INSIDE THE BLACK BOX

THE PUBLIC FINANCES AFTER CORONAVIRUS

DISCUSSION PAPER

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ABOUT THIS PAPER

The global Covid-19 pandemic has required unprecedented government action at an unprecedented pace. It is vital that policymakers act to slow the spread of the virus, protect people's livelihoods and ensure the economic recovery delivers both prosperity and justice for the long term.

This discussion paper has been commissioned to provide rapid analysis and expertise to the UK government with this goal in mind and will be followed by further analysis and recommendations from IPPR.

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KEY MESSAGES

- Responding to the Covid–19 crisis requires increased public spending and borrowing.
- We present an interactive tool to explore the implications for the public finances under a range of assumptions about the effect of the lockdown on economic growth.
- We show that public debt remains manageable across a range of possible scenarios. Therefore, it is possible to continue to bolster the economy with support schemes for workers and a broad-based post-lockdown stimulus.
- We explain that an important driver of debt sustainability is the very low interest rate on government debt. Even if this were to rise, it would take sufficiently long to feed through to higher debt servicing costs that interest payments should remain manageable.
- The public needs to be prepared for very different outcomes than those forecast by the Office for Budget Responsibility (OBR) and the Bank of England, in particular the likelihood of 'scarring' effects from the lockdown preventing a full economic 'bounceback' (a 'V-shaped recession') when the lockdown is lifted.
- We highlight the uncertainty around our forecasts using fan charts, instead of single line projections. This allows us to show a range of possible outcomes for growth, the deficit, and public debt under each set of assumptions.

INTRODUCTION

The Covid–19 crisis will have a significant impact on the public finances. Higher unemployment, reduced tax revenue and substantial government spending on schemes to support the economy will lead to higher government deficits. Already there are calls for a return to austerity once the most acute phase of the medical emergency has passed. Others instead propose that we accept higher levels of public debt. It can be difficult for citizens to take a position on these debates: many may feel that they don't have the necessary understanding or technical knowledge.

Forecasts of the public debt and deficit play an important role in framing these debates. Media headlines give the impression that higher public debt presents an immediate danger to the financial security of the average citizen. This limits the ability of voters to question their government's policies on the basis of an informed position on the likely costs and benefits of alternative strategies.

This paper considers the implications of the Covid–19 crisis for the UK public finances. We present an interactive forecasting tool for the public sector deficit and debt which has been designed to meet the following objectives.

1. It should produce plausible probability forecasts of the public finances.
2. It should remain accessible to non-specialists.

This tool is hosted online so that anyone interested in the public finances, and their implications for government policy, can use it. To illustrate its use, this paper presents forecasts for two possible scenarios: a short lockdown, as in the 'coronavirus reference scenario' recently published by the Office for Budget Responsibility (OBR 2020b), and a longer lockdown with 'scarring' effects as a result of job losses and bankruptcies.

The forecasting tool is based on the OBR database and reference scenario, and differs mainly in the assumptions made about likely GDP growth. In addition, the forecasts are presented as ranges of possible outcomes rather than single projections, with the extent of these ranges based on historical volatility.

The paper concludes by considering the policy implications of the short and long lockdown forecasts. Under our expected time paths for the public debt, and given the recent historical behaviour of interest rates, we do not consider there to be any need for a return to the spending cuts of the Osborne and Hammond years. With sensible taxation policies in place, public debt, even at higher levels following the coronavirus outbreak, is likely to remain manageable.

While the model's forecasts are rigorous enough for use in policy planning, a key purpose of the model is educational: by experimenting with different options and assumptions, users will gain an intuitive feel for the dynamics of the public sector deficit and debt.

CORONAVIRUS, PUBLIC DEBT AND FORECASTING

Public sector debt rose from less than 40 per cent of GDP to over 80 per cent of GDP as a result of the 2008 financial crisis, with the figure passing 140 per cent if bank nationalisations are taken into account. Fiscal austerity, ostensibly in response to the danger posed by this debt, became a permanent feature of the political landscape after 2010. The necessity of spending cuts went unchallenged by the majority of economic commentators at the time, with disagreement largely limited to questions of scale and speed. The outcome was one of the worst economic recoveries on record: for a decade, productivity and wages stagnated, growth in employment was dependent on expansion of low-paid, precarious work, and previously positive trends on poverty and health went into reverse (Marmot et al 2020, CEJ 2018). The profound weaknesses caused by a decade of austerity are thrown starkly into relief by the Covid–19 crisis. Those on lower incomes, those suffering from worse health, and those in more precarious financial situations are bearing the brunt of both the medical crisis and the economic crisis.

Austerity in 2010 was not inevitable, but the lack of dissenting voices in the media and public discourse gave the impression that there was no room for debate. This lack of dissenting opinion was compounded by a culture of 'black box' modelling in academic and public sector economics, in which a small number of influential forecasts added legitimacy – and a sense of inevitability – to policy decisions taken by the Coalition government (Wren-Lewis 2015).

This paper, and the web tool that accompanies it, aim to demystify the process of forecasting the public finances. A small number of institutions specialise in producing such forecasts, and most use 'black box' models. Unless the reader has a specialist training in macroeconomic modelling, it is very difficult to understand the official documentation of the OBR macroeconomic model, for example. Even for those with training, reproducing the computer model and interacting with it can be challenging. In contrast, our web tool produces plausible and rigorous fiscal forecasts, but is simple enough for non-experts to use.

Today's crisis is more severe, and the human cost greater, than the 2008 financial crisis. The secondary economic effects are likely to be at least as important as the initial shock: a recent Ipsos MORI poll suggests that over half of the public will feel uncomfortable going to bars and restaurants after the lockdown is lifted, while prominent figures from the most-affected sectors are warning that business could take years to recover (Ipsos MORI 2020, King 2020). A sharp rise in unemployment is inevitable – and the rise will be substantially larger if government support measures are withdrawn prematurely.

The scale of public borrowing and the consequent increases in public debt will almost certainly surpass those seen after 2008. Debate has already started on how the government should respond to rising deficits: while some argue for higher

taxation, or for allowing debt levels to rise, there are already calls for a return to austerity in the form of government spending cuts when the immediate danger from the virus has passed. Debate was recently sparked by the leak of a Treasury document containing warnings of a 'sovereign debt crisis' caused by increased borrowing due to the coronavirus crisis (Wren-Lewis 2020).

This is the context in which forecasts of the public finances from organisations such as the OBR enter the public debate. These forecasts, and the commentary they generate, are powerful tools for legitimising or challenging fiscal policy decisions. It is therefore vitally important that citizens understand the basics of the public finances, the manner in which they are forecast, and the implications of these forecasts. A healthy democracy requires a public that can question the policies of its government.

The OBR is the UK's 'fiscal watchdog': a public sector organisation tasked with producing macroeconomic forecasts and analysis of the public finances. Its projections are widely used and cited in the media. Twice a year, alongside the budget and the chancellor's autumn statement, the OBR releases detailed projections of the UK economy and public finances. These provide an official benchmark against which government fiscal policy is judged, and are reported extensively in the national media.

The 'coronavirus reference scenario' published in April 2020 by the OBR therefore attracted substantial attention. This was not one of the scheduled twice-yearly forecasts, but an update to the forecast presented a month earlier on 11 March.

A striking feature of this scenario is that, with the exception of unemployment and the public finances, the economic effect of the coronavirus is predicted to be almost entirely transitory. Once past the two-year period at the start of the scenario, the projections align almost exactly with those presented alongside the budget in March, before the lockdown was announced and the likely scale of the economic and financial impact of the coronavirus was understood.

The accompanying documentation points out that the scenario is 'not a forecast' and notes the substantial uncertainty surrounding the economic effects of the coronavirus and the form and timing of the strategy to exit from lockdown. Notwithstanding these uncertainties, the OBR opted to present a 'reference scenario' that shows how an assumed three-month lockdown will affect the public finances.

Despite the caveats added by the OBR, it is difficult to understand the basis of a projection that shows no persistent effects of Covid–19 on the UK economy. The OBR scenario assumes, on the basis of a plausible accounting exercise, that real GDP will fall by 35 per cent in the second quarter of 2020, mostly due to labour shortages resulting from the lockdown. However, despite projected unemployment increasing from below 4 per cent to over 10 per cent, the OBR assumes that the economic collapse will entirely reverse over the subsequent two quarters, so that GDP fully recovers to pre-crisis levels by the final quarter of 2020.[1]

But the economy is not like a spring that will simply recoil once restrictions are lifted. During the lockdown period, household balance sheets are deteriorating, workers are being laid off and firms are going bankrupt. While government measures to support households and businesses have been significant, it is becoming increasingly clear that these are not sufficient to prevent lasting damage to the economy. It is highly unlikely that the economy will fully recover from the shock of the coronavirus within six months. The longer the lockdown and social distancing measures last, the more severe the damage will be, and the longer the resulting economic effects will last.

1 The Bank of England's 'illustrative economic scenario' forecasts a similar 'V-shaped' recession (Bank of England 2020)

MODELLING THE CORONAVIRUS SHOCK

As economists forecasting the public finances, we are interested in the trajectories of the public sector deficit, the public sector debt-to-GDP ratio, and related statistics such as annual interest payments on the debt. These numbers are widely reported in the press, often with limited contextualisation, and are the focus of sustained and heated political debate.

In this paper, we use historical data on GDP, government spending and taxation, some key accounting relationships, and a small number of plausible assumptions about the future path of GDP to produce forecasts of the effect of the Covid–19 crisis on public finances. We use the macroflow model to produce these forecasts.[2]

Users can interact with the model by making different assumptions about the length of the lockdown, the extent to which the economy 'bounces back' when the lockdown is lifted, and the degree of long-run damage suffered by the economy during the lockdown. Users can observe in real time how these assumptions affect forecasts of public debt and the deficit. The model is designed to produce plausible probability forecasts of the public finances while remaining accessible to non-specialists.

A forecast can be thought of as a subjective probability distribution over a set of possible futures. In simpler terms, this means that a forecast is a list of possible outcomes with probabilities attached to each. So, for example, in meteorology one might forecast a '50 per cent probability of rain in three days' time', or 'less than a 5 per cent probability of snow in April'. These forecasts are based on previous historical experience – eg the observed frequency of snowfall in April – and anything else known about the process being forecast. Crucially, forecasting in economics is rarely a purely mechanical process, and the majority of macroeconomic forecasts are mediated by the judgement of the forecaster.

The projections in this paper take the OBR's 'coronavirus reference scenario' as a baseline, but alter key assumptions to produce new forecasts.[3] The OBR dataset and projections used in the macroflow model are summarised in table 1.

TABLE 1: OBR REFERENCE SCENARIO DATA AND PROJECTIONS

	Outturn	OBR reference scenario					
	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Public sector tax receipts (£bn)	813	839	743	902	946	981	1,019
Total managed expenditure (£bn)	851	887	1,016	978	1,008	1,041	1,077
Public sector net borrowing (£bn)	38	47	273	76	63	61	59
Public sector net debt (£bn)	1,774	1,799	2,203	2,285	2,359	2,428	2,291
Debt-to-GDP ratio (%)	81.8	80.9	112.0	95.4	95.2	94.8	86.3
Nominal GDP (£bn)	2,167	2,223	1,966	2,394	2,478	2,562	2,654
Nominal GDP growth (%)	3.9	2.6	-11.6	21.8	3.5	3.4	3.6

Source: OBR (2020b)

2 A public web interface to the model can be accessed here: macroflow.org/forecasts/uk/2020-05-corona/

3 Data and projections for the OBR coronavirus reference scenario are available at https://obr.uk/coronavirus-analysis/.

All variables in the table correspond to the public sector financial year (ie April to March).[4] The historical data and forecasts are all presented in nominal terms, ie they are expressed as a sterling value without adjusting for inflation. Public sector net borrowing in each year (the deficit) is equal to expenditure less taxation. Public sector net debt increases each year by an amount equal to the deficit plus an additional 'non-borrowing adjustment' which is not shown in the table, but can be inferred by comparing the cumulated deficit with the public debt series. Non-borrowing adjustments include things like bank nationalisations, privatisations and some lending by the Bank of England to the private sector.

The steps taken by the macroflow model to forecast the public finances can be summarised as follows.

1. Allow the user to select the length of the lockdown. This input determines GDP growth in 2020/21 and the time path of government expenditure.
2. Allow the user to specify what they think GDP growth will be in 2021/22 – ie the 'rebound' – and what they think growth will be in 2022/23, 2023/24 and 2024/25.
3. Given these user inputs, compute the implied tax receipts, public deficit-to-GDP ratio, and debt-to-GDP ratio based on a small number of pre-specified parameters.

The model presents forecasts of nominal GDP growth, the level of nominal GDP, the deficit and the debt-to-GDP ratio alongside brief explanations. For a three month lockdown we follow the OBR GDP and government expenditure figures, while for longer lockdown forecasts we assume that each additional month of lockdown reduces GDP growth in 2020/21 by a further percentage point and increases government expenditure by £15 billion. The latter figure is in line with the OBR scenario, and effectively assumes that the current policy package will be maintained throughout each additional month of lockdown.

There are four options for the lockdown length, four options for the growth rate in 2021/22, and four options for the medium-term growth rate. Users can therefore generate 64 separate trajectories for the public finances, and experimenting with the different combinations should allow them to gain an intuitive understanding of how the dynamics of the public finances are determined. The technical details of the model are discussed in box 1, and the pre-specified parameters are discussed in box 2.

4 The first four rows can be found in table 1.5 and the fifth row in table 1.10 of the OBR commentary document, and the final two rows are calculated from the rows above.

BOX 1: TECHNICAL DESCRIPTION OF THE MACROFLOW MODEL

The macroflow model uses the OBR data in table 1. Given a lockdown policy and two further user-specified inputs, it computes probability distributions for the major public sector finance aggregates from 2019/20 to 2024/25 using the following algorithm:

1. The user chooses a three-month, six-month, nine-month or twelve-month lockdown policy. The three-month policy implies a government expenditure trajectory similar to the OBR trajectory in table 1, and an expected 2020/21 GDP growth rate equal to -12 per cent, which is similar to the OBR growth rate in table 1. Each additional month of lockdown is assumed to reduce expected growth by 1 percentage point and increase government expenditure in 2020/21 by £15 billion.
2. The user specifies a value for expected nominal GDP growth in 2021/22 – ie what they expect the 'rebound' to look like – and a value for expected nominal GDP growth in 2022/23, 2023/24 and 2024/25 – ie what they expect medium-term growth to be.
3. Using these inputs, the model simulates *n* hypothetical trajectories for nominal GDP under the assumption that GDP growth is normally distributed.
4. Using the *n* simulated trajectories for nominal GDP growth, the model simulates *n* hypothetical trajectories for nominal tax receipts under the assumption that tax receipts are linearly related to GDP.
5. Using the *n* simulated trajectories for tax receipts and nominal GDP, alongside the fixed trajectory for government expenditure, the model computes *n* hypothetical trajectories for the public sector finances using accounting identities. Specifically, the public sector deficit is calculated using the following accounting identity:

$$DEFICIT_t = EXPENDITURE_t - TAXATION_t$$

The public sector net debt is calculated using the following accounting identity:

$$DEBT_t = DEBT_{t-1} + DEFICIT_t + ADJUSTMENTS_t$$

where non-borrowing adjustments are inferred from the OBR reference scenario and are mainly due to the Term Funding Scheme (TFS) for SMEs. This is a Bank of England scheme that offers funding for private banks at interest rates at, or close to, the bank rate, with more funding available to private banks that expand lending to SMEs. The loans to private banks made by the Bank of England under the TFS are financed by issuing reserves, and as the loans are classified as 'illiquid assets' they do not net out against the debts incurred. Hence public sector net debt increases by the amount of reserve creation.

This method for forecast generation is relatively unconstrained by a formal model. In fact, other than the accounting identities and assumptions over the lockdown policies, the only imposed relationships are the parameterisation of the normal distributions for GDP growth and the linear relationship between taxation and nominal GDP. These are explained in box 2.

BOX 2: PARAMETERISATION OF THE MACROFLOW MODEL

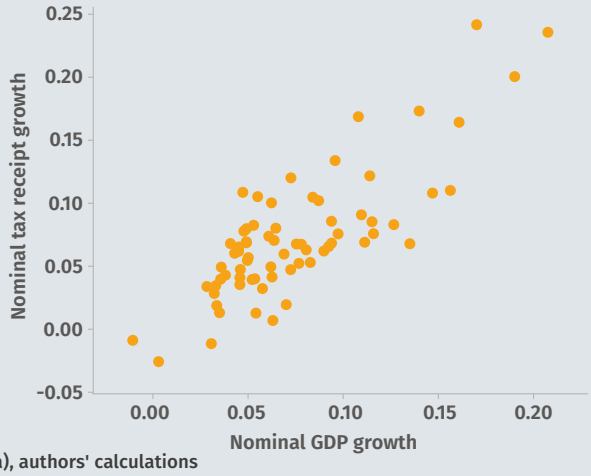
As discussed in box 1, the macroflow model requires the user to choose between a set of lockdown policies and specify two expected GDP growth figures. Aside from this, there are a small number of parameterisations that the user cannot change.

First, the expected value for GDP growth in 2019/20 is fixed at 2.6 per cent, which is the same as in the OBR's reference scenario.

Second, the standard deviation of nominal GDP growth is equal to its post-1997 sample standard deviation of 1.73 percentage points each year, other than in 2019/20 in which it is quartered, and in 2020/21 and 2021/22 in which it is doubled. This reflects the greater certainty we have about growth in 2019, and the greater uncertainty we have about the impact of Covid–19.

Third, nominal tax growth is assumed to be equal to nominal GDP growth plus a normally distributed white noise shock. In fact, if we examine a scatter plot of nominal tax growth against nominal GDP growth from 1948/49 to 2018/19, we can see that the relationship is strong, linear and almost one-for-one. If we regress tax growth against GDP growth, we obtain an intercept estimate of 0.0007 and a slope estimate of 0.9631, and the p-value for an F-test of the joint hypothesis that the intercept equals zero and the slope equals one is 0.77.

FIGURE B1: SCATTER DIAGRAM OF TAX GROWTH AND GDP GROWTH, 1948/49–2018/19



Source: OBR (2020a), authors' calculations

Finally, a Shapiro-Wilk normality test on the residuals from the unconstrained regression yields a p-value of 0.82 – ie we cannot reject normality at a reasonable significance level. Thus, we assume that tax growth is equal to nominal GDP growth plus a normally distributed shock, for which we set the standard deviation equal to the post-1997 standard deviation of the residuals from the constrained regression, which is approximately 1.8 percentage points.

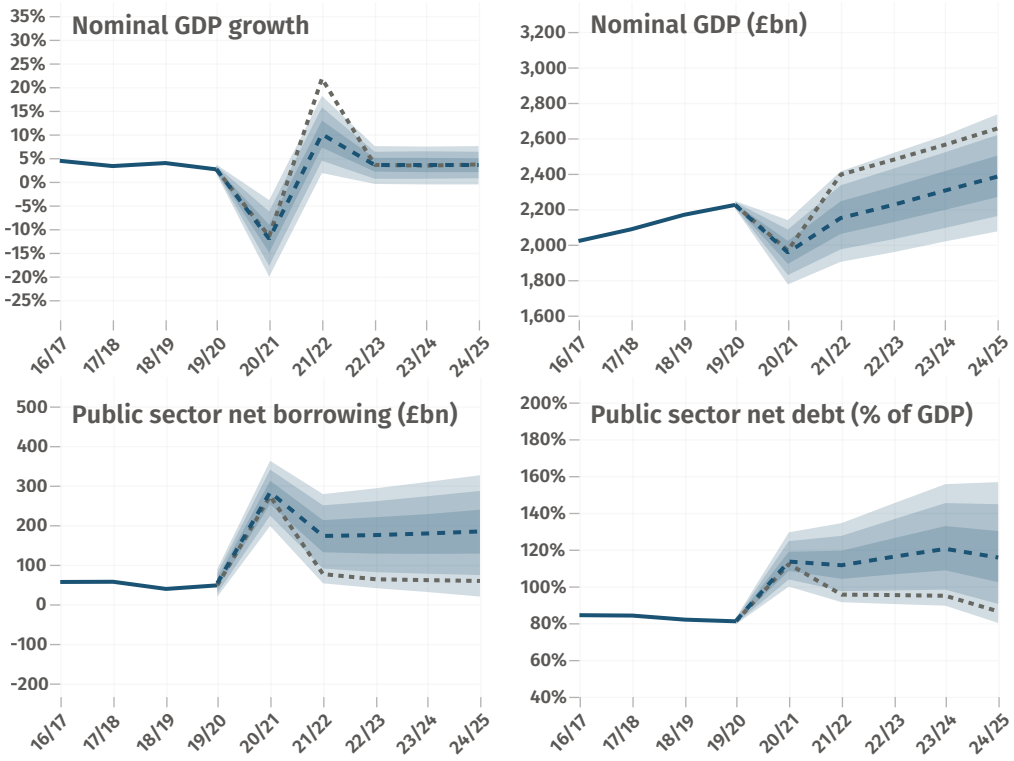
To illustrate the use of the model, we present forecasts for two scenarios: a three month lockdown scenario with medium-term growth equal to its pre-crisis average, and a six month lockdown scenario with medium-term growth one percentage point lower than its pre-crisis average. Following the prime minister's address to the nation on 10 May, it is becoming clear that the lockdown will last longer than three months. However, it is still useful to consider forecasts for a

shorter lockdown, as restrictions are likely to be lifted progressively over the summer, so a lockdown that lasts between three and six months will imply deficit and debt forecasts that lie somewhere between the three and six month forecasts discussed here. A three month scenario also allows us to highlight the differences between our forecasts and those of the OBR. Much will depend on whether the current policy package is in fact replicated for the length of the lockdown, and how employers respond when the furlough scheme is pared back.

SCENARIO 1: THREE-MONTH LOCKDOWN

Figure 1 presents the macroflow forecasts for a three month lockdown. The blue dashed line is the median of our forecast distribution – according to the model, there is a 50 per cent probability that an indicator will lie above this line in any given year, and a 50 per cent probability that an indicator will lie below this line in any given year. The grey dashed line shows the OBR reference scenario. The uncertainty bands in figure 1 correspond to the 1st and 99th percentiles (lightest band), 5th and 95th percentiles (intermediate band), and 20th and 80th percentiles (darkest band). The way to interpret these is as follows: based on our assumptions, the economic indicators are more likely to remain within the darker bands than the lighter bands. There is a 1 per cent chance that any given indicator will have a value greater than the top of the lightest band in any given year, and there is a 1 per cent chance that any given indicator will have a value less than the bottom of the lightest band in any given year. Likewise, there is a 5 per cent chance that any given indicator will be below the intermediate band, and a 5 per cent chance it will be above it. There is, therefore, a 98 per cent chance that any indicator will be within the range shown by the lightest band, a 90 per cent chance it will be within the intermediate band, and a 60 per cent chance it will be within the darkest band.

FIGURE 1: NOMINAL GDP, NET BORROWING AND NET DEBT FORECASTS, SCENARIO 1



Source: OBR (2020a, 2020b), Macroflow model

The central forecast of nominal GDP growth in 2020/21, represented by the blue dashed line, is equal to -12 per cent. This is approximately equal to the immediate hit to nominal GDP in the OBR reference scenario: this is plausible and is justified by the accounting exercise in the commentary accompanying the OBR scenario. It is also consistent with the forecasts of real GDP growth in the recent reports, *Doing more of what it takes* from the Resolution Foundation, and *Prospects for the UK economy* from the National Institute of Economic and Social Research (Hughes et al 2020, Lenoël et al 2020). However, since the economic effects of the Covid–19 crisis and the accompanying lockdown measures are highly uncertain, the colour bands around the median forecast are wide. For example, the intermediate colour band in the GDP growth panel shows a forecast range of approximately -6 per cent to -18 per cent in 2020/21: this represents our view that under a short lockdown scenario, there is a 90 per cent chance that GDP will contract by between 6 per cent and 18 per cent this year.

The OBR assumes that GDP returns to its pre-crisis trajectory during the current financial year, resulting in a 2021/22 nominal growth rate of just over 20 per cent. In common with several other commentators, we do not consider this to be a plausible central forecast (eg Jacobs, 2020) – the Treasury are reported to be preparing for a 'U-shaped' recovery (Rayner and Mikhailova 2020).

As such, in our three month lockdown scenario we expect the 2021/22 nominal growth rate to be closer to 10 per cent, again with a high level of uncertainty. This implies that medium-term nominal GDP is forecast to be around 10 per cent lower than its pre-crisis trajectory, which is a similar level effect to that seen after the 2008 crisis. In this scenario, nominal GDP growth from 2022/23 onwards is projected to return to the rate predicted by the OBR of approximately 3.5 per cent, and nominal GDP is expected to return to its pre-crisis level by some point in 2023.

In our three-month scenario, the OBR reference scenario emerges as a ‘best-case scenario’, since it lies within the lightest of our probability bands. This result is driven by our assumption that the 2021/22 economic rebound will be around half the size of the rebound in the OBR reference scenario.

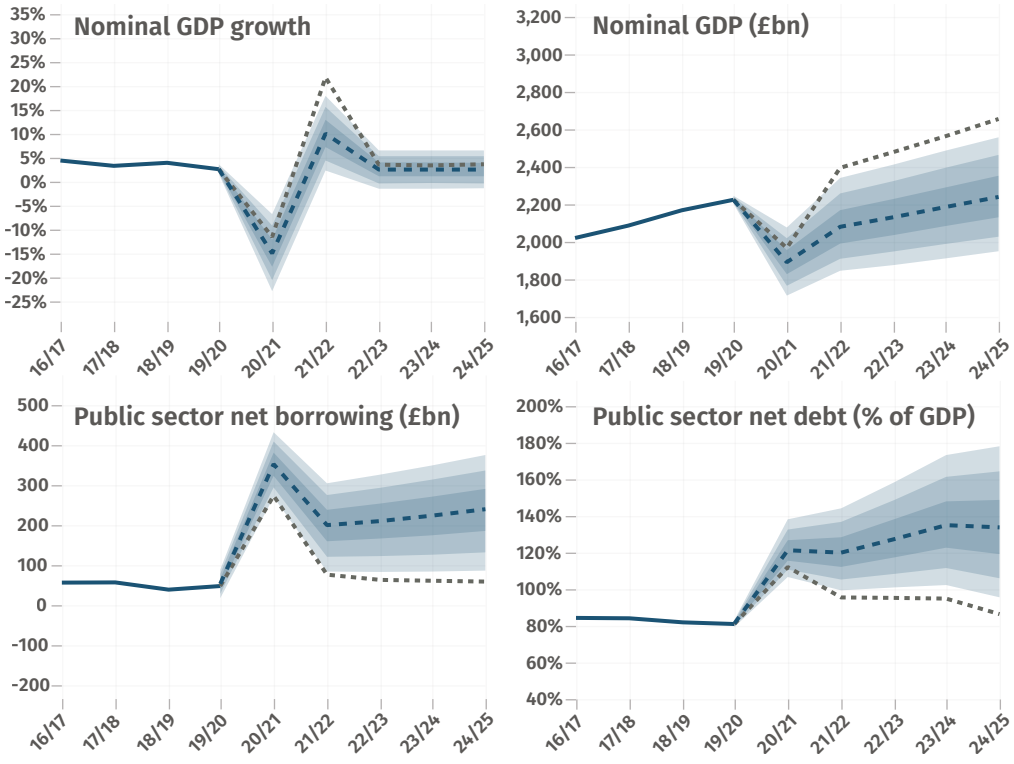
In our scenario, the government is expected to borrow around £200 billion a year more than is suggested by the OBR reference scenario by 2024/25. This is because tax receipts are forecast to be lower than in the OBR scenario because GDP is lower, while the government expenditure trajectory is the same as in the OBR reference scenario. This is a very simple way to approach the problem of deficit forecasting, because we rely in large part on the OBR projections and do not separate government expenditure into its various components (eg current and capital spending, interest payments on debt etc). Its purpose, however, is to illustrate the government’s policy problem for the user in a very straightforward way: GDP is expected to fall, therefore tax receipts are expected to fall, therefore the deficit is expected to rise conditional on the government’s planned expenditure remaining constant.

As the deficit increases, so too does the government debt. As a percentage of GDP, debt is expected to rise to around 120 per cent by 2023/24, which is driven by the increase in the deficit, the fall in nominal GDP, and an additional increase of around £130 billion as a result of the Bank of England’s Term Funding Scheme for SMEs and valuation changes caused by quantitative easing. The debt is then forecast to fall back slightly as a percentage of GDP in 2024/25 as the Term Funding Scheme loans are paid back – this assumption (and the associated numbers) follow the OBR reference scenario. Again, however, there is significant uncertainty surrounding these numbers. If the lockdown does in fact last three months, our assumptions suggest that a plausible 98 per cent interval forecast for the debt-to-GDP ratio by the end of the current financial year is between 100 per cent and 130 per cent.

SCENARIO 2: SIX-MONTH LOCKDOWN AND 'SUPER-HYSTERESIS'

Figure 2 presents forecasts in which the lockdown is assumed to last six months and the medium-term growth rate falls as a consequence of economic 'scarring' – an effect known in the literature as 'super-hysteresis'.[5] We assume that each additional month of lockdown decreases the 2020/21 expected nominal GDP growth rate by one percentage point, so moving from a three month to a six month lockdown reduces expected growth from -12 per cent to -15 per cent. This is a more muted response than the Resolution Foundation's projection of a 20 per cent fall in real GDP following a six-month lockdown, but their figure is consistent with our forecast distribution as the uncertainty surrounding 2020/21 growth is high. We retain the assumption of a 10 per cent rebound in 2021/22, so the immediate post-crisis level of nominal GDP is lower in scenario 2 than in scenario 1.[6]

FIGURE 2: NOMINAL GDP, NET BORROWING AND NET DEBT FORECASTS, SCENARIO 2



Source: OBR (2020a, 2020b), Macroflow model

In this scenario, nominal growth in 2022/23, 2023/24 and 2024/25 is equal to 2.5 per cent, which is just over one percentage point lower than the 2010–2019 average. This is a similar decrease in the growth rate to that observed after the 2008 financial crisis, when nominal growth fell from a 1997–2007 average of around 5 per cent to the 2010–2019 average of around 3.7 per cent. This type of 'super-hysteresis', in which the growth rate of economic activity is permanently reduced following a recession, is associated with falls in productivity driven by the crisis. The reasons for

5 'Hysteresis' refers to a return to the previous growth rate at a lower level of GDP, while 'super-hysteresis' refers to both a lower level of GDP and a lower growth rate.

6 Note that the six-month lockdown does not need to be interpreted as a continuous full lockdown: three months of full lockdown followed by another six months of looser social distancing measures could have similar effects on GDP, as could two separate episodes of three months of full lockdown within the year.

the dramatic fall in UK productivity growth after the 2008 financial crisis are subject to ongoing debate, and a consensus has not yet emerged. Despite this, and in recognition of the empirical evidence, we give users the option to choose a degree of 'super-hysteresis' which is similar to the effect seen after 2008.

In this scenario, the expected public debt-to-GDP ratio rises to more than 130 per cent, and it appears highly likely that the public sector debt will remain above 100 per cent of GDP until 2024/25. The major driver of this result is the larger fall in 2020/21 nominal GDP resulting from the longer lockdown, and therefore the larger level effects on nominal GDP and taxation compared to scenario 1, rather than the reduction in the subsequent growth rate. This is easy for the user to see when experimenting with the parameters, and again illustrates the government's policy problem in a simple manner. The peak debt-to-GDP ratio of more than 130 per cent is similar to the Resolution Foundation's expected peak following a six-month lockdown, but occurs later given the lower medium-term growth rate.

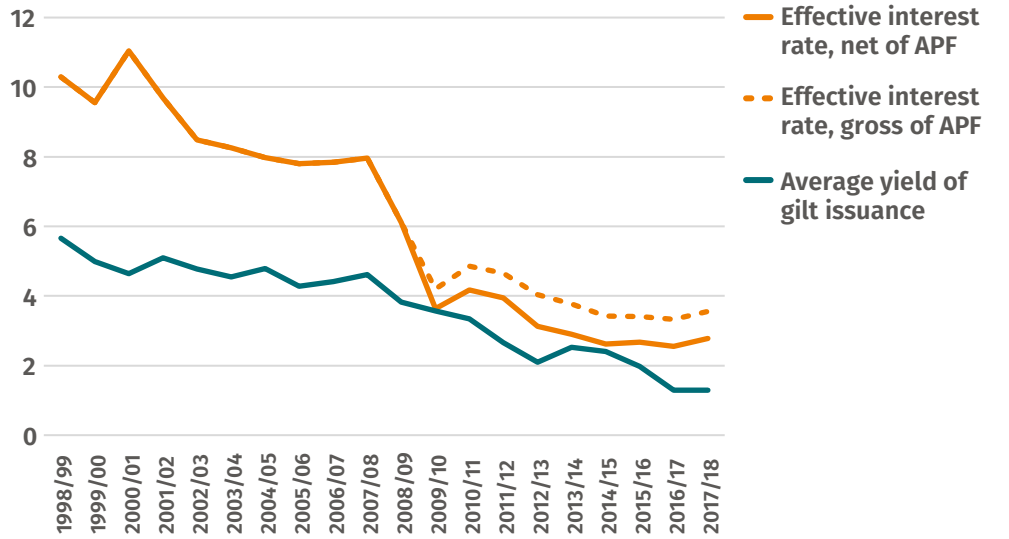
As already emphasised, both of the scenarios above are subject to substantial uncertainty. One major factor contributing to this uncertainty, above and beyond Covid–19, is the UK's yet to be completed withdrawal from the European Union. With a mismanaged and disorderly Brexit at the end of 2020, the prospects for GDP growth would be significantly worsened.

IS HIGHER PUBLIC DEBT SUSTAINABLE?

In the scenarios discussed above, public sector net debt is expected to peak at approximately 120 per cent of GDP in the case of a three-month lockdown, and approximately 135 per cent of GDP in the case of a six-month lockdown with 'super-hysteresis'. The policy implications of these figures depend on the future path of interest rates, because the effect of public debt on the public finances depends on the percentage of tax revenue required to service that debt.

At the end of April 2020, market yields on gilts – bonds issued by the UK Treasury – were well below 1 per cent across the maturity spectrum. Figure 3 plots the average yield on gilts issued between the 1998/99 and 2017/18 financial years, and the effective interest rate paid on the public sector net debt between the same years. The effective interest rate is simply the total cash value of the interest payments made by public sector organisations to bondholders divided by the sterling value of the public sector net debt; in figure 3 this is presented gross and net of the effects of quantitative easing (ie gross and net of the 'asset purchase facility' (APF) which is the subsidiary of the Bank of England used to purchase government bonds).

FIGURE 3: EFFECTIVE INTEREST RATE ON THE PUBLIC DEBT AND AVERAGE GILT YIELDS AT ISSUANCE, 1998/99–2017/18



Source: ONS (2020), OBR (2020a), DMO (no date), authors' calculations

Prior to the 2008 financial crisis, the effective interest rate paid on the public debt was above the average yield of gilt issuance. This is because the government funds part of its debt by issuing long-dated gilts – ie gilts that pay fixed interest rates for 15 or more years – so when interest rates are falling the yield on newly issued gilts is lower than the yield on the average gilt. This describes the situation prior to the financial crisis, in which the 10-year benchmark rate fell steadily from the early 1990s onwards. Between 2007/08 and 2009/10, when the public debt rose from £545 billion to £997 billion, the effective interest rate fell to a level that was much closer to the yield on newly issued gilts. This happened for the simple reason that almost half of the outstanding debt as of March 2010 had been issued in the previous two years.[7]

The average maturity of outstanding gilts is around 16 years, with the average maturity on index-linked gilts higher and the average maturity on conventional gilts slightly lower.[8] Given this, figure 3 implies that a significant part of the outstanding gilt portfolio was issued at yields above 2 per cent. If market yields stay below 2 per cent, therefore, these gilts will be refinanced at a lower rate. As gilts issued to fund current and post-crisis deficits will be issued at less than 2 per cent, and the refinancing of gilts issued before the crisis will involve a reduction in their rates, we would expect the effective interest rate on the public sector net debt to fall further over the medium-term. This situation is similar to re-mortgaging at the end of a fixed-term mortgage during which interest rates have fallen.

If, on the other hand, average market yields rise to 2 per cent in the near future, we would expect the effective interest rate on the public debt to stabilise near its current level. Under our three month lockdown scenario, in which debt-to-GDP is expected to peak at around 120 per cent of GDP, an effective interest rate

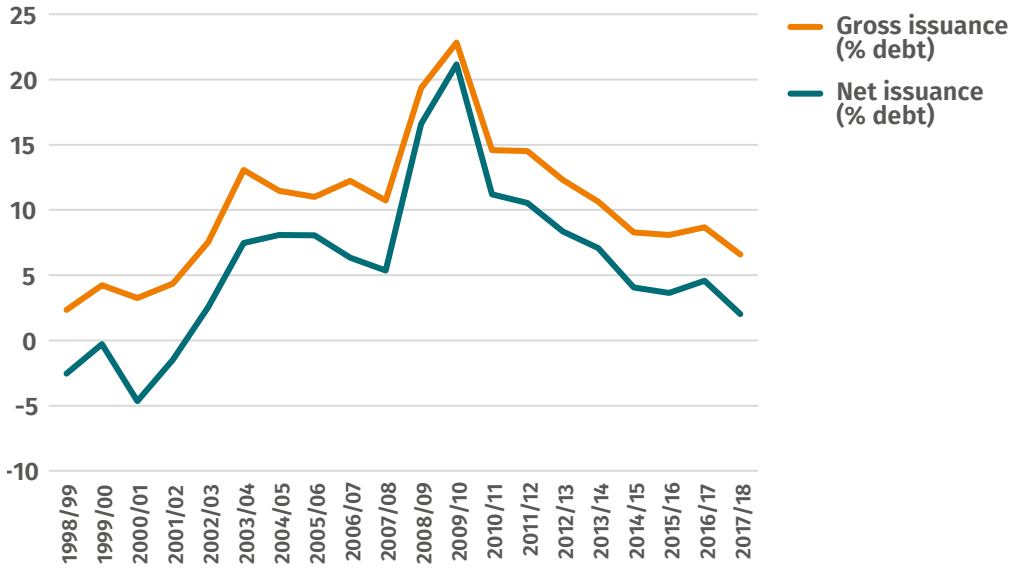
7 The public sector net debt data are taken from the OBR's April 2020 PSF databank, and the public sector interest payments data are taken from the ONS (codes JW2P and MU74). The average yield on issued gilts are from the Debt Management Office, see: https://dmo.gov.uk/data/gilt-market/average-gilt-issuance-yields/.

8 The interest rate on index-linked gilts adjusts to compensate for inflation. The majority of gilts outstanding are not index-linked, so the rate of interest remains fixed regardless of changes in inflation.

of 2.5 per cent implies interest payments of around 3 per cent of GDP and 8 per cent of tax revenue, because tax receipts as a share of GDP should remain close to their current value of 37.5 per cent. Under our six month lockdown scenario, in which debt-to-GDP is expected to peak at around 135 per cent of GDP, a 2.5 per cent effective interest rate on the public debt implies that interest payments would increase to around 9 per cent of tax revenue. However, these are likely to be overestimates, because the part of the public debt accounted for by the TFS for SMEs is financed at bank rate, we have not taken into account the recently announced extension to quantitative easing, and it seems reasonable to suppose that the Bank of England would extend its asset purchases further if yields rose significantly in the absence of inflation.[9]

Finally, if market yields were to rise to a materially higher level than they are today – perhaps due to some form of sustained inflationary shock – then the effective interest rate on the public debt would take some time to rise. This would be a situation opposite to that which existed prior to 2008, as the yield on newly issued gilts would be higher than the yield on the average gilt. In this case, all of the gilts issued after 2011 at average yields of around 2 per cent would take some time to refinance at higher rates. As shown in figure 4, in normal times gross debt issuance is around 10 per cent of the total stock in any given year, of which around half constitutes the refinancing of existing debt and half funds new borrowing.[10] Therefore, in the event that market yields do rise significantly in the medium-term – and we consider the probability of this happening to be low – the effective interest rate on the public debt will take some time to catch up. Using the mortgage analogy again, higher interest rates will not have an effect until the end of the fixed-term period is reached.

FIGURE 4: GROSS AND NET ISSUANCE OF GILTS, 1998/99–2017/18



Source: OBR (2020a), DMO (no date), authors' calculations

Overall, there is little evidence to suggest a clear and present danger to UK citizens from elevated debt-to-GDP ratios. Calls for immediate spending cuts should therefore be resisted: the economic and social cost of cuts in government

9 For discussion, see Michell and Toporowski (2019).

10 These data are also from the Debt Management Office, see: https://www.dmo.gov.uk/data/gilt-market/gross-and-net-issuance-data/

programmes and reductions in state capacity would greatly exceed the benefits of risk reduction due to lower deficits. Over the medium term, however, it makes sense to ensure that public finances are on a sustainable footing by reducing the deficit through progressive taxation, including taxation of wealth. Given that government spending as a share of GDP will almost certainly need to rise, due to the effects of an ageing population, aiming for a higher tax share in GDP should be a medium-term policy goal. Tax rises should be calibrated in such a way as to minimise their effect in dampening aggregate demand: increases in VAT should be avoided, for example.

CONCLUDING OBSERVATIONS

In this paper we have presented a forecasting tool that can be used to produce plausible probability forecasts for the public finances using a method which is transparent and easy to understand. Under a three month lockdown scenario, the model implies an expected peak debt-to-GDP ratio of around 120 per cent of GDP, which rises to more than 130 per cent in a six-month lockdown scenario with 'scarring' effects on medium-term growth. These central forecasts are highly uncertain, however, and the web interface quantifies this uncertainty by using fan charts.

Whether or not these 'scarring' effects on medium-term growth materialise, it is important for the public to understand that scenarios from institutions such as the OBR and the Bank of England of a short lockdown followed by an immediate 'V-shaped' economic rebound are implausible. It is highly unlikely that the economy will fully recover from the shock of the coronavirus within six months, and the longer the shutdown and social distancing measures last, the more severe the damage will be. At the time of writing, recent announcements from the prime minister and chancellor suggest that a number of measures will be in place until at least the autumn.

Government policies to mitigate the economic effects of the crisis should, therefore, remain in place for some time and arguably should be strengthened. Once the most acute phase of the crisis has passed, the heightened debt levels resulting from sustained deficits and a deep recession do not imply the need for a return to the spending cuts of the Osborne and Hammond years. In the medium-term the public finances appear to be manageable, as judged by the likely future path of interest payments, suggesting that an equitable approach to the public finances after Covid–19 would be to stabilise the public finances at somewhere close to their post-crisis level. In the immediate future, increases in progressive taxation could be used to finance the rebuilding of social security and the welfare state after 10 years of austerity, and more substantial tax rises on those at the upper end of the income and wealth distributions could be used to finance higher post-crisis debt ratios.

We do not, however, impose these policy conclusions on users of the model presented in this paper: it is designed as much as a tool for public education as a policymaking guide. Importantly, while the underlying data is taken from the OBR, and the forecasts are broadly consistent with those of other reputable institutions such as the Resolution Foundation and National Institute of Economic and Social Research, our model allows the user to change the forecasting assumptions and observe the effects in real time. A healthy democracy requires a public that can question government policy. This is not possible without sustained efforts at public education: opening the 'black box' of public debt forecasts is a small step in this direction.

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