

Understanding and Confronting Uncertainty: Revisions to UK Government Expenditure Plans

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Thomas Lazarowicz, Adrian Pabst and
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Abstract

We develop a simple model that motivates fiscal stabilisation policy, in the presence of economic and control uncertainty. An examination of a real-time database of economic variables and forecasts shows that our knowledge of the current and future state of the economy is subject to significant revisions over time. Multi-year government spending plans are also significantly revised over successive fiscal events. We show the risk for any given government expenditure plan by constructing measures of historical expenditure revisions. We also show that the most significant factor in explaining public expenditure revisions are changes to the expected path of GDP growth. We illustrate how to model the components of public expenditure and are thus able to remark on the extent to which expenditure is warranted. Finally we report on findings from interviews with key policymakers in the past 25 years on how fiscal expenditure was managed and uncertainty confronted.

Keywords: expenditure control, monetary-fiscal interactions, revisions, uncertainty

JEL Classifications: C68, E32, E63

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This paper reflects many helpful comments made at a workshop of policymakers held at NIESR in July 2018, which was funded by Nuffield grant WEL/43002. This paper draws on interviews with current and former policy-makers, politicians, civil servants and special advisers. In this version of the paper those interviews are anonymised but drawn upon in our analysis. The early results from this pilot project are made available but are not final. This work forms part of a new initiative on policy making under uncertainty at NIESR.

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Key Findings

- We illustrate the extent to which our knowledge of the state of the economy is revised in its measurement (Figure 1) but also in forecasts (Figure 2) that are based on economic data.
- Government expenditure plans are themselves subject to considerable uncertainty at every fiscal event (Figure 3) and we should, as a matter of course, be constructing error bands around the Chancellor's projections
- The most significant factor in explaining changes to published expenditure plans are revisions to GDP growth forecast (Figure 8) and find that a 1% revision to GDP expectations leads to a 0.9% fall in government expenditure (Table 1). For longer horizons the response can be up to twice as large, which suggests that automatic stabilisers are in place.
- We find that Bank rate is positively associated with spending revisions suggesting that the MPC may be responding to the aggregate demand boost from high expenditures (Table 1).
- We separate the Cameron and May Governments from the rest of the sample and find on a preliminary basis that since 2010 (Table 2), spending plans have been somewhat less counter-cyclical than previously, or equivalently, the Major, Blair and Brown governments reacted more to news of the economy in terms of adjusting the path of TME.

Executive Summary

Focus of the paper

Policy decisions on public expenditure and tax are taken against a backdrop of considerable error in measuring the state of the economy and in producing economic forecasts. In every year from 2007 to 2017, the GDP forecast for the year of the budget by HM Treasury until 2010 and then by the OBR over-predicted the outturn for economic growth. There are substantial lags from the preliminary measures of activity to the final estimate and accordingly significant revisions to our understanding of the state of the economy are stored up. For example, ONS data on GDP were revised 73 times upwards and 33 times downwards after the first month following publication in the period 1989-2016 with a median absolute revision of 0.2% points to the published annual growth rate.

This paper seeks to understand the scale of those revisions with the context in the recent history of UK fiscal policy (1993-2015), with a particular emphasis on the expenditure side and the relationship to planning and control during that period, and how it might be possible to use statistical techniques and ‘rules of thumb’ to deal with the uncertainty arising from imperfect knowledge about the true state of the economy. This raises a number of questions, which our paper addresses:

1. Were these revisions to GDP statistically large and significant?
2. What impact, if any, did they have on public spending plans?
3. What explains, if any, the revisions to government expenditure plans in relation to total managed expenditure and its composition?
4. How effective were the ‘rules of thumb’ used by HMT to anticipate changes to economic forecasts and knowledge of the state of the economy?
5. Can we model the overall level of government expenditure to understand what is warranted and what is not in aggregate and by function?

The paper is structured as follows. Section 2 illustrates some key interactions between fiscal policy and the state of the economy and we explore the extent to which government expenditure might offset deviations in output from potential, Section 3 outlines the extent of revisions to the preliminary estimates of GDP and show that these can explain a significant portion of GDP forecast errors, which implies that GDP revisions are a key component to learning about the evolving state of the economy. Given the evolution in the state of the economy, we then measure the revisions to expenditure plans. We will also examine the planned expenditure over time and its composition and evaluate the extent to which they changed as a result of changes in the state of the economy or from policy choice. Accordingly, Section 4 outlines our core dataset and explains our

econometric methodology for understanding the drivers of expenditure revisions. One key focus aspect of this work will be the distinction between the normal course of action and responses to unanticipated shocks (for which revisions to expenditure plans and automatic stabilisers might be a proxy). In Section 5 we start to construct measures of what we call ‘warranted expenditure’ for overall expenditure and for spending by departments. The residuals from these measures might be used to guide or explain future expenditure plans. Section 6 outlines some provisional findings of interviews we have had with policymakers based on our preliminary analysis presented in Sections 2 to 5. The final section concludes and offers pointers to future work.

Core Argument and findings

Government control of fiscal expenditure can refer to a number of different measures of overall public expenditure (see Thain and Wright, 1995). The most widely used is Total Managed Expenditure (TME) and this refers to the total amount that the government spends in a fiscal year. Within the National Accounts system it is defined as the sum of public sector current expenditure and public sector gross investment. TME can be broken down into two subcomponents:

1. Departmental Expenditure Limits (DEL) set the amount that government departments are allocated to spend in a given fiscal year and usually result from negotiations with HMT before a spending review. Departments cannot exceed the DEL but DELs can be altered between spending reviews, as a result of policy changes or by drawing money from the Treasury reserve. Examples include the costs of running services, hospitals, schools, and staffing costs; and
2. Annually Managed Expenditure (AME) encompasses all spending that is not controlled by a government department. It is classed as spending that cannot reasonably be subject to firm multi-year limits. AME includes welfare, pensions, debt interest payments, accounting adjustments etc.; in other words, AME generally includes demand-led spending programmes.

Both AMEs and DELs can be further split into resource and capital components. Resource spending can be thought of as money that is spent on day-to-day resource and administration costs, while capital spending is on investment and projects that are designed to promote economic growth.

While the existing literature discusses the path of UK fiscal policy for the period in question (e.g. Johnson, 2016), this paper, motivated by the literature on policy uncertainty, explores several areas of particular importance (see, for example, Auerbach, 2014). First, we are motivated by the observation that there is uncertainty in statistical measures of economic activity and these uncertainties are a major factor in explaining

revisions to economic forecasts. Secondly, and accordingly, when HMT presents a path for government expenditure, what risks are there to that path and to what extent can we model the factors that lead to systematic revisions to published expenditure plans? Thirdly, the period from the early 1990s has been characterised by the adoption of formal rules that replaced earlier, more *ad hoc* arrangements (see, for example, Chadha and Nolan, 2007), adopted a formal inflation target for monetary policy in 1992 and developed an independent fiscal council to assess HMT expenditure and revenue plans in 2010. We also ask how much sense does it make to impose spending limits on individual government departments or overall total managed expenditures. Finally, we start to model actual expenditure as a conditional rule (see Pain et al, 1997).

We present new results on the size of data revisions and the extent to which they affect forecasts of economic activity. Our analysis of the revisions to economic data in the period 1993-2015 shows that there has only been one occasion when GDP figures were not revised a quarter after the first release, and only 14 times when there was no change after a month. There were 73 upward revisions and 33 downward revisions after the first month following release. The average upward revision was 0.23% and the average downward revision was 0.33% and they are both statistically significant.

We then go on to present new estimates of the uncertainty of fiscal expenditure plans, based on the revisions to plans announced at fiscal events since 1990. Our research shows the scale of uncertainty around current spending projections based on the size of historic past forecast errors at each horizon. For instance, the standard deviation of errors made in the past by the fiscal authority in year-ahead projections of total managed expenditure is around £5 billion. This implies that with a certainty of 95% the spending next year (as at the 2017 Budget) falls within a range of £824-£844 billion, or within twice £5 billion in either direction from the central projection of £834 billion.

Given these uncertainties in expenditure we outline the fiscal problem of stabilising output in the presence of a monetary policy maker targeting inflation and with uncertainty in control parameters, in the sense of Brainard (1967). We show that multi-year government spending plans are also significantly revised over successive fiscal events, and particularly after changes in government. In our period, Conservative governments tended to revise spending up more significantly than Labour governments. A candidate explanation for this occurs through early Coalition government spending plans (2010-15) significantly ‘over-promising’ in terms of spending reduction plans, which were then subsequently revised up due to a combination of the economy underperforming and (possibly) political pressures. It would seem that since 2010, spending plans have been less counter-cyclical than previously. Or equivalently, the Major, Blair and Brown governments reacted more to news of the economy in terms of adjusting the path of TME.

We show the risk for any given government expenditure plan by constructing measures of historical expenditure revisions. We also show that the most significant

factor in explaining public expenditure revisions are changes to the expected path of GDP growth. We illustrate how to model the components of public expenditure and are thus able to remark on the extent to which expenditure is warranted, which we define as an estimate of the amount of public spending that would have been chosen by previous governments if confronted by the circumstances of today. Based on Hantzsche and Young (2018), we find that the consolidation in public spending between 2010-11 and 2014-15 was actually a little slower than what was warranted. The weak fiscal position at the start of the period (2010) required a reduction of TME to close to 40 per cent of GDP over a five-year period. This is broadly the pace of consolidation that the coalition government wanted to achieve when it set out its 2010 spending plans. However, our analysis shows that after 2014-15, actual spending became more stringent than would have been warranted by previous governments' spending priorities. In particular rising demographic pressures in combination with a more favourable business cycle meant that our benchmark path for TME rises back up to 44 per cent of GDP, compared to actual spending which dropped below 40 per cent in 2016-17.

Finally we report on findings from interviews with key policymakers in the past 25 years on how fiscal expenditure was managed and uncertainty confronted. The first finding relates to the nature and kind of uncertainty that policy- and decision-makers have to manage. A number of interviewees argued that there is an important difference between two levels of uncertainty: (1) 'predictable' uncertainty, which includes 'normal-order' events (political or economic events such as changes in government or interest rate changes), what we might think of as identifiable risks; and (2) 'unpredictable' uncertainty, which relates to unidentifiable risks, for example the implications of events such as the collapse of Long-Term Capital Management in 1998, the bursting of the dot.com bubble in 2001, the 2008 financial crash (Chadha et al., 2016) or the near-collapse of the Eurozone in 2010-11. The second finding concerns fiscal rules. All the interviewees emphasised that fiscal rules matter but that they have a limited duration. One of the main reasons why fiscal rules and their usefulness are limited in time is the trade-off between credibility and flexibility. At some point in the economic and the political cycle, sticking to a set of rules will be at odds with having room for manoeuvre.

Third, fiscal rules tend to reduce uncertainty in the sense of unpredictable behaviour by government, but they can introduce new types of complexity that exacerbate an already uncertain horizon. For example, new rules can lead to even greater departmental under-spend than previous fiscal frameworks, as the sanctions for over-spend may become more severe. Fourth and in light of the above, what 'rules of thumb' did HMT use in order to manage uncertainty? 'Rules of thumb' ranged from formal fiscal rules via estimates of Annual Managed Expenditure and forecasts for GDP and tax revenue to pension expenditure, public sector pay and other big 'fixed costs' (e.g. monthly meetings of pay boards in the period 1997-2010). Arguably, this process can be described as the 'rule of big numbers', which is the result of an asymmetry of information in

favour of spending departments. Finally, our research found that the commitment to prudence, which successive governments have invoked, raises questions about the purpose of prudence (economic and/or political considerations) and the ways in which prudent planning of public expenditure translates into economic policy. HMT tends to have built-in margins of errors: (i) cutting capital expenditure rather than current spending; (ii) ‘back pockets’ to offset forecast errors. Problems arise when cutting capital expenditure hits national output in times of sluggish economic growth or when new spending pledges drain ‘back pockets’.

Concluding reflections and future work

The analysis in this paper has focussed solely on the expenditure side of fiscal planning undertaken by the Treasury. Our intentions for future work are to extend this analysis in a number of directions, incorporating suggestions from participants at our policy workshop held at NIESR. In particular, and as discussed earlier, the potential heterogeneity across types of spending in response to news is of particular interest. While our spending series is an aggregate measure, it is important to recall the spending structure introduced in 1997 that splits spending into DEL and AME. Repeating the analysis for disaggregated spending will shed light on whether our finding of a countercyclical response of spending reflects heterogeneous responses of DEL and AME. The same distinction can be made in terms of Government consumption and capital spending, allowing us to examine whether politicians and Treasury officials routinely prioritise one area of spending when they receive new information about the economy. This work will involve extending the cross-sectional dimension of our sample by disaggregating the headline series into the sub-components discussed here.

Several workshop participants emphasised that to understand fully the pass-through mechanism from revisions to growth forecasts to changes to spending plans, it is important to consider both the reaction of tax receipt forecasts to changes in growth forecasts, as well as how the level of fiscal space available to the Government affects both reductions to spending (if, for example, debt/GDP is high by historical standards) and increases in spending (if the Government has a high degree of ‘fiscal space’). In a sense, these questions are linked, in that they involve understanding how revisions to the state of the economy, spending and taxation affect each other contemporaneously. Offering a definitive answer will involve extending our available dataset both in terms of the number of periods available, as well as creating a similar revision series for tax receipts and solving the endogeneity problem that is immediately apparent. As such, this work is deliberately left as work for a larger scale project.

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1 Introduction

Policy decisions on expenditure and tax are taken against a backdrop of considerable error in measuring the state of the economy and in producing economic forecasts. In every year from 2007 to 2017, the GDP forecast for the year of the budget by HM Treasury until 2010 and then by the OBR over-predicted the outturn for economic growth. There are substantial lags from the preliminary measures of activity to the final estimate and accordingly significant revisions to our understanding of the state of the economy are stored up, as a consequence. This paper seeks to understand the scale of those revisions with the context in the recent history of UK fiscal policy (1993-2015), with a particular emphasis on the expenditure side and the relationship to planning and control during that period, and how it might be possible to use statistical techniques and ‘rules of thumb’ to deal with the uncertainty arising from imperfect knowledge about the true state of the economy.

For example, ONS data on GDP were revised 73 times upwards and 33 times downwards after the first month following publication in the period 1989-2016 with a median absolute revision of 0.2% points. This raises a number of questions, which our paper addresses:

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we model the factors that lead to systematic revisions to published expenditure plans? Thirdly, the period from the early 1990s has been characterised by the adoption of formal rules that replaced earlier, more ad hoc arrangements (see, for example, Chadha and Nolan, 2007), adopted a formal inflation target for monetary policy in 1992 and developed an independent fiscal council to assess HMT expenditure and revenue plans in 2010. We also ask how much sense does it make to impose spending limits on individual government departments or overall total managed expenditures. Finally, we start to model actual expenditure as a conditional rule (see Pain et al, 1997). We present new results on the extent of data revisions and the extent to which they affect forecasts of economic activity. We then go on to present new estimates of the uncertainty of fiscal expenditure plans, based on the revisions to plans announced at fiscal events since 1990. Given these uncertainties in expenditure we outline the fiscal problem of stabilising output in the presence of a monetary policy maker targeting inflation and with uncertainty in control parameters, in the sense of Brainard (1967). We show that multi-year government spending plans are also significantly revised over successive fiscal events, and particularly after changes in government. We show the risk for any given government expenditure plan by constructing measures of historical expenditure revisions. We also show that the most significant factor in explaining public expenditure revisions are changes to the expected path of GDP growth. We illustrate how to model the components of public expenditure and are thus able to remark on the extent to which expenditure is warranted. Throughout the paper we report on findings from interviews with key policymakers in the past 25 years on how fiscal expenditure was managed and uncertainty confronted. (See Annex for a detailed summary of the interviews, which have been anonymised). Specifically, the interviews were semi-structured and they involved one former Chancellor of the Exchequer, one former Chief Secretary to the Treasury, one former chief adviser to the Chancellor and three former officials in HMT. The paper is structured as follows. Section 2 illustrates some key interactions between monetary and fiscal policy and we explore the extent to which government expenditure might offset deviations in output from potential, Section 3 outlines the extent of revisions to the preliminary estimates of GDP and show that these can explain a significant portion of GDP forecast errors, which implies that GDP revisions are a key component to learning about the evolving state of the economy. Given the evolution in the state of the economy, we then measure the revisions to expenditure plans. We will also examine the planned expenditure over time and its composition and evaluate the extent to which they changed as a result of changes in the state of the economy or from policy choice. Accordingly, Section 4 outlines our core dataset and explains our econometric methodology for understanding the drivers of expenditure revisions. One key focus aspect of this work will be the distinction between the normal course of action (including the operation of ‘automatic stabilisers’) and responses to unanticipated shocks (for which revisions to expenditure plans might be a proxy). In Section 5 we start to

construct measures of what we call ‘warranted expenditure’ for overall expenditure and for spending by departments. The residuals from these measures might be used to guide or explain future expenditure plans. The final section concludes and offers pointers to future work.

2 Fiscal Response

To illustrate the issues facing monetary and fiscal policymakers, we develop a simple model of the policy setting ‘game’ faced by the authorities. In this set-up, similar in spirit to the analysis presented in Balls and O’Donnell (2002), output is subject to supply and demand shocks with the fiscal and monetary authorities tasked with stabilising output. The fiscal authority sets the monetary policy target, which we assume is the long run average of inflation, and this target is pursued with the policy rate. Fiscal policy is then tasked with reducing the overall variance of output around its potential by choosing the level of public expenditures. The particular problem that the fiscal policy authority faces is that it would not wish to conflict with the monetary policy authority by stimulating (contracting) activity simultaneously in an uncoordinated fashion nor can it know exactly what the impact is on activity of a given changes in its expenditure path. We do not distinguish between types of government expenditure here but simply set up the fiscal policy response to demand and supply shocks and motivate our basic estimating equation in Section 4.

Let us start with a simple exposition of the fiscal authority’s control problem, similar to Lambertini and Rovelli (2002). Output, Y_t , is assumed to deviate from its long run potential, Y^* , in response to government expenditure, g_t , to deviations in the policy rate, i_t , from its natural level, i^* , that is given by $\bar{r} + \pi^*$ - the long run real rate and the long run average inflation rate, respectively - and to temporary demand shocks, $\epsilon_{t,1}$ (which we assume are not intertemporally correlated) where α and γ are parameters reflecting the fiscal and interest rate multipliers, respectively.

$$Y_t = Y^* + \alpha g_t - \gamma(i_t - \pi^* - \bar{r}) + \epsilon_{t,1} \quad (1)$$

Equation (2) can be thought of as a traditional Phillips curve. Inflation π_t differs from the long run rate with the existence of an output gap, weighted by the parameter β , in addition to a supply shock, $\epsilon_{t,2}$, which we assume has no serial dependence and is uncorrelated with the demand shock $\epsilon_{t,1}$ (we can relax this assumption relatively trivially but impose it to ease exposition).

$$\pi_t = \pi^* + \beta(Y_t - Y^*) + \epsilon_{t,2} \quad (2)$$

The monetary policy authority is set an objective to pursue an inflation target, while also placing a weight on deviations of the real interest rate from its long run equilibrium level - noting that $i^* - \pi_t = \bar{r}$, weighted by the parameter μ .

$$L_M = (\pi - \pi^*)^2 + \mu(i_t - \pi^* - \bar{r})^2 \quad (3)$$

By substituting (1) and (2) into (3), and minimising the resulting loss function, we can solve for the monetary policy makers optimal interest rate response as a function of aggregate demand and supply shocks, $\epsilon_{t,1}$ and $\epsilon_{t,2}$, as well as changes in the path of government expenditure.

$$i_t^{br} = \pi^* + \bar{r} + \frac{\gamma\beta}{\gamma^2\beta^2 + \mu} [\beta(\alpha g_t + \epsilon_{t,1}) + \epsilon_{t,2}] \quad (4)$$

We can then re-write the aggregate demand equation (1), using (4) to obtain an expression for deviations of output from potential output that is conditioned on the monetary policy response (as we have substituted out i_t), and dependent upon government expenditure and the demand and supply shocks.

$$(Y_t - Y^*) = \frac{\mu\alpha}{\gamma^2\beta^2 + \mu} g_t + \frac{\mu}{\gamma^2\beta^2 + \mu} \epsilon_{t,1} - \frac{\gamma^2\beta}{\gamma^2\beta^2 + \mu} \epsilon_{t,2} \quad (5)$$

To simplify the analysis, we rewrite the coefficients premultiplying government expenditure and the demand and supply shocks can be re-written as $\phi_1 = \frac{\mu\alpha}{\gamma^2\beta^2 + \mu}$, $\phi_2 = \frac{\mu}{\gamma^2\beta^2 + \mu}$, $\phi_3 = \frac{\gamma^2\beta}{\gamma^2\beta^2 + \mu}$. We can then express the equation for the output gap in the same fashion as Brainard (1967).

$$(Y_t - Y^*) = \phi_1 g_t + \phi_2 \epsilon_{t,1} - \phi_3 \epsilon_{t,2}. \quad (6)$$

Following Brainard, we suggest that the fiscal authority is interested in stabilising the variance of output around potential output. This can be expressed by taking the second moment of (6), recalling that we assumed no covariance between the demand and supply shocks, formally that $\sigma_{\epsilon_1, \epsilon_2} = 0$, the time subscript is suppressed for notational convenience. We therefore allow for the existence of multiplicative uncertainty in the three parameters, capturing the notion that the fiscal policy maker is uncertain as to the exact size of the fiscal multiplier, as they are uncertain as to the impact of the demand and supply shocks. The second moment of the output gap is then given by:

$$E(Y_t - Y^*)^2 = \sigma_{\phi_1}^2 g^2 + \sigma_{\phi_2}^2 \epsilon_1^2 - \sigma_{\phi_3}^2 \epsilon_2^2 + 2g_t \epsilon_1 \sigma_{\phi_1 \phi_2} - 2g \epsilon_2 \sigma_{\phi_1 \phi_3} + (\phi_1^- g - Y^*)^2 \quad (7)$$

Following Brainard, we take the first order conditions of (7), and rearranging for g to express the optimal setting of the level of government expenditure as a function of the level of potential output, the supply and demand shocks, and the covariance between fiscal expenditure and the shocks themselves.

$$g = \frac{Y^* - \frac{1}{\phi_1} (\epsilon_1 \sigma_{\phi_1 \phi_2} - \epsilon_2 \sigma_{\phi_1 \phi_3})}{\frac{\sigma_{\phi_1}^2}{\phi_1} + \phi_1} \quad (8)$$

Equation (8) highlights the "conservatism" principle, that when the instruments of policy are uncertain in their impact, the fiscal policymakers sets g at a level lower than they would if there was no uncertainty. We can see this by noting that $\frac{\sigma_{\phi_1}^2}{\phi_1} + \phi_1 \geq 0$. This effect can, however, be overturned if the sum of the covariances between the demand and supply shocks and expenditure is sufficiently negative (as the sum enters equation (8) negatively) to outweigh the uncertainty as to the fiscal multiplier.

The form of the equation we therefore examine in Section 3.4 is given below, which states that government expenditure is driven by deviations in output from its potential and shocks to aggregate demand or supply:

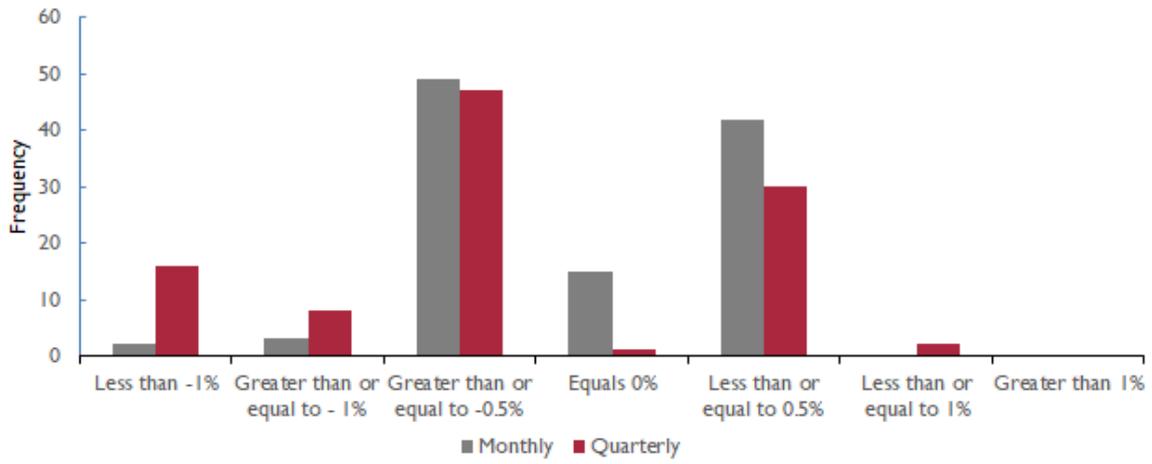
$$g = \Lambda_1 Y^* - \Lambda_2 \epsilon_1 + \Lambda_3 \epsilon_2 \quad (9)$$

3 Public Expenditure and the State of the Economy

3.1 Preliminary Analysis

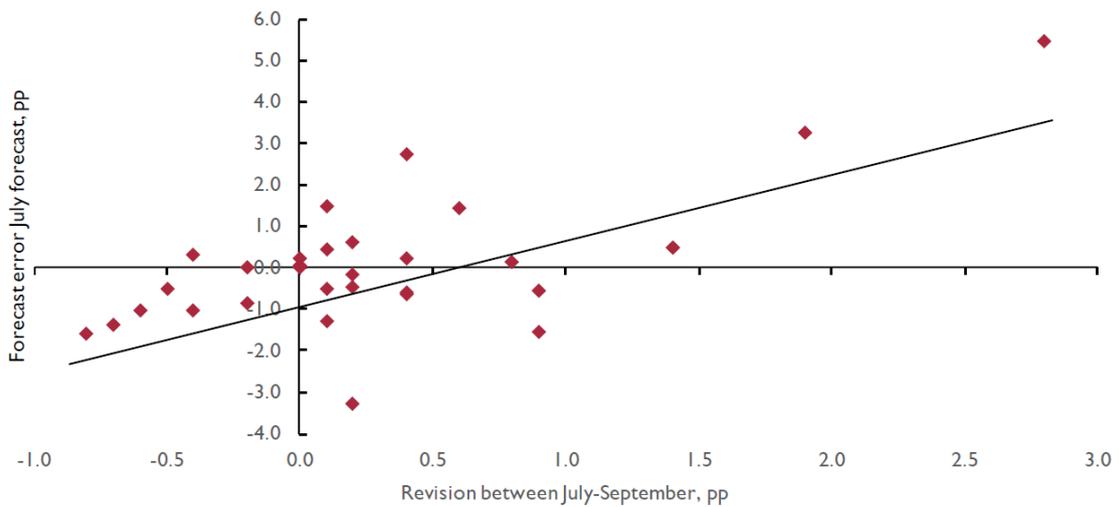
Let us first assess the revisions to economic data in the period 1993-2015. This revision process often means that early, or preliminary, GDP estimates are far from the final estimate: Figure 1 shows the difference in real GDP estimates a month and a quarter after the first release. There has only been one occasion when GDP figures were not revised a quarter after the first release, and only 14 times when there was no change after a month. There were 73 upward revisions and 33 downward revisions after the first month following release, suggesting a possible downward bias in estimation in this period. The average upward revision was 0.23% and the average downward revision was 0.33% and they are both statistically different from zero. These revisions to measured data are important in explaining revisions to forecasts of future GDP. And in fact, the revisions to the year-ahead median consensus forecasts, collected and published by HMT, tend to explain half of the overall forecast error made. The other half can thus

Figure 1. Revisions to real GDP



Source: NIESR database. Revisions to the first published estimate of real GDP after one month (grey) and one quarter (red)

Figure 2. Forecast errors (vertical axis) vs first forecast revisions

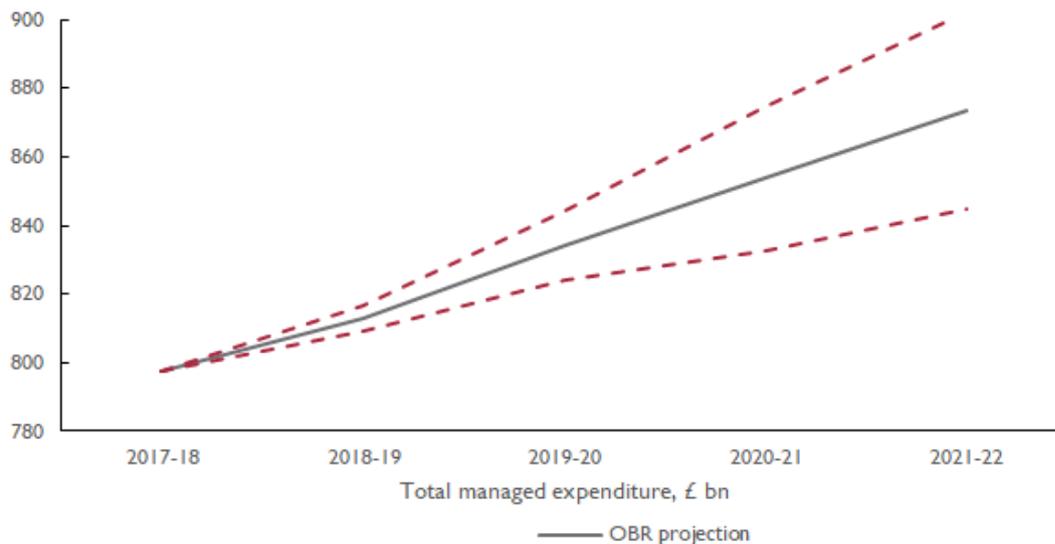


Source: HM Treasury and NIESR calculations.

be explained by new information since the forecasts were published. In Figure 2, the horizontal axis shows the consensus revision to GDP growth for year t made between July and December of year $t-1$. On the vertical axis the difference between the initial consensus forecast published in July of year $t-1$ and the realisation of growth in year t is shown. Revising forecasts is the standard way to help the reduction in forecast errors. And fits clearly with the finding of Banbura et al (2011) that interpretation of new public information plays an increasingly important role in understanding the current state of the economy.

Given that the preliminary estimates of GDP (and demand components) are subject to large and statistically significant revisions, and so are noisy, we may wish then to understand whether these revisions have led to adjustments in public expenditure plans. First, figure 3 constructs the error bands around the total managed expenditure path published in the November 2017 budget. The chart illustrates the uncertainty around current spending projections based on the size of historic past forecast errors at each horizon. The 95% confidence interval is calculated by adding to both sides of the

Figure 3 - 95% bands around central TME estimates



Source: HM Treasury and NIESR calculations

published projection two times the standard deviation of nominal TME forecast errors at each forecast horizon. For instance, the standard deviation of errors made in the past by the OBR in year-ahead TME projections is around £5bn, which implies that with a certainty of 95% the spending next year falls within a range of £824-£844 bn, or within 2x £5bn in either direction from the central projection of £834 bn. We repeat the exercise for the subsequent four years as well.

Our focus is on how planned expenditure changes over time in light of revised GDP estimates and other factors, including policy choices as a result of changing political priorities and institutions (see, for example, Persson et al, 2000). It may also be the case that GDP estimates have become more unreliable over the business cycle since the

start of the long expansion in 1992 (Chadha et al. 2016), as changes in the structure of the economy may have made the estimation of GDP more problematic. There has also been a large and persistent debate about the impact of public expenditure on activity (see McMahon, 2017) and we may need to understand the scope for ‘flexibility’ in light of changes to knowledge about the state of the economy. To that extent the debate on flexible inflation targeting has not had an analogue in the fiscal policy space (see Orphanides, 1998). A number of interviewees argued that there is an important difference between two levels of uncertainty: (1) ‘predictable’ uncertainty, which includes ‘normal-order’ events (political or economic events such as changes in government or interest rate changes), what we might think of as identifiable risks; and (2) ‘unpredictable’ uncertainty, which relates to unidentifiable risks, for example the implications of events such as the collapse of Long-Term Capital Management in 1998, the bursting of the dot.com bubble in 2001, the 2008 financial crash (Chadha et al., 2016) or the near-collapse of the Eurozone in 2010-11.

Government control of fiscal expenditure can refer to a number of different measures of overall public expenditure (see Thain and Wright, 1995). The most widely used is Total Managed Expenditure (TME) and this refers to the total amount that the government spends in a fiscal year. Within the National Accounts system it is defined as the sum of public sector current expenditure and public sector gross investment. TME can be broken down into two subcomponents:

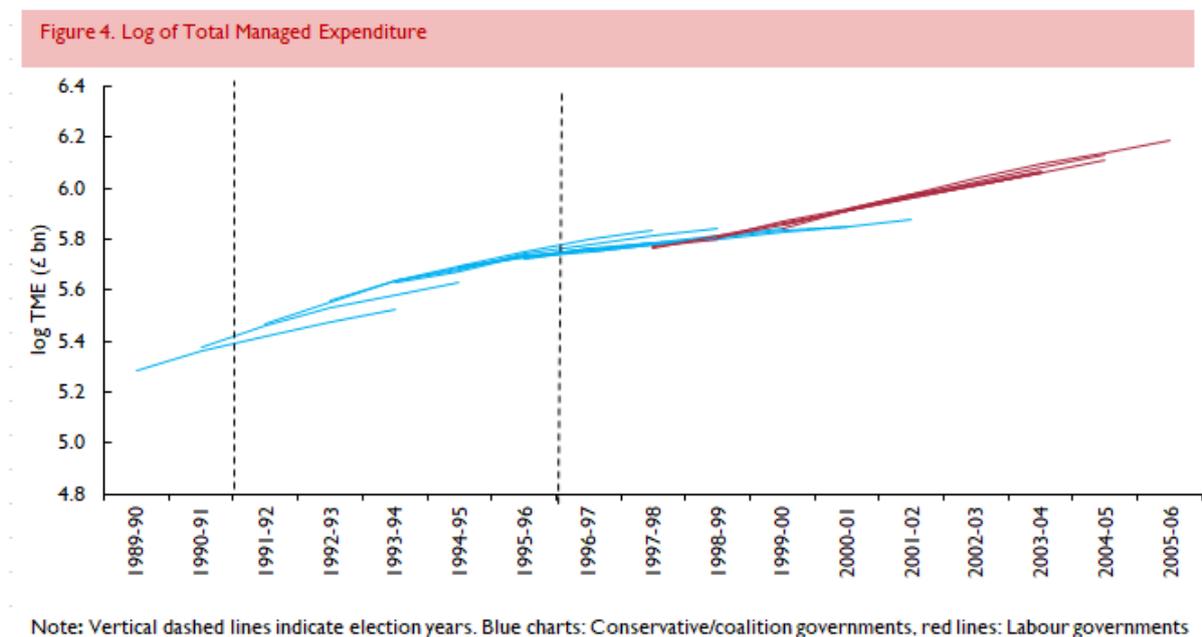
1. Departmental Expenditure Limits (DEL) set the amount that government departments are allocated to spend in a given fiscal year and usually result from negotiations with HMT before a spending review. Departments cannot exceed the DEL but DELs can be altered between spending reviews, as a result of policy changes or by drawing money from the Treasury reserve. Examples include the costs of running services, hospitals, schools, and staffing costs; and
2. Annually Managed Expenditure (AME) encompasses all spending that is not controlled by a government department. It is classed as spending that cannot reasonably be subject to firm multi-year limits. AME includes welfare, pensions, debt interest payments, accounting adjustments etc.; in other words, AME generally includes demand-led spending programmes.

Both AMEs and DELs can be further split into resource and capital components. Resource spending can be thought of as money that is spent on day-to-day resource and administration costs, while capital spending is on investment and projects that are designed to promote economic growth. The distinction between Resource Annually Managed Expenditure (RAME) and Resource Departmental Expenditure Limits (RDEL) occurs whether this spending is subject to multi-year planning (as in DELs) or more volatile spending that is harder to impose multi-year plans on (AME).

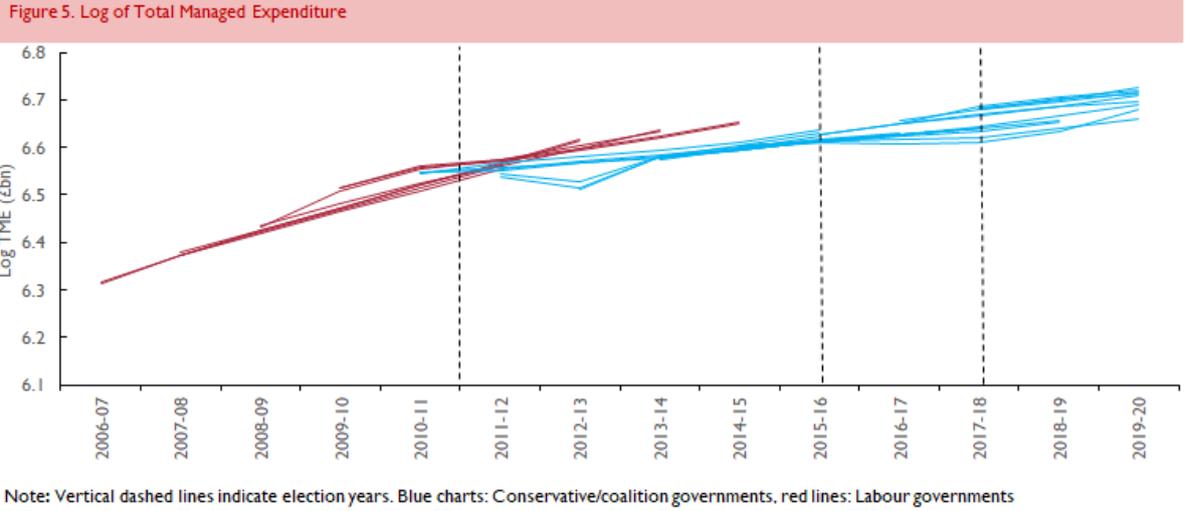
For this paper we do not split TME into DEL and AME but will wish to examine the contribution of both elements in any future work.

3.2 Data Analysis

The data used for our analysis is drawn primarily from two sources. We calculate a series of revisions to Total Managed Expenditure using the real-time database, “Historical official forecasts”, made available by the Office for Budget Responsibility. The forecasts for UK real GDP growth in a given fiscal year are drawn from the Institute’s own forecast database that forms part of its global macroeconomic model, NiGEM. We exploit NiGEM’s real time database to obtain our previously published forecast for the same month as any fiscal announcement. Doing so means we can be confident that the published forecast number incorporates all macroeconomic news that would be available to the government at the announcement date. Consequently, any revisions to forecasts of GDP growth reflect new information about the state of the economy between event t and $t - 1$.



Given the Institute’s influence on macroeconomic policy debates in the UK and the fact that its forecast is included in HMT’s set of independent forecasters further corroborates our assumption that changes to the economic forecast are observed by policymakers. To illustrate the TME series graphically, figures 4 and 5 plot each fiscal plan announced in the House of Commons from 1990 to 2018. Each individual line corresponds to an announced fiscal plan; plans announced by Conservative majority or Conservative-led Governments are coloured light blue, while the equivalent series for the Labour party are in red. The immediate takeaway is that plans do undoubtedly change. The dashed vertical lines plot election years, which makes clear the change in the fiscal



spending plans that occurred with a change in Government.

3.3 Revisions throughout time

The structure of the available data on TME allows us to construct two types of initial time series of revisions. We call these Fiscal Year revisions and Fiscal Event revisions. The distinction between the two series occurs in that the fiscal years series captures revisions for a fixed fiscal year across a range of budgets and pre budget reports, while the fiscal events series captures revisions for a fixed budget or pre-budget report across a range of fiscal years. The revisions can be expressed formally as:

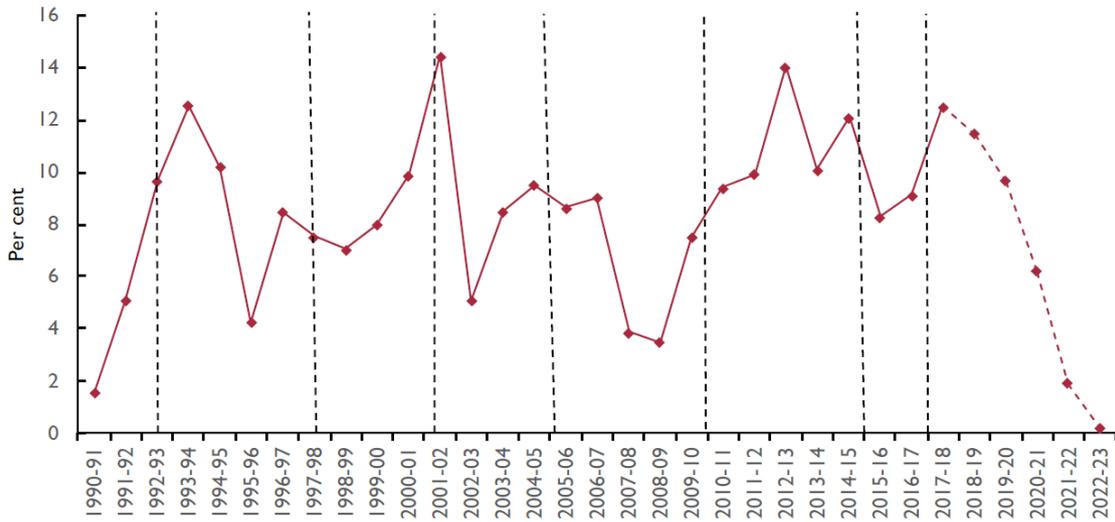
$$\epsilon_{t,h} = \frac{TME_t^h - TME_t^{h-1}}{TME_t^{h-1}} \quad (10)$$

where TME_t^h is Total Managed Expenditure plan for fiscal year t announced by HMT at fiscal event $h \leq t$. The structure of the data and the length of plan announcements allow us to construct revisions to spending plans at different horizons, denoted as $\epsilon_{t+i,h}$, where $t+i$ denotes a given fiscal year i years in the future. This allows us to compare how spending plans change at different horizons in response to news about the state of the economy today.

To illustrate the size of revisions, figure 6 shows the cumulative absolute value of revisions for a fiscal year. For instance, the fiscal year with the largest revisions (2001-2002) contains the sum of all revisions where a spending plan was published for that fiscal year. Dashed vertical lines indicate election years. The plotted series is expressed formally as:

$$\sum_{h=1}^N \epsilon_{t,h+i} = |\epsilon_h| + |\epsilon_{h+1}| + \dots + |\epsilon_N| \quad (11)$$

Figure 6. Absolute value of revisions

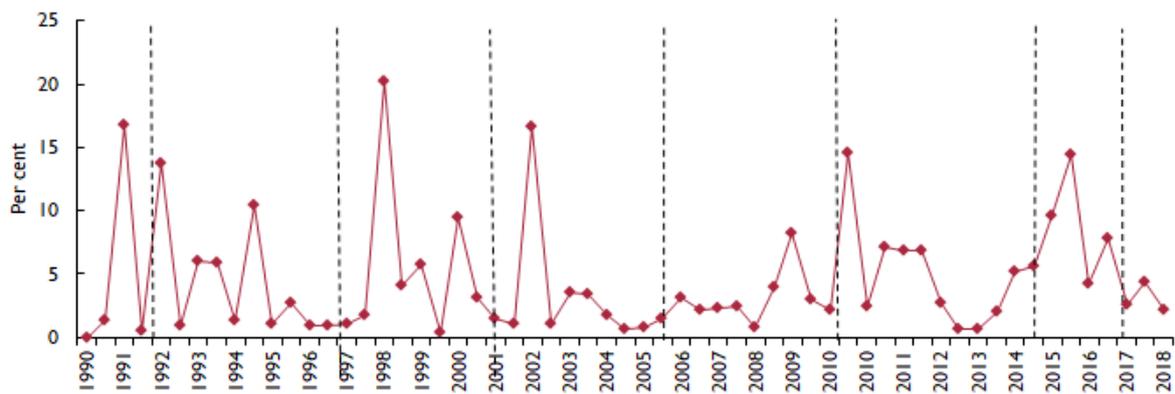


Note: Vertical dashed lines indicate election years.

Figure 7 plots the cumulative absolute value of revisions for a given fiscal event. This includes a range of fiscal revisions. The largest (absolute) value in the series is that of the June 1998 budget, where the largest individual contribution is the revision to spending plans in fiscal year 2001-02 (with the revision measured relative to the plan for 2001-02 published by the Major government). This is expressed as:

$$\sum_{t=1}^N \epsilon_{t+i,h} = |\epsilon_t| + |\epsilon_{t+1}| + \dots + |\epsilon_N| \quad (12)$$

Figure 7. Absolute value of revisions



Note: Vertical dashed lines indicate election years

Before assessing the impact of revisions to growth forecasts on expenditure plans, we follow Beetsma and Giuliadori (2010) in assessing 1) whether the revision series exhibits a projection bias (that revisions are not routinely positive or negative) and 2) that there is no serial correlation in the revision series (that revisions are not predictable from past

values of the series). To do so, the revisions are regressed on a constant and their own lag:

$$\epsilon_{t,h} = \mu_0 + \mu_1 \epsilon_{t,h-1} + v_{t,h} \quad (13)$$

Testing whether μ_0 and $\mu_1 = 0$ implements tests 1) and 2). We use Newey-West errors to account for any possible heteroscedasticity or autocorrelation in the error term of the above regression. The fiscal events series is unpredictable from previous errors and also features no projection bias. On the other hand, while the fiscal years series does not feature any projection bias, lagged revision values do appear to have predictive power for current revision values

Consequently, in the subsequent analysis we continue using the fiscal events revision series, and leave the fiscal years series as a descriptive measure.

3.4 Methodology

To analyse how public spending responds to uncertainty about the macroeconomy, we assess whether adjustments to spending plans can be explained by changes in the economic outlook. The relationship between spending and the state of the economy can be thought of as a fiscal reaction function (e.g. Galí and Perotti 2003). When estimated in real time, results from fiscal reaction functions of advanced economies tend to show that spending plans are counter-cyclical, whereas outturn data suggests a more pro-cyclical fiscal policy stance (Cimadomo 2016 reviews the literature). The literature also suggests that fiscal policy reacts to a number of other factors, like elections. We estimate the following regression model:

$$\frac{TME_t^h - TME_t^{h-1}}{TME_t^{h-1}} = \alpha + \beta(g_t^h - g_t^{h-1}) + \gamma C^h + \epsilon_t^h \quad (14)$$

where TME_t^h is the total managed expenditure plan for fiscal year t announced by HMT at fiscal event $h \leq t$

g_t^h is the NiGEM forecast of UK real GDP growth in fiscal year t published immediately prior to fiscal event h . C^h is a vector of control variables available in real time that may affect changes to spending plans or priorities, e.g. claimant count, Bank Rate, political party in power, election year dummy. The error term is denoted by ϵ_t^h . As is immediately apparent, in this specification the use of OLS is likely to be problematic and yield biased coefficient estimates. Growth forecasts for the coming year may anticipate changes to Government spending plans, if so, ϵ_t^h is likely to be correlated with the dependent variable. To deal with this, we instrument the regressor of interest ($g_t^h - g_t^{h-1}$) with variables that directly affect UK GDP (and through GDP Government spending) but are exogenous with respect to spending plans published by the UK Government. We use revisions to US GDP growth forecasts over h and $h - 1$

(drawn from NiGEM) and changes in the Fed Funds rate between h and $h - 1$ as instruments for changes to UK growth forecasts.

Table 1. Full specification

	1 OLS t=h	2 IV t=h	3 IV t=h	4 OLS t=h+1 yr	5 IV t=h+1 yr	6 IV t=h+1 yr	7 OLS t=h+2 yrs	8 IV t=h+2 yrs	9 IV t=h+2 yrs
GDP growth	-0.084 (0.34)	-0.850** (0.40)	-0.803*** (0.27)	-0.278 (0.32)	-1.308* (0.75)	-1.836* (0.94)	0.787 (0.96)	-2.355 (3.04)	-2.921 (1.93)
Claimant count			-0.197* (0.10)			-0.240 (0.16)			-0.382** (0.17)
Bank Rate			0.218** (0.09)			0.354** (0.15)			0.541*** (0.12)
Election			-0.031 (0.29)			-0.075 (0.52)			0.257 (0.59)
Conservative			0.827* (0.47)			1.132 (0.75)			1.142** (0.53)
Constant	0.208 (0.13)	0.027 (0.13)	-0.399 (0.31)	0.462** (0.20)	0.372* (0.19)	-0.510 (0.74)	0.692** (0.28)	0.481 (0.33)	-0.502 (0.61)
Observations	58	58	58	54	54	54	49	49	49

Robust standard errors in parentheses

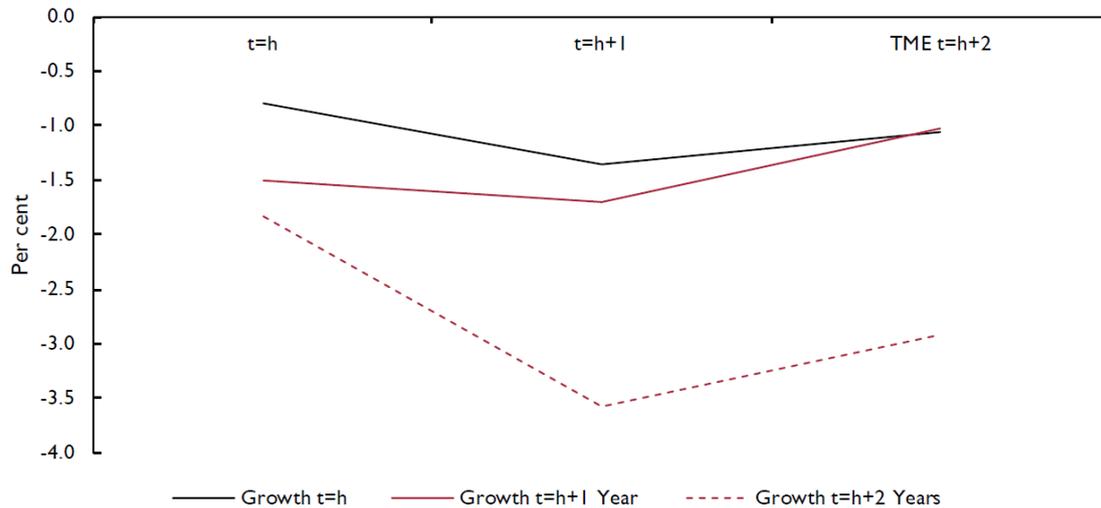
*** p<0.01, ** p<0.05, * p<0.1

Table 1 reports our baseline results. OLS estimates yield biased and insignificant results, but when we implement our instrumental variable approach, we show that revisions to UK GDP growth have a negative and statistically significant effect on TME revisions across a range of forecast horizons and are robust to a range of control variables. The magnitude varies over the horizon but is consistently negative in the IV specifications. For revisions that concern the current fiscal year ($h = t$), a 100 basis point revision to growth forecasts results in a 85 basis point reduction in TME, while for $t = h + 1$ the reduction in TME is between 130 and 170 basis points, depending on the specification used. Results for $t = h + 2$ are larger in magnitude but are no longer statistically significant. This result suggests that revisions to spending plans are countercyclical in response changes in expectations about the state of the macroeconomy. One potential explanation for this result (which will be explored in future work) is that AME expenditure revisions dominate DEL expenditure revisions. This would occur through the automatic stabiliser effect, whereby when the economy surprises to the upside, expenditure on out of work welfare payments is lower than forecast, while the corollary holds for surprises to the downside.

Of the control variables, Bank rate enters with a positive coefficient and remains significant throughout. Initial inspection implies that tighter monetary policy is correlated with upward revisions in TME. In fiscal-monetary interaction terms we may think of this as the Bank of England responding to what it perceives as “loose” fiscal policy from the Treasury, or vice versa. Of the remaining variables, a higher claimant is correlated with lower spending, possibly because the variable reflects institutional changes to spending control over time, while in our sample, Conservative governments tend to revise spending up more significantly than Labour governments. A candidate explanation for this occurs through early coalition government spending

plans significantly “over-promising” in terms of spending reduction plans, which were then subsequently revised up due to a combination of the economy underperforming and political pressures.

Figure 8. Revision impact across multiple horizons



Note: $t=h$ refers to the impact on TME of a 100 basis point forecast revision for the current fiscal year. $t=h+1$ and $t=h+2$ show the same effect for one and two years ahead.

The conclusion of a countercyclical reaction of expenditure to news about GDP forecast also holds across different forecast horizons. While the results in table 1 focus on revisions to GDP forecasts and TME spending for the same year, figure 8 reports the impact of a revision to a GDP forecast on TME across all years. As is clear, for a given growth forecast horizon, spending plans for the upcoming fiscal year ($t = h + 1$) are most reactive to revisions to growth forecasts.

To further verify the conclusions we draw, we shorten the sample to only include observations prior to the Cameron Government and repeat the analysis from Table 1. Table 2 reports the results from the first exercise, separating the Cameron and May Governments from the rest of the sample. Since 2010, spending plans have been less counter-cyclical than previously, or equivalently, the Major, Blair and Brown governments reacted more to news of the economy in terms of adjusting the path of TME.

It is tempting to conclude that these revisions were part of a sensible response to ‘news’ about the economy, in so far as they seem to represent the operation of automatic stabilisers. However, until we assess the contributions from AME and DEL, we will not be sure that learning about the state of the economy finds an automatic response in fiscal expenditure, nor will we know if it is anywhere near to optimal given the shock and the structure of the economy. We will not know how to set rules for expenditure and control that allow for such responses within the overall fiscal framework as planned by HMT and assessed by the OBR. These are very significant issues, as all the

Table 2. Reduced sample

	1 IV t=h full sample	2 IV t=h pre-2010	3 IV t=h+1 year full sample	4 IV t=h+1 year pre-2010	5 IV t=h+2 years full sample	6 IV t=h+2 years pre-2010
GDP growth	-0.803*** (0.27)	-0.882*** (0.25)	-1.704* (0.96)	-2.177** (0.93)	-2.921 (1.93)	-3.227* (1.85)
Controls	Y	Y	Y	Y	Y	Y
Observations	58	40	54	36	49	31

Standard errors in parentheses
*p<0.05, **p<0.01, ***p<0.001

interviewees emphasised that fiscal rules matter but that they have a limited duration. The importance of formal fiscal rules consists in imposing two kinds of discipline: (1) external discipline, through independently assessed forecasts in the period 1997-2010 or through the independent Office for Budget Responsibility (OBR) since 2010. However, neither arrangement necessarily eliminates forecast bias, which is to do with economic modelling that has changed little since independent assessments or the creation of the OBR; (2) internal discipline, by defining a framework that balances departmental demands with overall spending, as well as the composition of expenditure (current and capital, but this distinction is arguably more blurred than is commonly assumed). The new fiscal framework that was adopted after 1997 marked a fundamental change insofar as it shifted expenditure planning and controlling from a one-year horizon with annual negotiations between HMT and spending departments to a three-year horizon, including the possibility of carrying over non-spend. But while the Spending Reviews allowed for some more long-term economic planning, the Budget and the Autumn Statement continued to generate an element of political uncertainty. One of the main reasons why fiscal rules and their usefulness are limited in time is the trade-off between credibility and flexibility. At some point in the economic and the political cycle, sticking to a set of rules will be at odds with having room for manoeuvre. There are two prominent examples during the period in question: (1) the lower-than-expected tax revenues in 2000-01 from non-financial corporations, which led to a structural deficit in the 2004 Spending Review (see, Johnson, 2016) and an extension of the economic cycle from seven years to twelve years (cf. HMT, 2008); (2) lower-than-expected growth in 2011-12, which shifted the timetable in relation to deficit reduction. Fiscal rules also tend to reduce uncertainty in the sense of unpredictable behaviour by government, but they can introduce new types of complexity that exacerbate an already uncertain horizon. For example, new rules can lead to even greater departmental under-spend than previous fiscal frameworks, as the sanctions for over-spend are becoming more severe. Reasons for under-spending allocated budgets include the fear of being hauled in front of the Public Accounts Committee, the lack of good procurement and the tendency of front-line departments (especially local government and the NHS) to be better at spending

money than Whitehall departments. Moreover, HMT has relatively poor oversight in terms of departmental budget accounting, and the end-of-year spending facility has been contested. If departments end up ‘gaming the system’, then that would lead to greater unpredictability. What ‘rules of thumb’ did HMT use in order to manage uncertainty? ‘Rules of thumb’ ranged from formal fiscal rules via estimates of Annual Managed Expenditure and forecasts for GDP and tax revenue to pension expenditure, public sector pay and other big ‘fixed costs’ (e.g. monthly meetings of pay boards in the period 1997-2010). Arguably, this process can be described as the ‘rule of big numbers’, which is the result of an asymmetry of information in favour of spending departments.

4 Warranted Expenditure

Having examined the drivers of innovations in government expenditure, we can also try to model the overall level of expenditure. We can interpret deviations from the ‘warranted’ level of expenditure as a deliberate discretionary choice. We can then go further and decompose expenditure by function and being to understand which departments were supported and which were not over time in the overall allocation of spending. We will, for example, add up all spending on education whether it comes from the education department or other departments, including the devolved authorities. And this analysis would allow us to determine whether governments routinely target particular departments when implementing spending reductions, or when conducting fiscal expansions. This would perhaps shed light on whether the spending paths for any departments should be treated with particular caution (in that the confidence intervals around these departments spending plans would be wider). The largest share of government expenditure (around 40 per cent) is spent on social protection, which includes pensions and other welfare spending, followed by health care spending (around 20 per cent) and education (10-15 per cent). According to this classification, the type of public service that saw the largest absolute decline in annual funding between 2010-11 and 2016-17 of £260 per head was education, a reduction of 16 per cent. In percentage terms, spending on economic development was reduced most (60 per cent or £130 per head in real terms), followed by employment policies (48 per cent or £36 per head) and housing (45 per cent or £131 per head). Per capita spending on health care and social protection remained relatively unchanged. Annual health care expenditure in real terms was increased from around £2,100 per head in 2010-11 to £2,200 per head in 2016-17, while annual social protection spending was around £4,000 per head in 2016-17, virtually the same as six years before. But even some of the protected areas may not have received enough resources to maintain the quality of service expected. For example, at a time when the elderly population is increasing, it is often claimed that not enough resources have been allocated to health, even though its budget has not been cut. The demand for other services too is likely to be affected by population aging and other

demands. This raises an important consideration for our analysis, namely, do whether governments (inherently political in their nature) respond not just to news about the underlying economy, but also pressure from the electorate. One method to implement this notion is set out in Hantzsche and Young (2018) and in Pain, Weale and Young (1997). To implement this method, four main drivers of Total Managed Expenditure are assumed:

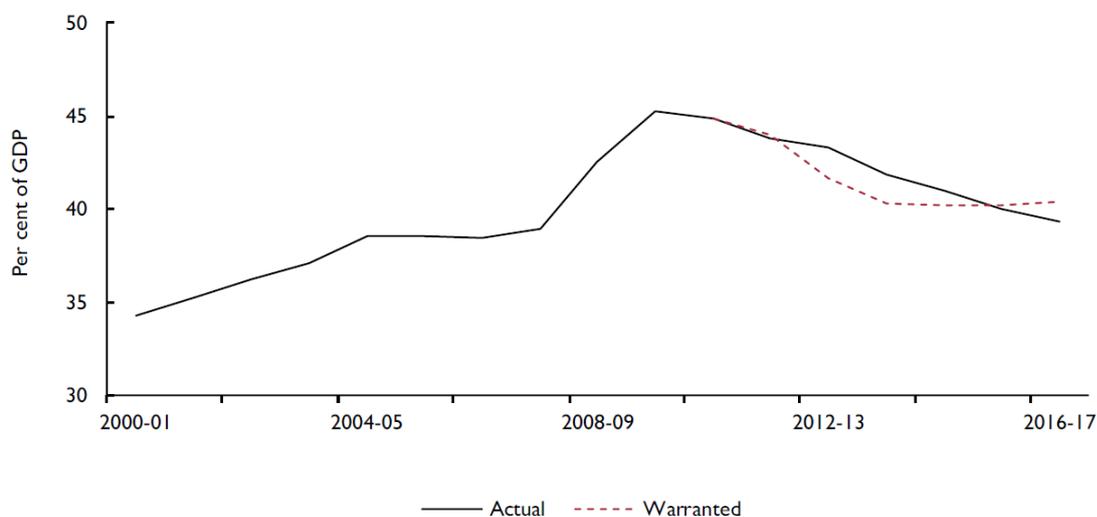
1. Economic development
2. Demographic trends
3. Business cycle stabilisation
4. Fiscal sustainability

This is estimated in a regression of the following form:

$$\frac{TME}{Y} = \beta_0 + \beta_1\left(\frac{TME}{Y}\right)_{t-1} + \beta_2\left(\frac{TME}{Y}\right)_{t-2} + \beta_3\left(\frac{debt}{Y}\right)_{t-1} + \beta_4\left(\frac{Age85+}{Population_t}\right) + \beta_5 Growth_{t+1} + u_t \quad (15)$$

The approach allows for the construction of an estimate of the amount of public spending that would have been chosen by previous governments if confronted by the circumstances of today. We call this warranted spending as it reflects the historic choices made by democratically elected governments. Hantzsche and Young find that the consolidation in public spending between 2010-11 and 2014-15 was actually a little slower than what was warranted (red line in Figure 9).

Figure 9. Difference between real total managed expenditure per capita and benchmark by year

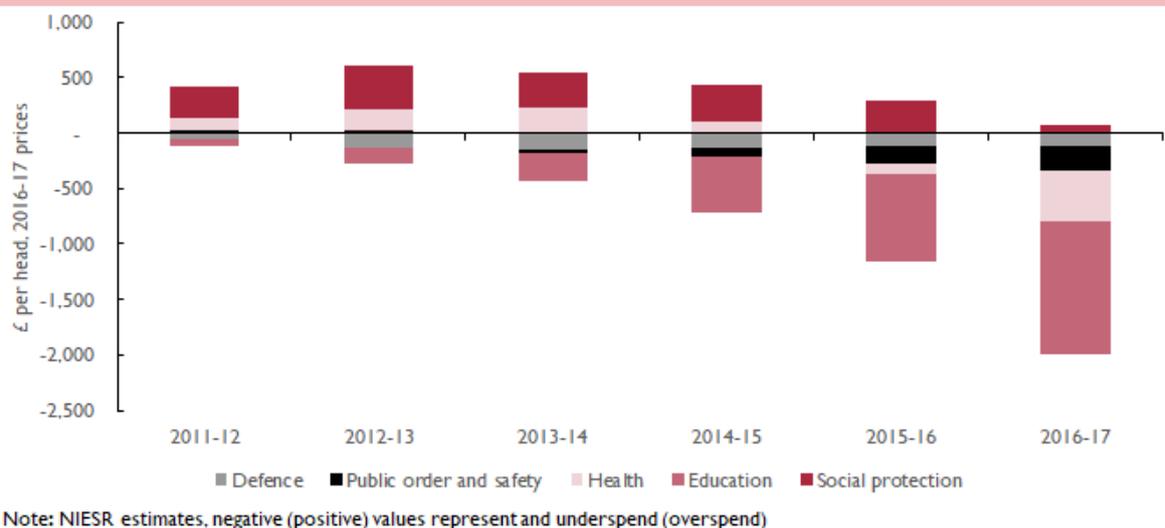


Source: NIESR estimates.

The weak fiscal position at the start of the period required a reduction of TME to close to 40 per cent of GDP over a five-year period. This is broadly the pace of consolidation that the coalition government wanted to achieve when it set out its 2010 spending plans. However, our analysis shows that after 2014-15, actual spending became more stringent than would have been warranted by previous governments spending priorities. In particular rising demographic pressures in combination with a more favourable business cycle meant that our benchmark path for TME rises back up to 44 per cent of GDP, compared to actual spending which dropped below 40 per cent in 2016-17. We can use this analysis to calculate the implications for real spending per head of population. In the financial year 2010-11, the government spent £12,494 per head in real terms. Six years later, the average expenditure on public services had dropped by 6% to £11,738. Figure 10 shows for each of those six years, by how much real spending per capita deviated from our benchmark.

During the early years of the consolidation, our analysis suggests that there would have been room to reduce annual spending per head by another £300 to £400, or 3 per cent. After 2014-15, however, the consolidation appears to have been extended beyond the levels implied by our benchmark relationship as annual spending per head was cut by up to £1,400, or 12 per cent, compared to what previous governments would have undertaken. If this “underspend” were to continue, it may pressure the Government to diverge from their spending plans, regardless of any news about the forecasted prospects for the economy.

Figure 10: Difference between real total managed expenditure per capita and benchmark by year, selected functions



The same approach can be implemented by function. Figure 10 shows the over- and underfunding of spending areas, accumulated over the seven years of the fiscal consolidation 2010-11 to 2016-17, as suggested by our benchmark. Spending on education has fallen short by around £3,000 per head, compared to our benchmark. This is despite the fact that schools funding had been protected by the government.

Real education spending per head of population fell by 13% over the period, partly reflecting the shift away from government funding of universities.

We break down our estimates of over- and underfunding by year, shows that even in areas in which spending in the early years of the fiscal squeeze has been very much in line with our benchmark, such as health care and social protection, consolidation has been going on for too long now. For instance, our analysis implies that in 2016-17 the health care sector lacked around £440 per head in funding. Any room to save on spending for social protection appeared to be fully exhausted by 2017.

The estimates of warranted spending suggest that the spending restraint introduced by the coalition government was broadly warranted by past experience, but was no longer the case beyond 2015. This approach then suggests that by the end of the period further spending restraint was no longer compatible with the historic choices of the British electorate, and may provide an incentive for the Government to deviate from published spending plans, over and above the underlying state of the economy. Other issues that emerge from our analysis and the interviews include the shift after 1997 from assessing the outcome of public expenditure to measuring the efficiency, output and value-for-money, and this has changed the ways in which public spending is planned and controlled. Since then HMT dedicates more time to measuring the extent to which spending departments achieve the centrally defined targets. During the ten years of economic expansion, the need to boost productivity was far less urgent, but following the financial crash, the tendency of productivity to flat-line costs the public sector in the region of £30bn per year. Fiscal consolidation would look very different with stronger productivity growth.

5 Further work and concluding remarks

The analysis in this paper has focussed solely on the expenditure side of fiscal planning undertaken by the Treasury. Our intentions for future work are to extend this analysis in a number of directions, incorporating suggestions from participants at our policy workshop held at NIESR. In particular, and as discussed earlier, the potential heterogeneity across types of spending in response to news is of particular interest. While our spending series is an aggregate measure, it is important to recall the spending structure introduced in 1997 that splits spending into DEL and AME. Repeating the analysis for disaggregated spending will shed light on whether our finding of a countercyclical response of spending reflects heterogeneous responses of DEL and AME. The same distinction can be made in terms of Government consumption and capital spending, allowing us to examine whether politicians and Treasury officials routinely prioritise one area of spending when they receive new information about the economy. This work will involve extending the cross-sectional dimension of our sample by disaggregating the headline series into the sub-components discussed here. It will also

involve: a more detailed analysis of the composition of UK public spending, in particular how strict or fluid the boundaries are between current and capital expenditure; the tax side has to be fully integrated into a comprehensive analysis of how expenditure planning and control deals with uncertainty; the ways in which uncertainty is managed also require another key dimension, notably taking into account the symmetry of monetary policy targets in relation to the asymmetry of fiscal policy; monetary policy has a symmetric target: it is not desirable either to over- or to under-achieve the inflation target or to jeopardise financial stability; by contrast, fiscal policy has to be asymmetric because of prudence about projected GDP growth figures and because it is easier to manage better-than-expected growth and tax revenues than worse ones; more lessons are yet to be learned from the various fiscal framework in the period of 1993-2015 (HMT, 1997 and 1998); more lessons are yet to be learned from the various fiscal framework in the period of 1993-2015 (HMT, 1997 and 1998); there is also much work to be done on revising economic modelling in order to reflect a national and a world economy characterised by high volatility and low predictability.

Several workshop participants emphasised that to understand fully the pass-through mechanism from revisions to growth forecasts to changes to spending plans, it is important to consider both the reaction of tax receipt forecasts to changes in growth forecasts, as well as how the level of fiscal space available to the Government affects both reductions to spending (if, for example, debt/GDP is high by historical standards) and increases in spending (if the Government has a high degree of 'fiscal space'). In a sense, these questions are linked, in that they involve understanding how revisions to the state of the economy, spending and taxation affect each other contemporaneously. Offering a definitive answer will involve extending our available dataset both in terms of the number of periods available, as well as creating a similar revision series for tax receipts and solving the endogeneity problem that is immediately apparent. As such, this work is deliberately left as work for a larger scale project.

Bibliography

1. Auerbach, A. J. "Fiscal Uncertainty and How to Deal with It", Hutchins Centre on Fiscal and Monetary Policy, Working Paper No. 6.
2. Balls, E. and O'Donnell, G. eds. (, Reforming Britain's Economic and Financial Policy. Towards Greater Economic Stability (London: HM Treasury and Palgrave)
3. Banbura, Marta, Domenico Giannone, and Lucrezia Reichlin, (2011). Nowcasting, in M. Clemens and D. Hendry, eds., Oxford Handbook on Economic Forecasting, 2011, pp.193–224.
4. Beetsma and Giuliodori (2010) Fiscal adjustment to cyclical developments in the OECD: an empirical analysis based on real-time data
5. Brainard, W., (1967). "Uncertainty and the Effectiveness of Policy", American Economic Review Papers and Proceedings, 57, pp411-425.
6. Chadha, J.S. and Nolan, C. (2007), "Optimal simple rules for the conduct of monetary and fiscal policy", Journal of Macroeconomics, Vol. 29, No. 4 (2007), pp. 665-689.
7. Chadha, J.S., Crystal, A., Pearlman, J., Smith, P. and Wright, S. (eds.) (2016), The UK Economy in the Long Expansion and Its Aftermath (Cambridge: Cambridge University Press, 2016).
8. Cimadomo, J. (2016). Real-time data and fiscal policy analysis: A survey of the literature. Journal of Economic Surveys, 30(2), 302-326.
9. Davis, E.P. (2012), "The state of evidence-based policy evaluation and its role in policy formation", National Institute Economic Review, Vol. 219, no. 1 (January 2012), pp. 41-52.
10. Galí, J., & Perotti, R. (2003). Fiscal policy and monetary integration in Europe. Economic Policy, 18(37), 533-572.
11. Ghysels, E., C. Horan and E. Moench, "Forecasting through the Rearview Mirror: Data Revisions and Bond Return Predictability", The Review of Financial Studies, 31(2), pp.678–714.
12. Hantzsche and Young (2018), "Light at the end of the fiscal tunnel?", National Institute Economic Review, 244
13. HMT (1997), "Fiscal policy. Lessons from the last economic cycle", HMT Paper, November 1997.

14. HMT (1998), "Delivering economic stability: lessons from previous macroeconomic experience", HMT paper, November 1998.
15. HMT (2008), "Public Finances and the Cycle", HMT Economic Working Paper, 2008, <http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/d/pbr08-publicfinances.444.pdf>
16. Johnson, P. (2016), 'UK fiscal policy before the crisis', in Chadha, J.S. et al. (eds.), *The UK Economy in the Long Expansion and Its Aftermath* (Cambridge: Cambridge University Press, 2016), pp. 409-36.
17. Lambertini, L. and R. Rovelli, (2003). "Monetary and fiscal policy coordination and macroeconomic stabilization. A theoretical analysis," Working Papers 464, Dipartimento Scienze Economiche, Universita' di Bologna.
18. McMahon, M. (2017). "Sound Finances: Strategy or Soundbite", *National Institute Economic Review*, 241(1), pp.13-32.
19. Orphanides, A. (1998). "Monetary Policy Evaluation with Noisy Information", *Federal Reserve Board Finance and Economics Discussion Series*, 50.
20. Pain, N., M. Weale and G. Young, (1997). "Britain's Fiscal Problems", *Economic Journal*, 107(443), pp.1142-1156.
21. Persson, T., Roland, G., and Tabellini, G. (2000). "Comparative Politics and Public Finance", *Journal of Political Economy*, 108(6), 1121-1161.
22. Thain, C. and Wright. M. (1995). *The Treasury and Whitehall*, Oxford: Clarendon Press.

Annex – Anonymised Interviews

I. former politician at HMT

1. the post-1997 fiscal framework had 3 objectives
 - (i) political credibility – reassurance of prudent stewardship of public finances
 - (ii) stability and longer-term perspective
 - (iii) boosting investment in health and education→ room for manoeuvre determined largely by social security
2. fiscal rules had the effect of
 - imposing external discipline: independently assessed forecasts
 - imposing internal discipline: departmental expenditure and demands
3. RAB was set up with the best of intentions but did not really work to produce better stewardship, e.g. true costs of government in relation to the student loan system
4. current versus capital spending: largely presentational, and caught in the tensions between discipline and flexibility
5. forecasts: it is not just the government that is optimistic, so are the OBR (essentially the same people and the same models)
6. fiscal consolidation after 2010: the LibDems provided political cover for Tory austerity
7. halving or eliminating the deficit was the main fault-line between Lab and Tory approach
8. cutting capital and local government spending did affect economic growth but very hard, if not impossible, to quantify
9. areas of government expenditure less affecting growth include defence spending, but politically untenable to impose even larger cuts
10. in terms of fiscal rules, longer-term horizons are better than shorter ones BUT
 - a. uncertainty arises from unanticipated events
 - b. there is fluidity between capital spending, current spending and revenue from tax
 - c. room for manoeuvre is key

II. former politician at HMT

1. key issues
 - (a) how did Labour end up with a structural deficit in 2004 Spending Review?
 - (b) double dip recession
 - (c) lessons from fiscal consolidation
 - (d) how to conduct fiscal consolidation without harming equality?→ governments need
 - [i] a story
 - [ii] an industrial strategy
 - [iii] radical decentralisation
2. did the new fiscal framework reduce uncertainty?

[a] yes but there was also growing complexity:

- (i) departmental under-spend
- (ii) poor oversight by HMT in terms of departmental budgetary accounting
- (iii) end of year funding was contested

→ departments end up gaming the system, which leads to greater unpredictability

[b] HMT's response was focused on

- (i) growth balance
- (ii) tax revenue (and GDP) are volatile → spending envelope

3. growth forecasts (whether by HMT and then checked by ONS or later by OBR) tend to be over-optimistic; as are tax revenue forecasts

=> structural deficit in 2004 because of big spending hike (2000-01 onwards) but tax revenue poorer

4. departmental under-spend:

- (i) personal fear (being hauled in front of Public Accounts Committee)
- (ii) poor at procurement
- (iii) frontline departments (e.g. local government and NHS) is much better at spending money than Whitehall departments

=> New Labour's preference for PPP and PFI

5. AME forecasts

=> the culture of HMT has adapted to 'well-known' uncertainty (Rumsfeld's known unknowns) but it is not good at stable medium-term fiscal management

6. what 'rules of thumb'?

- fiscal rules (Golden Rule and stable investment rule)

- AME

- growth

- forecasts for tax revenue

- pension expenditure fairly stable

- models within big spending departments are poor, e.g. DWP on disability or Defence

=> public sector pay and other big 'fixed costs' (that's why New Labour created monthly meetings of pay board)

=> rule of 'big numbers' as a result of asymmetry of information in favour of spending departments

7. there were 3 things New Labour should have done but did not do

(i) maximising transparency by creating the OBR in a context of

- high volatility

- low predictability

→ OBR would have been in line with the spirit of the 1997 fiscal rules in an open economy

(ii) 2/3 spending and 1/3 tax component of fiscal consolidation mix

→ one question is how quickly tax revenues would have rebounded

→ VAT increase instead of NICS (NOT advocated by other)

(iii) tone and presentation

- not enough reassurance of the markets
- split at the heart of government between PM and Chancellor

8. fiscal consolidation after 2010 General Election

- 90% spending cuts, 10% tax

- but investment declined and so did economic growth

- compounded by regional differences, a lack of investment contributed to the slowest recovery in 70 years or so

8. There was and is a fetish of big projects (roads, HS2 or now Heathrow) whereas a boost in house building is what was most needed, for example by raising the borrowing cap of certain councils across the country

9. reduce revenue spending and increase capital spending BUT NHS, schools and defence absorb vast resources, while BIS and local government spending were slashed

10. there were 2 errors:

- (i) over-optimistic growth forecasts
- (ii) over-optimistic expectations about tax revenue

III. former official at economic agency

1. in the period 1990-95, GDP estimates were higher than real GDP, but so were actual tax revenues (compared with projected ones)

→ spending was higher than initially anticipated, but still tight

→ over-optimism

2. fiscal policy should be asymmetric, deliberately cautious about projected GDP growth figures (audited by ONS until creation of OBR) because it is easier to manage better than expected growth and tax revenues than worse ones

3. monetary policy, by contrast, has a symmetric target: neither over- nor under-achievement of inflation target is desirable

4. built-in margins of errors

(i) cutting capital expenditure rather than current spending

(ii) back pockets should be significantly large to offset forecast errors

5. new spending pledges can drain back pockets, e.g. New Labour's NHS expenditure pledges in 2001-2

6. 'prudence for a purpose' (HMT officials versus political priorities)

7. composition of spending has changed

8. about RAB: it should have made a difference but came on stream too late (2010/11); capital charging (to spending departments)

9. PBR

- in principle 3-year horizon existed prior to 1997

- in practice, negotiations were on a year-by-year basis

→ HMT did little else than negotiate with departments

→ spending review freed up time for other things and for some more long-term planning

10. on capital spending, the overall composition of expenditure changed

(i) generally, government investment as a proportion of GDP: 3-4%

(ii) by 1997, this has declined to 0.6% and then rose to about 1.5%

(iii) 30-40% of public debt as a proportion of GDP was seen as acceptable

11. frontline spending

(i) public sector productivity was very flat

(ii) in the good years, less concern for productivity and value-for-money

12. fiscal consolidation after 2010

(i) in a context of flat-lining productivity but also historically low interest rates

(ii) local government spending slashed

(iii) some investment going up, e.g. Cross Rail and HS2

→ coalition government was frustrated by lack of capital investment in the private sector and long delays in getting public investment going

13. on tax

(i) tax revenue from VAT went down in the 1990s (against expectations)

(ii) HMRC has data but does not necessarily share it

IV. former official in HMT

1. over-optimism?

(i) not quite: there are built-in protections but politicians may not always take notice

(ii) OBR has marked a shift in forecasts and projections

(iii) Gold Rule and other fiscal rules

→ flexibility in relation to rules because uncertainty is a fact of life

2. greater continuity or discontinuity when there is a change in government?

(i) balance budgets over the economic cycle

(ii) long-term sustainability of public finances (government 'balance sheet')

(iii) degree to which fiscal policy should be used to manage the cycle

(iv) IMF views do not fundamentally change the analysis or action, but they act as important opinion-formers

3. unclear how different fiscal rules really are; HMT officials tend to give the same advice

4. 2-3 year horizon and 5-year spending reviews

(i) the latter made a big difference when it came to large new programmes, e.g. BIS catapult project or investment in transport, but depends on department

(ii) relative stability for 2-3 years, but greater uncertainty at the time of Autumn/Spring Statement and Budget Day, as well as change in government

(iii) there is some inertia in the system, because the largest blocks of spending (health, DWP and education) tend not to change fundamental because of political priorities/pressures

(iv) however, a change in government can lead to important shifts, e.g. tuition fees or HS2

5. changes in 2010

(i) structural: tighten the belts

(ii) political priorities and strategy: ideology vs. evidence

(iii) "by definition, there is no evidence about the future". In this sense, the term 'evidence-based policy risks being an oxymoron...

V. former special adviser

1. there are two levels of uncertainty: manageable uncertainty ('stuff happens') and dramatic uncertainty (near collapse of LTCM in 1998, dot.com bubble, 2008 financial crisis, Eurozone)

2. New Labour voluntarily downgraded the trend growth rate from 2.5 to 2.25%

3. The overall approach was based on a cautious case and with the intention of controlling the timing of the economic cycle

4. OBR-type arrangement was not on the agenda

5. the most difficult thing politically speaking is to cope with late, random and unexpected revisions, just before budget day

6. one way to try to reduce uncertainty is to manage expectations

7. big change after 1997 was to move towards performance management: delivery and outcomes, not just outputs

8. 2002 is when things got tougher

(i) better than expected in 1998 and 2000

(ii) 2000 was capital heavy

(iii) 2001-02: fiscal revenue from non-financial corporations was lower than predicted

(iv) when a possible gap of 5-10bn emerged (according to IFS), 2005 and 2006 tried to squeeze

9. among the events that exacerbated the UK's position after 2010 was the 2010 US budget situation and the second wave of the Eurozone crisis

VI. former official in HMT

1. the interviewee has experience on both the spending and tax side; she worked in HMT and in spending departments

2. Under Ken Clarke, there was a principle of a 3-year horizon but in reality 1 year instead, with yearly negotiations between HMT and spending departments

3. (lack of) central control vs (absence of) bottom-up flexibility
→ this led to a shift towards 3-year spending envelopes

4. if growth went down or social security spending (and other automatic stabilisers), then what?
(i) there was flexibility in relation to capital spending, which can be a problem for economic growth but 'good' for politics
→ this changed after 1997 and remained largely intact until 2010
(ii) the model was one of top-down target and defining total expenditure

5. in terms of forecasts of the state of the economy, these were done first by HMT and later by the OBR
→ the question was always about the Chancellor's judgement and the credibility of the numbers
→ process response to shocks: Chancellor Brown excised his judgement, but not Chancellors Osborne or Hammond
→ ONS and OBR do not do the same thing

6. fiscal rules matter but they do not have a very long duration; once again there are questions about the credibility of fiscal rules
(i) after 2010, fiscal rules and OBR were key to the planning and controlling of UK public expenditure
(ii) some inevitable gaming of the system
(iii) big decisions on tax and spend

7. When growth turned out to be more sluggish, George Osborne tried to put more money into investment, but there was a fiscal straight jacket: financial and economic probity compared with New Labour

8. it is not true that the shift to longer-term spending envelopes has led to more strategic, long-term planning of UK public expenditure; under Chancellor Hammond, for example, there are two fiscal events per year even though it is supposed to be a single unified budget

9. the OBR evaluation of forecasts matters