

# The output gap: what is it, how can it be estimated and are estimates fit for policy makers' purposes?

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## Introduction

The Scottish Fiscal Commission (SFC), as part of its statutory remit to produce forecasts of the Scottish economy and revenues from devolved taxes, provide assessments of Scotland's 'output gap', which in turn are derived from estimating 'potential output'. The evolution of potential output and the output gap play key roles in any assessment of the current position of the Scottish economy, and in turn the outlook for future economic growth and tax revenues. This article looks at these concepts in more detail.

In what follows we explain the concept of the output gap, its relevance to policy, how output gaps in a given economy can be estimated and why the estimates are always uncertain. We then discuss current views on the evolution of the UK's output gap and the SFC's estimates of Scotland's output gap and end by discussing whether estimates of the output gap currently tell policymakers what they really need to know.

## What is the output gap<sup>30</sup>?

In general, economists are not only interested in whether output is going up or down, but also in whether it is above or below its potential. The output gap provides an assessment, at a given point in time, of the difference between an economy's estimated productive potential (typically referred to as 'potential output') and the actual level of output. Potential output is the maximum amount of goods and services an economy can produce when it operating efficiently, that is, at full capacity. A zero output gap implies that actual output is equal to potential output.

A healthy economy in which actual and potential output are growing together, such that the output gap remains at zero would be the aim. However, the output gap at any point in time could be positive or negative, and it is important to emphasise that neither a positive nor a negative gap is desirable. In the next section we sketch out why this is the case, looking in turn at monetary and fiscal policy in the context of positive and negative output gaps.

## Positive and negative output gaps and their relevance to monetary policy

A positive output gap occurs when actual output is greater than potential output. This generally happens when demand is very high and the economy is said to be "overheating". To meet demand, businesses, factories and workers operate beyond their most efficient capacity. This is feasible in the short term, but results in higher costs, which continually drive up prices and wages, generating rising inflation. If demand remains high, the only way this can be sustained without accelerating inflation is if potential output increases, i.e. the economy expands its production capacity; this is most likely to be achieved via investment in physical and human capital, which takes time to deliver. In the short term, a forecast of an emerging positive output gap is likely to result in tighter monetary policy, through a higher interest rate which is intended to "cool" the "overheating" economy by inducing a decline in interest sensitive components of demand, including business investment and household consumption.

A negative output gap occurs when actual output is below the level of output the economy could produce at full capacity. An emerging negative gap implies that there is spare capacity, or slack, in the economy due to deficient demand. During a recession, as output drops below potential, unemployment tends to rise and price and wage growth fall, resulting in falling inflation. On recognising that falling demand is leading to

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<sup>30</sup> There is a long established literature in economics on the theory and estimation of output gaps. While we will touch on this a little in this short article, we refer readers who are interested in a more in-depth discussion of these issues to some excellent review articles (for example Murray (2014)).

the emergence of a negative output gap and is likely to result in falling inflation, the Bank of England will generally adopt expansionary monetary policy in the form of a lower interest rate and/or unconventional methods such as quantitative easing, to boost demand, narrow the output gap and prevent inflation from falling below the 2% target.

Central banks typically define potential output as the level of output consistent with the absence of any pressure on prices to rise or fall. The aim for any inflation-targeting central bank is to achieve a zero output gap alongside low and stable inflation, ideally alongside sustainable and buoyant output growth.

### **The relevance of the output gap to fiscal policy**

From a fiscal policy perspective, assessments of the output gap are important in determining the extent to which developments in public finances are cyclical or structural. This distinction is crucial both when forecasting how fiscal balances are likely to evolve and when making judgements as to whether or not public finances are sustainable. Put simply, a budget deficit at a given point in time needs to be viewed alongside information on whether the economy is working at, above or below capacity.

To explain why the distinction between cyclical and structural developments is important, consider what happens as an economy enters a recession: the cyclically sensitive components of public expenditure such as job seekers allowance, housing benefits and so on, will automatically increase given existing rules on entitlement and levels of support; while tax receipts automatically fall, reflecting the impact of declining sales, earnings and employment at existing tax rates and tax thresholds. These cyclically sensitive components of spending and revenue are collectively known as “automatic stabilisers”.

As a negative output gap emerges, automatic stabilisers act to dampen the economy’s decline, but another result will be an emerging cyclical budget deficit. Importantly, automatic stabilisers also operate in reverse as the economy recovers and if the economy “overheats”. So, in and of itself, a deficit that emerges as a result of the operation of automatic stabilisers can be viewed as temporary, and can reasonably be financed by borrowing in the short term since it will automatically be replaced by cyclical surpluses that can be used to pay down that borrowing in the medium run, provided that the underlying structure of the economy has not changed.

The alternative of enforcing a balanced budget rule at every point in the cycle would be inappropriate. To illustrate this, imagine what would happen if, despite entering into a recession, policymakers had to balance expenditure and revenue in every period. Weakening activity would still result in declining revenues and increases in some elements of expenditure through the operation of automatic stabilisers. In order to balance the budget, the government would then have to raise existing tax rates, introduce new taxes and/or cut discretionary expenditure, in order to offset the effect of automatic stabilisers. In the Scottish case there is of course the issue that fiscal policy is in part controlled by the UK government, so assessing the overall fiscal stance requires more than an assessment of the cyclical/structural elements of the Scottish budget. Since this is not the primary focus here, we avoid a full discussion of this point.

The problem with balancing the budget during a recession is that the required policies would then exacerbate the downturn: reducing households’ disposable income, firms’ post-tax profits and public sector jobs and having further knock on effects to reduce demand, resulting in a rising debt to GDP ratio, despite avoiding any change in borrowing. The increase in the debt to GDP ratio would not reflect increases in debt but rather the adverse impact on GDP. Likewise when an upturn in activity results in a cyclical improvement in government revenues and a decline in welfare spending, balancing the budget would require lower tax rates and/or higher discretionary spending, both of which would add to demand, exacerbating the “overheating” of the economy and adding to inflationary pressure during the upturn.

In a downturn, fiscal policymakers who are able to do so may choose to add to the operation of automatic stabilisers with discretionary stimulus. They can potentially do this via cuts in tax rates, bringing forward public sector investment, making decisions to boost infrastructure spending, and so on. Adding discretionary stimulus in this way is likely to be particularly beneficial when a recession is expected to be

severe and/or long lasting, and all the more so once monetary policymakers have already reduced interest rates as far as they can go. At such times there is now ample evidence that fiscal expansion can have beneficial impacts, unchecked by the kind of ‘crowding out’ of private sector investment and consumption that might occur at other times, given that both are depressed.

However, any such discretionary stimulus will not automatically be corrected as the economy recovers. Left unchecked, this is the kind of policy that could result in deficit bias; that is a tendency to run deficits in bad times and in good times, which can result in a continuously rising, and ultimately unsustainable debt to GDP ratio. Financial markets, well aware of the implications of such trends, demand higher bond yields and hence accelerate a damaging vicious circle. To avoid this, prudent fiscal policy makers will make clear that once a recovery is underway, and while monetary policymakers turn their focus to how quickly inflation pressure will pick up, they will be monitoring how long it takes for tax receipts to recover and benefit spending to fall, and make decisions on when it is appropriate to replace discretionary stimulus with austerity measures. Note that timing is crucial here and the questions rightly focused upon by both monetary and fiscal policymakers are different. In particular it is possible that inflation pressure could potentially pick up well before the public finances fully recover following a sustained recession.

From this discussion it should be clear why, when forecasting developments in fiscal balances and making policy decisions, fiscal policymakers should not simply look at the most recent data in isolation and their objective should not be to balance their budget in each year. A particular value of a budget deficit today, or more importantly, given that the tax base rises with GDP, the budget deficit as a % of GDP today, has to be considered alongside forecast changes in both the output gap and the components of the deficit over coming years.

As noted above, the SFC have a remit to produce forecasts for the economy and devolved tax revenues in Scotland, so must make assessments about the evolving economic cycle. SFC forecasts therefore incorporate judgement about the size of the recent and current output gap and on how long it will take for any gap to close. Linked to this is a judgement about the extent to which the evolving deficit is cyclical or structural, and a view on how government revenues and expenditure will correct as the output gap evolves.

The SFC should, in our view, do much more to explain this in the commentary that accompanies its published forecasts. While admitting that judgements are being made, there is an absence of any discussion of sensitivity to alternative assumptions.

Judgement is also important when it comes to selecting a method to derive estimates of the output gap itself. In the next section we will discuss the different methods for producing estimates of the output gap and discuss their shortcomings.

## **Estimating output gaps**

Unlike actual output, the output gap and potential output are unfortunately not observable directly, they can only be estimated.

Various approaches to estimation are commonly used in practice, all of which assume that output can be divided into a trend and cyclical component. In broad terms approaches can be divided into three categories: i) univariate estimates that make use of statistical filters; ii) multivariate methods of which production function based estimates are the most common; and iii) survey based measures. Any estimate of potential output and the output gap will have its shortcomings, and this in part explains why a range of alternatives are often presented. Where these methods provide differing views it is important to consider what inference can be taken from this additional information and how this too can inform policymakers.

Taking each approach in turn, at their most simple, the univariate methods employ statistical filters to smooth actual output and generate a measure of trend output. The Hodrick-Prescott filter is one technique that is frequently used in practice, but there are many others. Estimating trends in time series data is particularly problematic near the end of the sample. Unfortunately this means that estimates of potential

output and the output gap are most uncertain for the period of the greatest interest to policymakers, i.e. for the recent past and in near term projections. For Scotland, the fact that the relevant data are available over a relatively short time period and the most recent data appears with a longer lag than does comparable UK data, present additional challenges. However one advantage of filtering univariate data is that no assumptions need to be made about the structure of the economy.

Multivariate techniques incorporate useful information on a number of other variables alongside output, and rely on using relationships based on economic theory. An example of a multivariate technique is the production function approach. This approach is applied widely, by the OECD, the OBR and others. Measures of the available labour force and the available capital stock are combined to calculate potential output under the assumption that all inputs into production are fully utilised. In principle the use of economic theory in guiding the estimation is attractive, but the production function method still requires assumptions to be made about population trends, trends in labour force participation, in accumulation of the capital stock, and in total factor productivity (the efficiency with which inputs are combined). Views about these trends, as well as about the underlying structure of the economy, can differ across researchers, therefore any given results can be controversial and consensus is unlikely.

Lastly, survey based measures of the output gap are typically derived from responses to questions that ask firms if they are working at or above/below normal levels of capacity utilisation. To the extent that the questions focus on utilisation of current capacity they are in danger of missing out on capturing intentions to increase capacity, or indeed the lack of such intentions. There is not an obvious single method for translating survey answers into a quantitative measure of the output gap, and of course survey measures are imperfect because they have limited coverage, achieve only partial response rates, and firms' responses may reflect different interpretations of the same questions.

Given limitations in all the methods, and the fact that all the methods involve a degree of judgment, it makes sense for forecasters and policymakers to also consider a range of economic indicators to infer the extent of excess demand or supply, for example tracking inflows and outflows into employment and unemployment, labour shortages, average hours worked, hourly earnings alongside surveys of investment intentions.

## **Uncertainty in output gap estimates**

Perhaps the greatest problem with all the estimation approaches outlined above is the fact that all measures of the output gap are subject to considerable uncertainty.

In broad terms, output gap uncertainty can be attributed to three main sources: end point uncertainty; data uncertainty; and model uncertainty. End point uncertainty affects the univariate and multivariate approaches outlined above: inference on the today's cyclical position has to be estimated based on trends projected into the unknown future and is highly sensitive to assumptions made. This is less of a problem with survey based measures. Data uncertainty reflects the fact that information available at the time of estimating the gap will generally be the latest available release (or vintage) of data, not the final vintage. Subsequent data releases tend to include revisions which improve accuracy, reflecting new information, and revisions can be attributed either to potential output or the output gap. The final source of output gap uncertainty relates to uncertainty about the underlying relationships in the economy. The fact is that extreme events such as the global financial crisis, the subsequent deep recession, and even the policy responses to the crisis, can potentially cause the structure of the economy to change. Certainly growth rates of output achieved in the recent past are remarkably low by historical standards, and wage growth has not so far picked up in the way that has been associated with past recoveries. It is possible that some of this reflects structural change.

## **Current views on the UK economy's output gap**

Following the financial crisis and great recession, estimates of the UK's output gap were consistently negative. Nonetheless, there is a general consensus that the UK's output gap has narrowed in recent times.

Since May 2017, forecasts in successive Bank of England Inflation Reports have pointed to spare capacity being fully absorbed before the end of the forecast period. As a result, the focus of the Bank of England's Monetary Policy Committee (MPC) has been on when interest rates should rise, see, for example Saunders (2017, 2018).

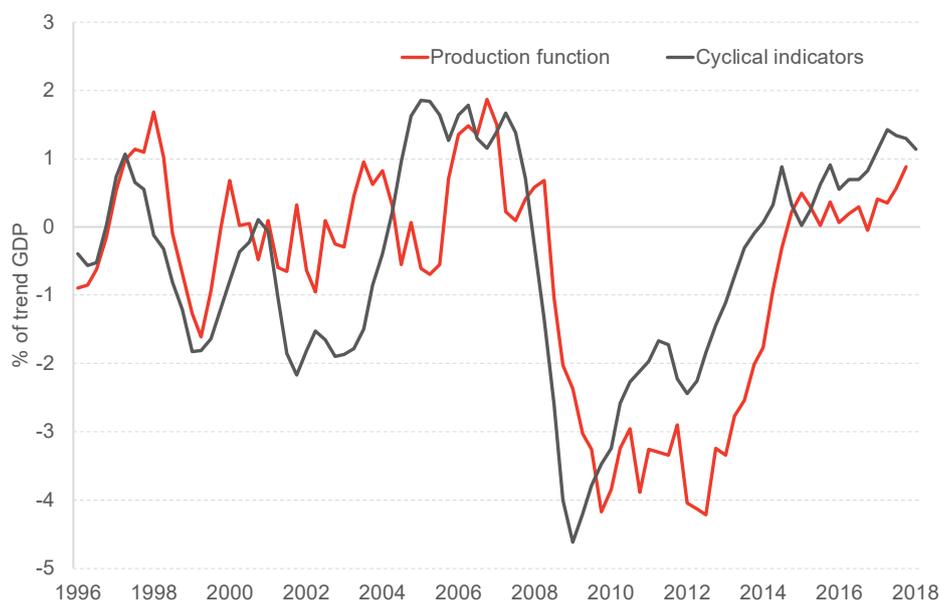
Likewise, recent forecasts from Office of Budget Responsibility (OBR) present a central scenario with a small positive output gap at the end of 2017 which then fluctuates at or slightly below this level through their forecast horizon. The OBR also consider a range of alternative scenarios for both potential output, and the output gap.

### The current view on the Scottish economy's output gap

Estimates of the output gap for Scotland's economy are now provided by the Scottish Fiscal Commission (SFC), and are intended to inform the Scottish Government's use of enhanced powers and responsibilities over fiscal policy.

The SFC has so far published two rounds of forecasts, in December 2017 and May 2018. They admittedly have a harder job than some, given the challenge of the available data, meaning they face greater difficulty in estimating both pre- and post-crisis trends. Nonetheless it is surprising that they only provide two estimates of the output gap: a central one, generated using a production function approach, and another that uses a range of Scottish specific and UK wide surveys (in an unspecified way). These are shown in Figure 1 below. The SFC comment that both estimates currently indicate a similarly sized positive output gap in 2017-18. However, they make no mention of the very different paths of the two measures during the recovery from recession, and have not presented any sensitivity analysis or alternative scenarios for the recent evolution of potential output.

**Chart 1:** Scottish Fiscal Commission estimates of Scotland's output gap



Source: Scottish Fiscal Commission, May 2018

### Do output gap estimates tell policy makers what they need to know?

Indicators of output gaps suggest there is little spare capacity left in the UK and Scottish economies. However, growth in actual output has now been weak now for a prolonged period and is not currently forecast to pick up substantively. This implies that both output and potential output are growing very slowly

by historical standards. These circumstances are very different to observing a narrowing output gap at a time of buoyant output growth.

The deep and protracted recession experienced since 2008 certainly had the potential to have caused a sizeable drop in potential output. This could be the case if large numbers of unemployed workers have exited the labour force and become inactive; if firms close and are not replaced; and if previously successful firms have ceased to operate due to stricter lending by banks that lost money during the recession. Fiscal austerity enacted before a strong recovery was underway could also have exacerbated long-term damage to potential output. However, we know that employment has been relatively strong with rising labour force participation, though this has been achieved alongside remarkably weak growth in productivity and wages.

But do we really believe that the economy is in immediate danger of “overheating”? Will firms respond to continued weak demand by raising prices? Public finances certainly haven’t yet fully recovered, and the OBR has now consistently overestimated income tax revenues for some time. So, output gap estimates alone do not seem to be sufficient to tell policy makers what they need to know.

### **Policymakers should be concerned about a likely innovations gap**

Given weak growth, it seems likely that many companies have not been investing in the most productive equipment and the best production techniques in the recent past. This will apply less to leading companies at the frontier, but could be having a major impact on the evolution of potential output if it applies to large numbers of companies whose combined performance has a far greater influence on aggregate figures. What this means is that there is likely to be a difference between actual output and the level of output that could be achieved if companies had started using the best technology available to them. Wren Lewis (2017, 2018) has referred to the gap between actual output and the output that could be achieved using the best available technology as the “innovations gap”.

Wren Lewis argues that when the innovations gap is high, as is likely now, the output gap is no longer a good indicator of how far and fast the economy can expand without generating inflation.

In a normal recovery from recession, when demand is growing rapidly, companies are happy to incur the fixed costs associated with investing in the best technology since they need to expand capacity – there is unlikely to be a persistent innovation gap in these circumstances. In contrast, in a weak and drawn-out recovery, most firms observe only very modest demand growth which is likely to be insufficient to generate significant new investment, particularly when they factor in continuing uncertainty around Brexit. The latest ONS international comparisons of show that the UK has had relatively weak investment as a proportion of GDP for a sustained period now (ONS 2018).

The UK and Scottish economies have now grown at rates well below previous trends for a significant period. Many companies may well know that their current production methods are outdated, too labour intensive and inefficient. If demand were to increase significantly, would they raise prices or rather undertake profitable investment in new equipment to meet more buoyant demand? If the latter, the potential for the return of wage growth justified by higher productivity, without therefore generating inflation, but boosting tax revenues, becomes more tenable.

Without significant investment, the innovations gap is likely to widen and persist, inhibiting growth of potential output and sustaining slow growth in actual output. Investment is essential to work toward closing the innovations gap.

### **Consequences of a large innovations gap**

From the discussion above, it is easy to argue that the greatest scope for sustained recovery comes from action that can boost potential output. From a monetary policy perspective, raising interest rates certainly won’t, in and of itself, make investment to close this gap more attractive. From a fiscal perspective, higher government investment could be necessary to shift the economy out of a low growth equilibrium, and

resolution of Brexit related uncertainty may be crucial to bringing back the desire of many businesses to invest. And if indeed there is a significant innovations gap in the UK and Scottish economies at present, this has the potential to undermine the current assessments of the OBR and SFC on the pre-eminence of policies to ensure fiscal sustainability while assuming slow growth will continue, indeed this could become a self-fulfilling prophecy.

In conclusion, policymakers, Wren Lewis argues, need to “stop treating the sustainable level of output as something which is independent of what they do.” They need to do more that recognises their role in policies that can boost potential output and the likes of the OBR and SFC could help by making it clear just how sensitive their forecasts are to alternative scenarios for potential output, including any innovations gap.

In a time of sustained weak growth, the output gap is perhaps simply no longer a sufficient guide for policy makers and policymaking.

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