has been subject to heavy criticism. For example, Hamilton (2017), in an elegantly titled paper 'Why You Should Never Use the Hodrick-Prescott Filter', cited the following criticisms:

> (1) The HP filter produces series with spurious dynamic relations that have no basis in the underlying data-generating process.
>
> (2) Filtered values at the end of the sample are very different from those in the middle, and are also characterized by spurious dynamics.
>
> (3) A statistical formalization of the problem typically produces values for the smoothing parameter vastly at odds with common practice, e.g., a value for λ far below 1600 for quarterly data.[12]

The R package 'mFilter' and the function 'hpfilter' was used to run the HP filter on the seasonally-adjusted GDP time series data. Following Hodrick and Prescott (1981), the recommended frequency of 1,600 was applied for the quarterly data series.

5.1.2 Baxter-King filter

The BK band-pass filter, proposed by Baxter and King (1995), produces similar results to the HP filter. A relatively serious drawback of this method is that the smoothing factor results in

[11] Micallef, 2014: 4.

[12] Hamilton, 2017: 1.

the loss of observations at the beginning and the end of the series. This is a particular problem for short time series such as we are dealing with in this paper.

The R package 'mFilter' and the function 'bkfilter' was used to run the BK filter on the seasonally-adjusted GDP time series data. The default lower and upper bound of 2 and 32 periods, respectively, was applied.

5.1.3 Kalman filter

The Kalman filter is an algorithm that uses a series of measurements observed over time, containing statistical noise and other inaccuracies, to produce estimates of unknown variables by estimating a joint probability distribution over the variables for each timeframe.

In R, the Kalman Filter can be applied using the dynamic linear modelling (DLM) approach in the package 'dlm'.[13] In this paper, the example provided in Petris *et. al.* (2009) has been adopted.[14]

The model for seasonally-adjusted GDP as described by Petris *et. al.* (2009) is as follows:

$$Y_t = Y_t^{(p)} + Y_t^{(g)},$$

$$Y_t^{(p)} = Y_{t-1}^{(p)} + \partial_t + \varepsilon_t, \qquad \in_t \sim \mathrm{N}(0, \sigma_\epsilon^2)$$

$$\partial_t = \partial_{t-1} + z_t, \qquad \mathrm{z}_t \sim \mathrm{N}(0, \sigma_z^2)$$

$$Y_t^{(g)} = \phi_1 Y_{t-1}^{(g)} + \phi_2 Y_{t-2}^{(g)} + \mu_t, \qquad \in_t \sim \mathrm{N}\left(0, \sigma_\mu^2\right)$$

Where:

- Y_t is the log of real GDP; and
- $Y_t^{(p)}$is the log potential GDP.

This can be modelled as a state space DLM with two components: a stochastic trend component for the potential output (using the 'dlmModPoly' function)[15], and a stationary AR(2) residual component for the gap.[16]

<u>Potential output</u>

$Y_t^{(p)}$ follows a linear growth model, observed without error as follows:

- The state vector is $\theta_t^{(p)} = \left(Y_t^{(p)}, \partial_t\right)'$;
- The innovation vector is $w_t^{(p)} = (\varepsilon_t, z_t)'$;
- The observation and variance matrix are:
  - $F^{(p)} = [1,0]$, $V^{(p)} = [0]$;

[13] For more detail see: https://cran.r-project.org/web/packages/dlm/dlm.pdf.

[14] Petris *et. al.*, 2009: 115.

[15] This function creates an n-th order polynomial DLM.

[16] This function creates an object of class dlm representing a specified univariate or multivariate ARMA process.

- The system evolution matrix and innovation variance are:
  - $G^{(p)} = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$, $W^{(p)} = diag(\sigma_\epsilon^2, \sigma_z^2)$.

The error terms ε_t and z_t are interpreted as shocks to the output level and the output growth rate, respectively.

Output gap

The output gap $Y_t^{(g)}$ is described by an AR(2) model, which can be written as a DLM with:

- $\theta_t^{(g)} = \left(Y_t^{(g)}, \theta_{t,2}^{(g)}\right)'$;
- $F^{(g)} = [1,0]$, $V^{(g)} = [0]$;
- $G^{(g)} = \begin{bmatrix} \phi_1 & 1 \\ \phi_2 & 0 \end{bmatrix}$, $W^{(g)} = diag(\sigma_\mu^2, 0)$.

The DLM representation of the model is obtained by adding the two components described above to obtain the following combined matrices:

- $F = [1010]$;
- $G = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & \phi_1 & 1 \\ 0 & 0 & \phi_2 & 0 \end{bmatrix}$;
- $V = [0]$; and
- $W = diag(\sigma_\epsilon^2, \sigma_z^2, \sigma_\mu^2, 0)$.

The DLM has five unknown parameters viz. σ_ϵ^2 and σ_z^2 for the trend component and ϕ_1, ϕ_2 and $\sigma_\mu^2$for the output gap component. The unknown parameters are estimated using a maximum likelihood estimator (MLE) – the 'dlmMLE' function in R.[17] The parameters of this MLE output are then utilised in a subsequent application of the Kalman filter (dlmFilter)[18] and then smoother (dlmSmooth)[19].

The MLE estimates for the unknown parameters are:

- σ_ϵ = 0.0191483, σ_z = 0.001060611 and σ_μ = 0.008931948;

[17] This function returns the MLE of unknown parameters in the specification of a state space model.

[18] This function computes the Kalman filtered values of the state vectors, together with their variance/ covariance matrices.

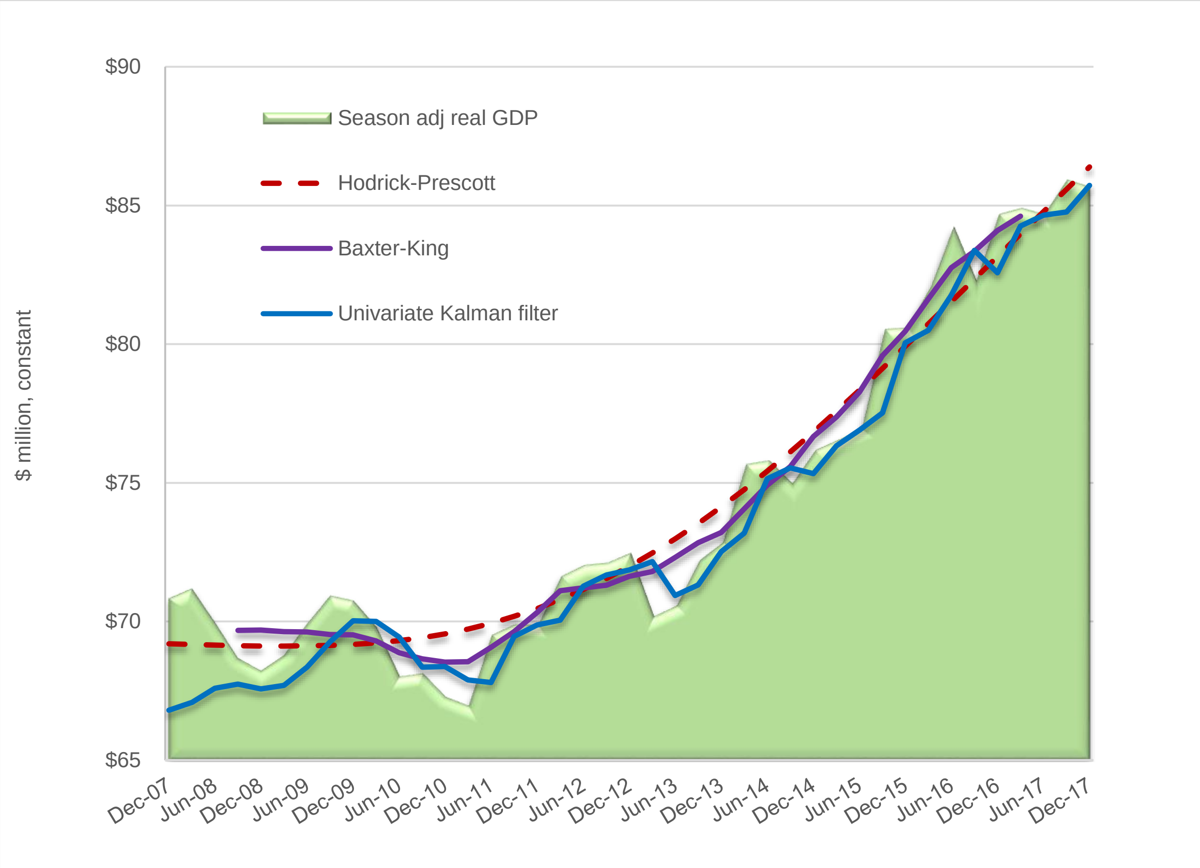
[19] This function computes the Kalman smoothed values of the state vectors, together with their variance/ covariance matrices.

- ϕ_1= 0.6278723, ϕ_2= -0.000008374249.

5.2 Univariate results

The extracted quarterly trend from the univariate HP, BK and Kalman filter methods are shown in Figure 5-1 compared to observed, seasonally-adjusted real GDP. The HP and BK results suggest a positive output gap since about September 2015, with actual GDP above potential GDP. The Kalman filter trend also suggests positive gap, for a longer period.

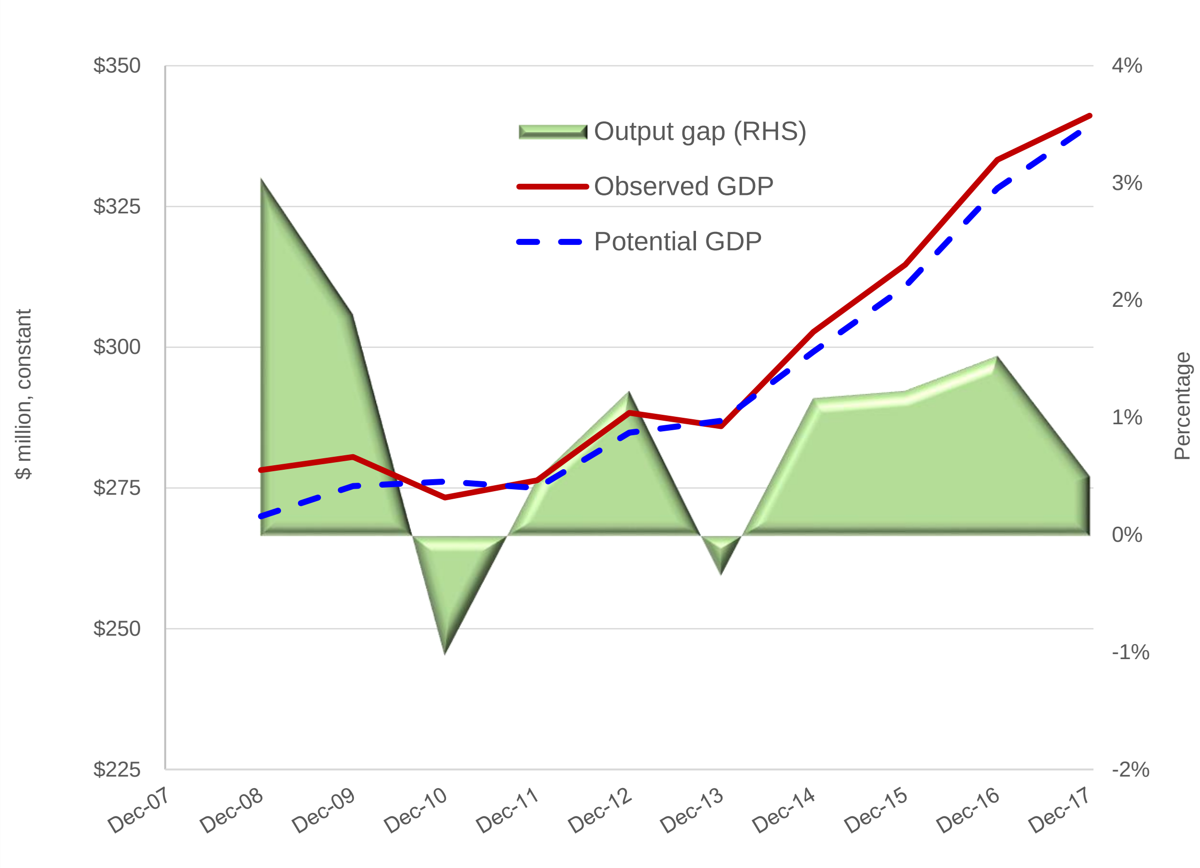
Figure 5-1: Quarterly univariate trend, $m



Source: MFEM analysis.

Figure 5-2 shows an annual representation of the output gap using the Kalman filter estimate as a percentage of actual GDP. This shows a substantial positive output gap for an extended period from 2014.

Figure 5-2: Annual output gap, univariate Kalman filter estimate[20]



Source: MFEM analysis.

[20] The output gap is calculated as a percentage of potential output.

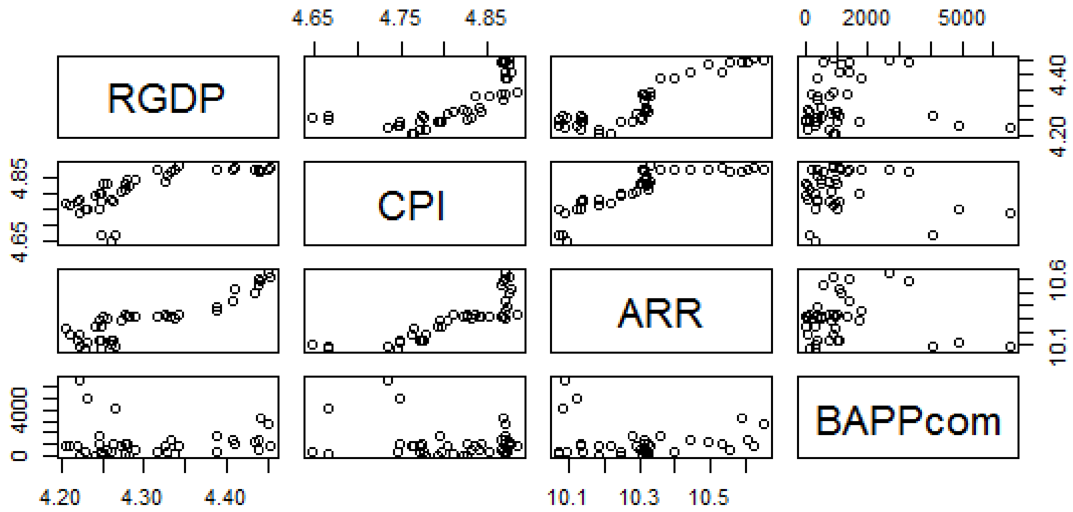
6 Multivariate approaches

6.1 Multivariate Kalman filter method

A time-varying DLM Kalman filtering approach with lagged regressors was applied, utilising the 'dlm' package in R, with real quarterly GDP (RGDP) regressed against lags of CPI, arrivals (ARR) and commercial building approvals (BAPP).

The 'pairs' function in R produces a matrix of scatter plots that provides a visual indication of the correlation between the dependent variable and explanatory variables. Two the explanatory variables – CPI and arrivals (ARR) – show a positive correlation with RGDP.

Figure 6-1: Pairs matrix



Source: MFEM analysis.

Following Piccoli (2015), the main feature of the DLM model is that the coefficients are allowed to change over time. The model is specified as follows:

$$y_t = \alpha_t + X_t\beta_t + v_t, \qquad v_t \sim N(0, V)$$

$$\alpha_t = \alpha_{t-1} + w_{\alpha,t}, \qquad w_{\alpha,t} \sim \mathrm{N}(0, w_\alpha)$$

$$\beta_t = \beta_{t-1} + w_{\beta,t}, \qquad w_{\beta,t} \sim \mathrm{N}(0, w_\beta)$$

where the system state is represented by the vector $\theta_t = (\alpha_t, \beta_t)'$.

β_t is a vector containing the regression coefficients related to the three explanatory variables at time *t*, and X_t is the matrix of the covariates $(x_{1,t}, x_{2t}, x_{3,t})$ at time *t*.

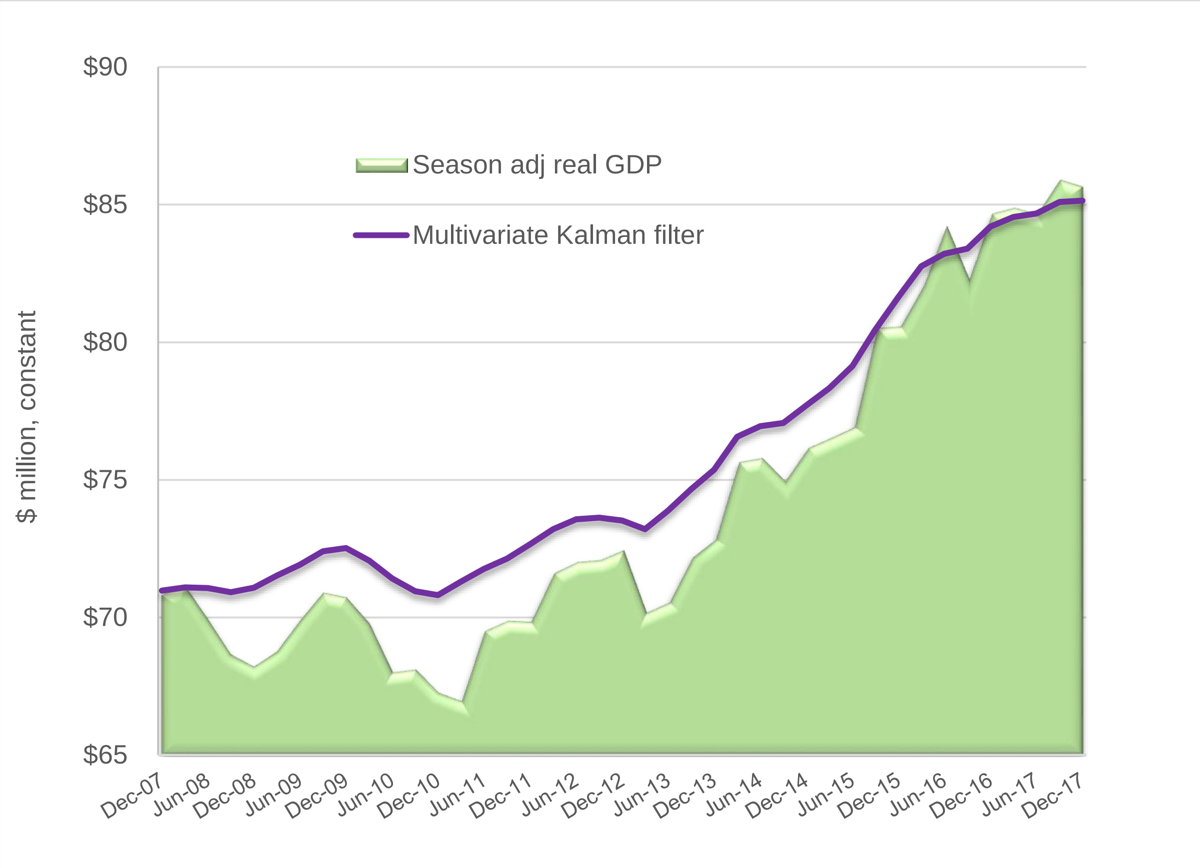
First, a regression model is constructed using the 'dlmModReg' function. The state vector is not composed by the means and the slopes of the considered variables at a given time t, but rather is time-varying in that it consists of the intercept and the regression coefficients related to the different explicative variables. The unknown parameters are estimated using MLE.

The model fit is then filtered using ‘dlmFilter’. It is then smoothed using ‘dlmSmooth’, and the smoothed trend extracted.

6.2 Multivariate results

The extracted quarterly trend from the multivariate Kalman filter is shown in Figure 6-2 compared to observed, seasonally-adjusted real GDP. While the multivariate measure is moving in the same direction as the univariate results, it suggests that the Cook Islands has entered positive output gap territory much more recently, and that the gap is smaller in magnitude.

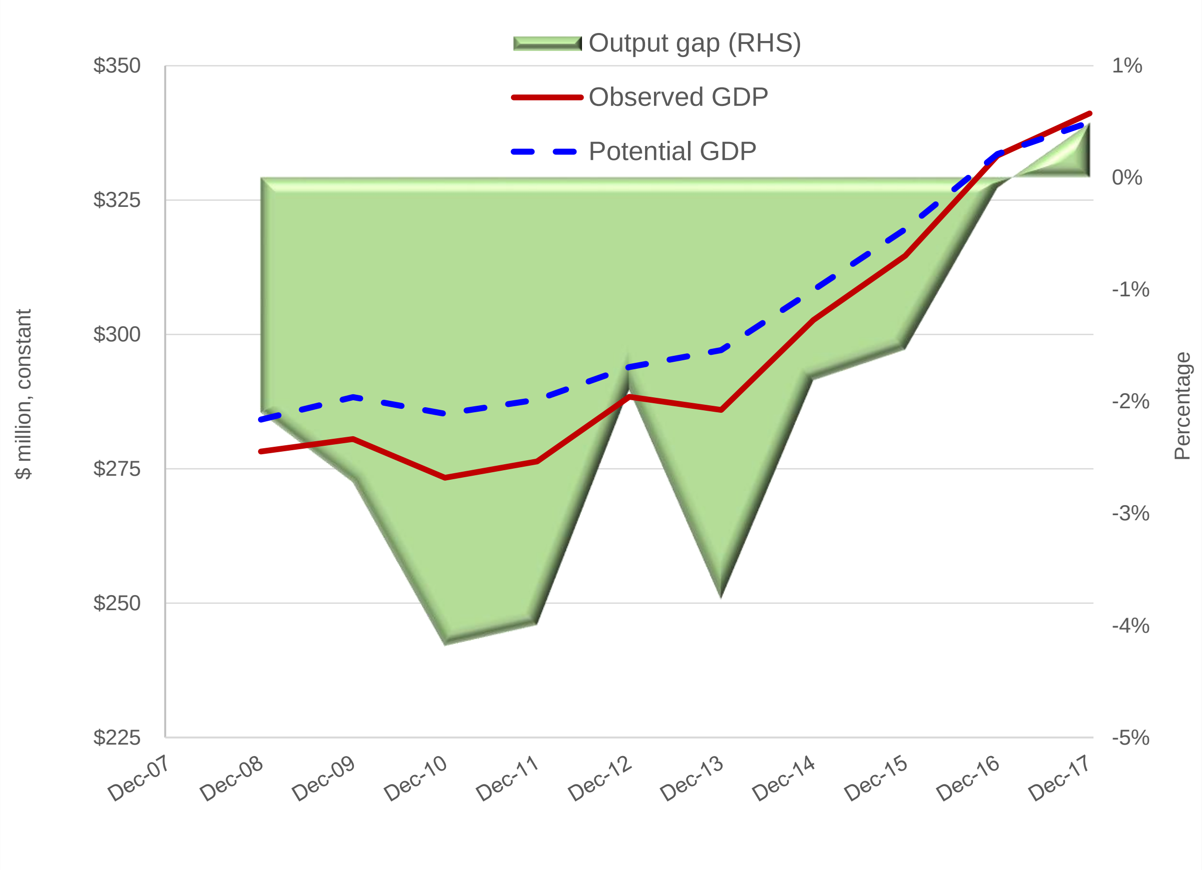
Figure 6-2: Quarterly potential output, multivariate Kalman filter estimate



Source: MFEM analysis.

This is confirmed in Figure 6-3 which shows an annual representation of the multivariate output gap.

Figure 6-3: Annual output gap, multivariate Kalman filter estimate[21]



Source: MFEM analysis.

[21] The output gap is calculated as a percentage of potential output.

7 Discussion and policy implications

7.1 Discussion

7.1.1 The univariate case

The results of the univariate analysis in Chapter 5 suggest that the Cook Islands has maintained a positive output gap over an extended period, for the previous 4 years using the Kalman filter estimate. While not a surprising result given the strong growth in GDP over the last few years, one would expect this situation to have led to a build-up of inflationary pressure. In addition, as noted in Chapter 1, such a situation is typically associated with a tightening labour market, with wage pressures further impacting on prices.

However, apart from anecdotal evidence – for example, the construction sector facing constraints finding skilled tradespersons, the tourism sector facing unskilled labour shortages and house rents rising – there appears to be little evidence of economic overheating in the leading economic indicator – the Cook Islands CPI.[22] As shown in Figure 3-3 in Chapter 3, inflation has remained fairly stable over the period in question.

There are two potential explanations for this outcome.

The first is that as a small import-intensive open economy, the Cook Islands CPI may be influenced more by external supply-side factors than domestic demand-pull forces. A cursory examination of the CPI components suggests that a significant proportion of the CPI basket comprises items whose prices are unlikely to be affected by the state of the local economy. For example, the food category, which accounts for nearly 30 per cent of the CPI basket, comprises items that are likely to be primarily imported from New Zealand.

While this first explanation would account for the lack of movement in the aggregate CPI measure, one would still expect to see components of the CPI with a high domestic content, such as housing, show signs of an increase. However, the opposite is the case, with the housing and rent component of the CPI showing a steady decline since June 2016. Taking into consideration anecdotal evidence of housing rental pressures in particular, this suggests that a review of the housing measure may be required to ensure it is adequately capturing price changes in the housing market.

A second possible explanation is that the univariate measures utilised in this paper are not realistically characterising the business cycle in the Cook Islands. An International Monetary Fund (IMF) working paper looking at the output gap in Slovakia, Konuki (2008), found that conventional univariate measures were not appropriate to estimate the output gap in an economy experiencing rapid economic growth driven by a supply-side impetus, like Slovakia.

At the time the IMF paper was written the Slovakian economy had experienced rapid growth, thanks to strong foreign direct investment inflows (following the introduction of a flat tax regime) with few signs of economic overheating. Despite this, output gap estimates using univariate methods indicated a significant positive gap:

[22]One would also expect to see an impact on unemployment rates. However, as noted in Chapter 1, no unemployment rate data series is published for the Cook Islands. In addition, there is no published wage price index, which one would also expect to be impacted by an extended positive output gap.

> Output gaps estimated by these conventional methods show a large positive swing during 2006–07: a large negative output gap observed in 2005 narrowed sharply in 2006 and turned significantly positive in 2007.[23]

Konuki (2008) argues that the univariate methods did not accurately reflect the Slovakian situation, suggesting that the explanation lay in an acceleration growth of potential output – shifting to a higher plateau due to the supply-side impetus of export-oriented investment projects – rather than an economic overheating. Konuki argues that a multivariate Kalman filter approach provides a better explanation:

> The MV Kalman filter estimates are much more plausible than those from the conventional methods when the economy is experiencing rapid growth, driven by a supply-driven impetus: it can incorporate the economic links between the output gap and other economic indicators, such as wage pressures in the [labour] market.[24]

Applying a multivariate Kalman filter approach, Konuki (2008) found that the output gap estimate pointed to an almost zero gap in 2007:

> Although the trend of the output gap in recent years is similar to that estimated by the conventional approaches, its magnitude is very different ….. The negative output gap observed in 2005 barely narrows in 2006, while the output gap is almost zero in 2007.

7.1.2 The multivariate case

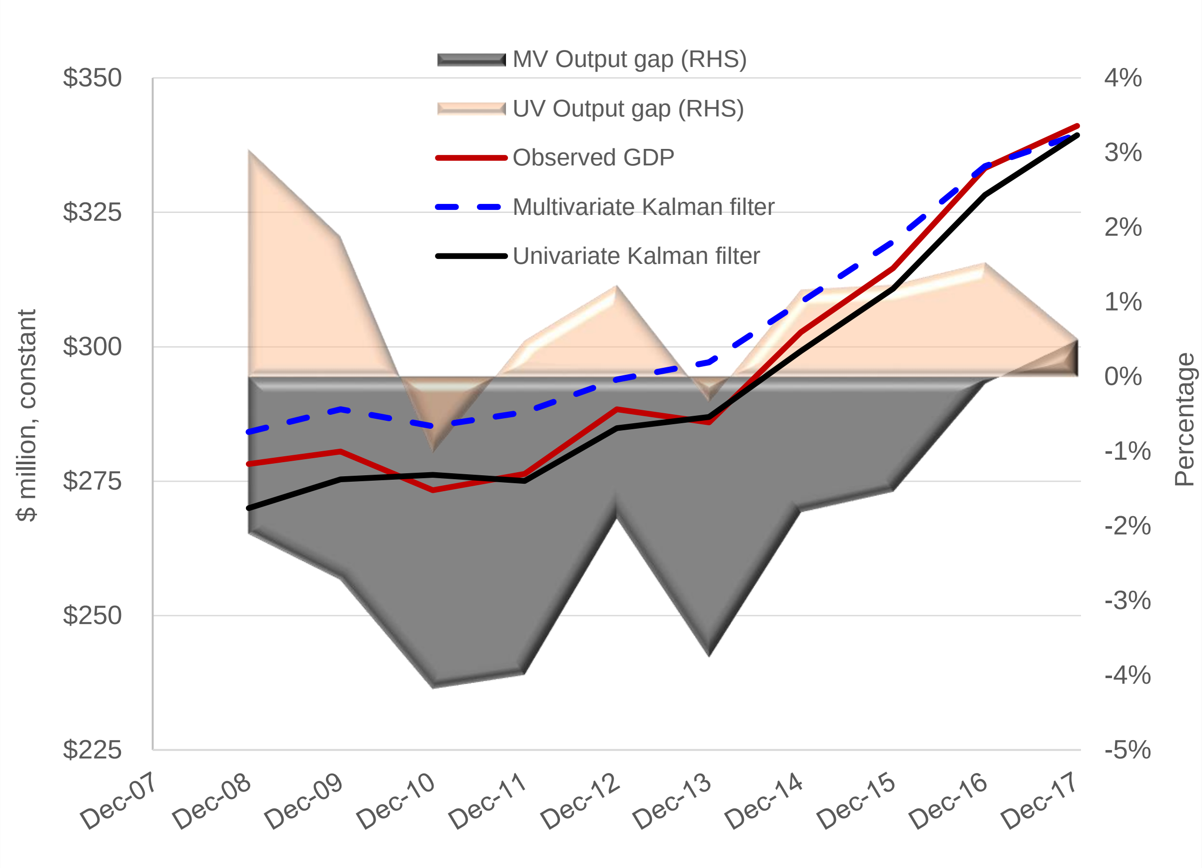
Given the similarities with the Slovakian situation in 2008 in terms of rapid economic growth on the back of an expanding tourism sector and associated business investment, as well as showing no signs of overheating in the published economic indicators, Chapter 6 presented a multivariate approach to see if that might shed more light on the Cook Islands economic situation.

Figure 7-1 shows the multivariate Kalman filter results in comparison to the univariate case. Three inferences can be drawn from this figure. First, the direction or trend of the output gap in recent years is similar between the multivariate and univariate approaches. That is, the Cook Islands is now performing above its potential output. Second, the Cook Islands economy has only been performing above potential output for about a year, a much shorter period than the 4 years implied by the univariate Kalman filter gap measures. Third, it suggests that the positive output gap is smaller in magnitude than that implied using the univariate measures.

[23] Konuki, 2008: 3.

[24] Konuki, 2008: 16.

Figure 7-1: Annual output gap, univariate and multivariate Kalman filter estimates[25]



Source: MFEM analysis.

This finding implies that the productive capacity of the Cook Islands economy – that is its potential output – may have grown at a faster rate than indicated by the univariate measures. This would help explain the absence of signs of overheating in the Cook Islands economic indicators.

7.2 Policy implications

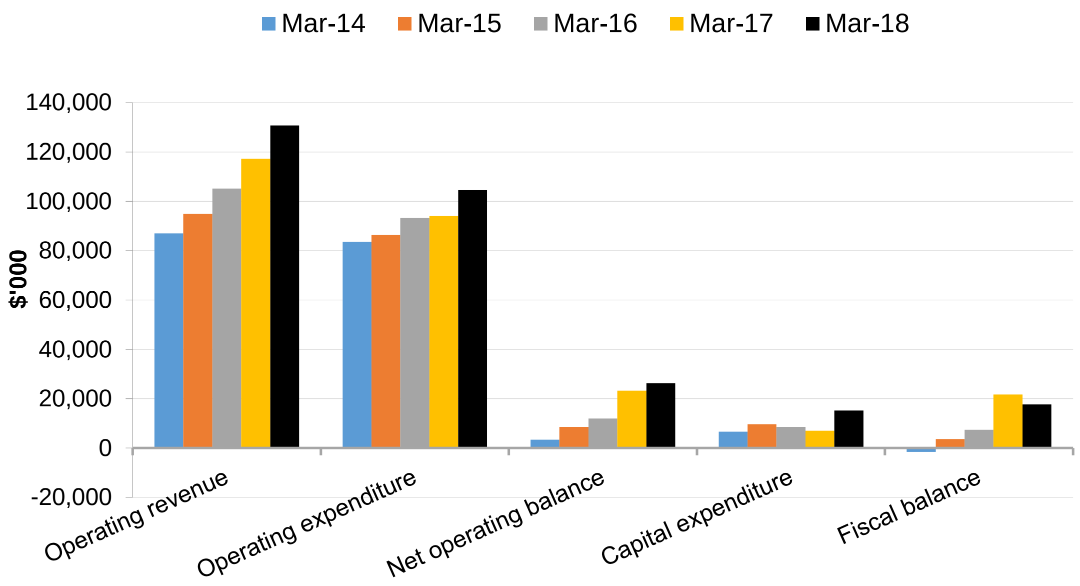
7.2.1 Fiscal policy

The key conclusion of this this paper is, irrespective of whether one applies a univariate or multivariate measure, that the Cook Islands is currently confronting a positive output gap. While there is no evidence of overheating showing up in the CPI data, should the positive output gap continue for an extended period of time, inflationary pressure and other overheating impacts such as labour and skills shortages are likely to eventuate.

In the absence of the traditional monetary policy levers, fiscal policy is the Cook Islands Government's (CIG) primary means of influencing economic output. The fiscal policy tools available to influence aggregate demand and therefore economic output are government expenditure and tax rates (government revenue). The CIG's stance on fiscal policy can be judged by examining changes in its fiscal balance (budget surplus or deficit). A shown in Figure 7-2, the CIG has maintained a fiscal surplus over the last few years.

[25] The output gap is calculated as a percentage of potential output.

Figure 7-2: Cook Islands Government fiscal balance, $'000



Source: MFEM analysis.

Following the Keynesian model, when faced with a positive output gap and the potential for the economy to overheat, government may consider implementing contractionary fiscal policy – in particular decreasing government expenditure. In the case of the Cook Islands, it may be worth considering either decreasing, or at least limiting the growth in, the future level of CIG expenditure, both operating and capital.

7.2.2 Data requirements

Good macroeconomic policy decision-making requires access to reliable and regular time series data on a range of key economic indicators. This includes indicators such as the consumer price index, unemployment and labour participation rates, and a wage price index. The analysis in this paper has highlighted a number of potential data quality and data availability issues for the Cook Islands.

It would be useful to review the current CPI measure, and in particular the components with a large domestic component, to ensure that they are adequately reflecting recent changes in price levels.

In addition, the introduction of a labour force data series and potentially a wage price index would allow an improved analysis of the Cook Islands economic cycle and better inform macroeconomic decisions by government. For example, the availability of an unemployment rate data series would enable the application of economic theories such as Okun's Law to further refine multivariate measures of the Cook Islands output gap.

Abbreviations and acronyms

ABS	Australian Bureau of Statistics
ACF	Autocorrelation function
AIC	Akaike Information Criterion
AR	Autoregressive
ARIMA	Autoregressive integrated moving average
GDP	Gross Domestic Product
HES	Household Expenditure Survey
MFEM	Ministry of Finance and Economic Management
OLS	Ordinary least squares
PACF	Partial autocorrelation function

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