1. Checking out the supply side of the economy

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Summary

- Last year, we argued that the UK was likely to find that its productive capacity had been severely impaired by the financial crisis. Accordingly, we suspected that the (negative) output gap reached something like only 4% of productive capacity at its maximum, and averaged just over 3% during FY2009–10, as opposed to the official Treasury view of it averaging more than 6% at that time. We also argued that the potential growth rate of the economy in the years ahead was likely to be much slower than what the Treasury judged it would be, rising by close to 1¾% per annum by 2014 in our estimation, instead of the 2¾% that the Treasury had assumed in the December 2009 Pre-Budget Report.

- Although the Treasury stuck to its guns in the March 2010 Budget, the official view of the economy's supply side changed dramatically after the election. The new Office for Budget Responsibility (OBR) – charged with the preparation of macroeconomic and fiscal forecasts – revised down sharply the official view of both the output gap (to just over 4% of potential during FY2009–10) and potential growth (to just over 2%).

- Using a variety of methods, we estimate that the output gap is probably a little smaller than what the OBR is assuming. Our estimates seem to do a good job when employed to help explain why inflation turned out higher than many expected last year. We also believe that potential GDP growth is slightly lower than what the OBR has estimated it to be.

- Looking ahead, an updated forecast of our supply-side analysis suggests that productivity growth will only rise gradually in the years ahead, averaging about 1% per annum over the next five years. Accordingly, our predicted profile for potential GDP registers only a mild acceleration over the next few years, with the annual growth rate not reaching its long-run sustainable rate (of 1¾%) until 2014. We continue to worry that the official view of future prospects, as contained in the OBR's analysis, is overly complacent about both future inflation risks and the scale of the required fiscal consolidation. Relative to a year ago, however, the gaps between our own and the official forecasts are now a lot smaller.

1.1 Introduction

'Supply' has been *the* really big issue for economists to grapple with over the past year or two, for the simple reason that, although it is normally a pretty dull affair – with potential growth rates for developed economies only gradually shifting from year to year by one or two tenths of one per cent – of late, it has got very exciting: some have argued that the 'hit' from the financial crisis for an economy such as the UK could be of the order of 10% on the level of supply. Moreover, some have also suggested that there may have been a permanent hit to potential growth of 1 percentage point per annum.

Given this room for disagreement concerning supply, and given that we know fairly precisely what has happened to demand (with just a little room for disagreement given the likelihood of there being some (small) revisions to current estimates of national income), estimates of the amount of spare capacity in the economy – the 'output gap' – vary enormously between the optimists' and the pessimists' numbers. Why does that matter so much? First, because a 'big' output gap is likely to indicate a relatively 'small' hole in public finances in need of repair by recourse to spending cuts and tax rises, and vice versa: a 'small' output gap means a 'big' estimated structural budget deficit. Second, because the size of the output gap will determine how much employment and earnings can grow by before capacity constraints start to create inflationary pressures.

In this chapter, we first briefly review the varying official estimates of supply that have been published over the past year – and, given the change of government, two Budgets, one Spending Review and one Autumn Forecast, there have been a lot of them. This serves to highlight that the gap between our own view on aggregate supply and the official one has narrowed somewhat, but not to the point that it is no longer interesting or important (Section 1.2). In Section 1.3, we look at two alternative ways of attacking the question of how big the output gap is, both of which entail using survey data to help improve the quality of the estimation of the gap. We then turn to examine the outlook for growth in potential output (Section 1.4). Finally, we check on the usefulness of our 'best' estimates, by seeing if they help explain what has happened to inflation over the past year better than do the official ones. This exercise helps corroborate our findings that the amount of spare capacity is likely to be less than what the Office for Budget Responsibility (OBR) suggests it to be, and the economy's potential growth rate lower (Section 1.5). Section 1.6 concludes.

1.2 Recent estimates of 'supply'

In last year's Green Budget, we argued that the historical evidence suggested that the financial crisis was likely to have a more debilitating effect on the UK economy's ability to supply goods and services than the Treasury had suggested would happen, affecting not just the level of aggregate supply, or potential, but also its future growth rate.[1]

Surveying the literature, and carrying out a few new analyses using a long run of UK data, we surmised that the overall hit to the level of potential GDP might be of the order of 7½%. And our studies pointed to the long-run ('trend') growth rate having fallen from 2½% per annum pre-crisis to around 1¾% by 2015, or ¾ percentage points lower once the 'temporary' effects of the crisis have worked their way through the numbers. These figures compared with a 5% hit to potential GDP that the 2009 Pre-Budget Report had pencilled in, and no impact on potential growth going forwards: the Treasury reckoned that growth was likely to return to the 2¾% that its economists had opined as the economy's pre-crisis potential growth rate.[2]

These widely different estimates of potential GDP have implications for the output gap, and hence the level of the structural (or 'cyclically-adjusted') budget deficit, and, in so

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[1] See M. Dicks, 'The UK's productive capacity: surveying the damage', in R. Chote, C. Emmerson and J. Shaw (eds), *The IFS Green Budget: February 2010*, IFS Commentary 112 (http://www.ifs.org.uk/budgets/gb2010/10chap1.pdf).

[2] We use the adjective 'Treasury' to describe the official view although it is, of course, possible that the view of Treasury officials was different from that of their bosses. Perhaps it was really the 'Alistair Darling' view, for example. For simplicity, we will refer to the published view as being the 'Treasury' view hereafter.

doing, affect what might be termed the potential impact of potential GDP on public finances. Whereas the 2009 Pre-Budget Report had reckoned on an output gap of around 6½% of potential national income at the end of last financial year, our own estimates had it pencilled in at only about 3%.[3] Accordingly, where the Treasury gauged the FY2010–11 structural current budget deficit to be 5.4% of national income, our figures were more than 2 percentage points higher, at 7.6% of national income: this difference was important, as our estimates implied that a greater fiscal tightening would be required if the deficit was to be lowered substantially over the lifetime of the new government, regardless of who ended up in power after the soon-to-be-held general election.

Before the 2010 election actually took place, the Labour government presented its March 2010 Budget, in which it included, inter alia, a spirited defence of its assumptions regarding the hit to national income from the crisis, although admitting to its projections being 'subject to a significant degree of uncertainty'. Indeed, it not only reiterated its earlier analysis that the output gap exceeded 6% of potential national income by end-2009, but actually lowered slightly its gauge of the cyclically-adjusted current budget deficit in 2009–10 from 5.4% of national income to 4.8% (thanks largely to lower-than-expected out-turns).[4] Accordingly, the then Chancellor, Alistair Darling, chose not to make any radical departures from the previous planned fiscal tightening – sticking to the broad pace and scale of the 2009 Pre-Budget Report plans, which, if our estimate of the output gap was correct, would have probably been insufficient to restore public finances to probity. (The new measures, announced to run over the following three years, totalled less than £¾ billion – a rounding error compared with our projected 5.4% of GDP cyclically-adjusted current budget deficit for FY2014–15 – although as a pre-election Budget, it had the obvious merit of not increasing the size of the hole in the public finances any further.)

After the election, the new coalition government announced a big shift in the fiscal institutional structure with the formation of the Office for Budget Responsibility.[5] The aim of this body is to limit the room for political interference in the management of the state's public finances by giving it responsibility (previously held by the Chancellor) both for forecasting and for assessing the amount of spare capacity currently available. Thus, it will be responsible for ruling on such sensitive issues as the size of the structural budget deficit. The government retains, however, the responsibility for deciding on the appropriate fiscal rule and the policy changes to implement in the event of a fiscal tightening being necessary (or a fiscal loosening being possible).

As an interim measure, the OBR was set up under the chairmanship of Sir Alan Budd, who – with the help of two members of the Budget Responsibility Committee (Geoff Dicks and Graham Parker) – was charged with reviewing the aggregate supply potential of the economy, and spelling out the implications for the output gap and cyclically-adjusted budget deficit, using the existent Treasury team of economists. Given the latter's recent

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[3] These figures come from table 6.7 in R. Chote, R. Crawford, C. Emmerson and G. Tetlow, 'Green Budget public finance forecasts', in the February 2010 Green Budget (http://www.ifs.org.uk/budgets/gb2010/10chap6.pdf).

[4] The details of its reassessment of potential national income in the light of our analysis and the work done by the IMF and OECD on the subject were contained in annex B of HM Treasury, *Budget 2010: Securing the Recovery*, April 2010 (http://webarchive.nationalarchives.gov.uk/20100407010852/http://www.hm-treasury.gov.uk/budget2010_documents.htm). The implications for the state of the public finances were contained in chapter 2 of the same report.

[5] For details of the announcement, see http://www.hm-treasury.gov.uk/d/press_01_10.pdf. A discussion of the operation of the OBR, both in principle and in practice, can be found in Chapter 2.

adjudication on the subject in the March 2010 Budget, it might have been reasonable to expect little shift in the Treasury's assessment of the impact of the crisis on potential. In fact, a major move was made in the direction of what we had suggested was a reasonable interpretation of the facts, with the OBR's pre-Budget assessment (published the week before the new government's June 2010 Budget) resulting in three significant changes from the March Budget's assessment:

- The OBR reckoned that the output gap during FY2009–10 amounted to only about 4% of potential national income, quite a lot closer to what we had gauged it to be than to the Treasury's Budget assessment published in the spring (Figure 1.1).[6]

- The OBR gauged that the economy's potential growth rate was likely to run at just 2.1% between the first quarter of 2014 and the first quarter of 2016, i.e. rather less than the 2¾% per annum previously assumed by the Treasury to occur from the second half of 2010 onwards, but higher than the 1¾% that we had suggested it would be reasonable to expect.

- The OBR estimated that the cyclically-adjusted current budget deficit in FY2009–10 amounted to some 5.3% of national income (Figure 1.2). Again, the OBR assessment was between our own and the Treasury's assessments, although its estimates were rather closer to the Treasury's than to ours. The main reason for this is that the actual budget deficit on the current budget had turned out lower than seemed likely six months earlier. (On this measure, the deficit was around 7½% of GDP, or about ¾ of a per cent of GDP lower than we had predicted it to be in February.) In making its calculations, the OBR assumed that the impact of the cycle on public finances was much the same as what both we and the Treasury have assumed is the case.[7]

Given this more gloomy assessment, compared with that of his predecessor, the new Chancellor, George Osborne, had a justification to adopt a more aggressive fiscal tightening than his predecessor.[8] It was hardly surprising, therefore, that in the June 2010 Budget he added £32 billion a year to the previously planned £52 billion a year of spending cuts, along with an additional £8 billion a year of tax rises to go alongside the £21 billion a year inherited from the Labour government.

In late November, the OBR – now under the new chairman, Robert Chote (he, Stephen Nickell and Graham Parker now comprise the Budget Responsibility Committee) – reassessed its initial assessment, in the form of the Autumn Forecasts.[9] In that document, the OBR broadly concurred with Sir Alan's findings, with mere tweaks to the previous analysis, as shown in Figures 1.1 and 1.2. From the government's perspective, the resultant changes were too small to warrant adjusting the fiscal stance. In other words, the Treasury let it be known that this was not a 'fiscal event' (i.e. something that required
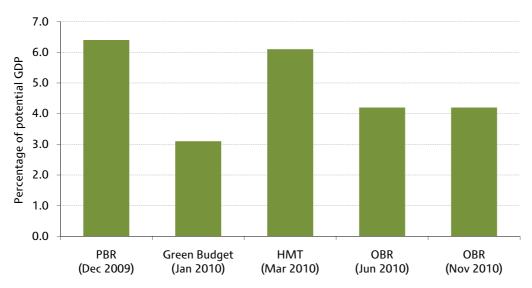
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[6] See, for example, chart 1.1 within the supplementary material released along with the OBR's June forecasts, available at http://budgetresponsibility.independent.gov.uk/d/junebudget_supplementary_material.pdf.

[7] A simple rule of thumb, to translate output gap estimates into impacts on the current budget balance, is to use a multiplier of around 0.5. (So, for example, an output gap of 4% of GDP should be responsible for just over 2 percentage points of the budget deficit (as a percentage of GDP).) The Treasury recommends also making allowance for lags, with an additional second-year multiplier of 0.2. For details, see HM Treasury, *Public Finances and the Cycle*, Treasury Economic Working Paper 5, November 2008 (http://webarchive.nationalarchives.gov.uk/20100407010852/http://www.hm-treasury.gov.uk/prebud_pbr08_publicfinances.htm).

[8] Of course, even without such a reassessment, he might have chosen to adopt a more forthright fiscal tightening. But the changes certainly made it easier to sell a more radical tightening.

[9] Office for Budget Responsibility, *Economic and Fiscal Outlook: November 2010* (http://budgetresponsibility.independent.gov.uk/econ-fiscal-outlook.html).
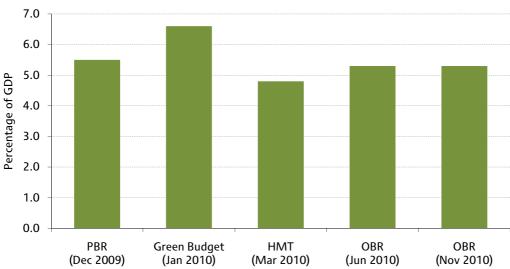
Figure 1.1. Evolving estimates of the size of the output gap in FY2009–10

Note: The output gap is negative; actual GDP is below potential GDP.
Sources: In order of bars in graph: HM Treasury, *Pre-Budget Report 2009*, December 2009 (http://webarchive.nationalarchives.gov.uk/20100407010852/http://www.hm-treasury.gov.uk/prebud_pbr09_index.htm); M. Dicks, 'The UK's productive capacity: surveying the damage', in R. Chote, C. Emmerson and J. Shaw (eds), *The IFS Green Budget: February 2010*, IFS Commentary 112 (http://www.ifs.org.uk/budgets/gb2010/10chap1.pdf); HM Treasury, *Budget 2010: Securing the Recovery*, March 2010 (http://webarchive.nationalarchives.gov.uk/20100407010852/http://www.hm-treasury.gov.uk/budget2010.htm); Office for Budget Responsibility, *Pre-Budget Forecast: June 2010* (http://budgetresponsibility.independent.gov.uk/d/pre_budget_forecast_140610.pdf); Office for Budget Responsibility, *Economic and Fiscal Outlook: November 2010* (http://budgetresponsibility.independent.gov.uk/econ-fiscal-outlook.html).

Figure 1.2. Evolving estimates of the cyclically-adjusted current budget deficit in FY2009–10

Sources: See Figure 1.1.

a policy shift). Accordingly, the new Chancellor noted the changes to the House of Commons, but did not lay out any tax or spending adjustments to go alongside them. Interestingly, however, the path for future government consumption, in volume terms, was raised by a cumulative 3 percentage points between 2011 and 2015 between the June and November OBR forecasts, of which half the shift up occurs this year and next. Most economists would, we suspect, define this as a significant shift in spending, but not, it would seem, the new government.

At first blush, Figure 1.2 makes our Green Budget analysis from last year stand out as the outlier. In fact, that is a rather rash judgement to draw. After all, between the March 2010 Budget and the subsequent OBR estimates there was a marked improvement in headline borrowing. This improvement almost cancelled out the deterioration in estimates due to the lowering of estimated trend/potential output. Figure 1.3, which shows the headline deficit estimates, helps make the point – showing a big drop in the headline (actual) current budget estimates taking place between the spring and early summer.

Figure 1.3. Evolving estimates of the headline current budget deficit in FY2009–10

Sources: See Figure 1.1.

So, what do we conclude from all this? Is there broad agreement over the hit to the economy's supply capacity, and even of the resultant structural budget deficit once allowance has been made for recent public finances data, and therefore on the implied scale of fiscal effort on the part of the authorities to deal with it? The answer to these interlinked questions seems to be a firm 'no', and for two reasons.

The first, and more fundamental, reason is that our and the OBR's figures are by no means identical: for example, there was a near 1 percentage point discrepancy in estimates of the scale of the output gap at end-2009, which would warrant a significant further adjustment to the planned fiscal tightening (of the order of 0.7% of national income, or roughly £10 billion), if our estimates turn out to be more accurate than the OBR's.

The second reason concerns whether – even if the OBR's estimate of the output gap, and of the resultant structural deficit, is accurate – the path down which the new government intends to tread is actually the right one or not. Might, for example, a front-loaded fiscal tightening that begins in 2010–11 when the recovery is in its infancy not just depress demand by more than the OBR assumes (and affect the output gap by lowering aggregate

demand relative to aggregate supply) but perhaps also lead to greater hits to supply as a consequence? (One route by which this might come about is if 'cyclical' unemployment becomes 'structural', say because those without work find that their skill levels deteriorate, turning them from being unemployed to almost unemployable – a process known as hysteresis.[10]) Indeed, if there is a perception that there is no 'Plan B', might such a tightening even lead to a further bout of downward pressure on sterling, fears concerning the sustainability of public finances and a possible downgrade of the UK's triple-A rating – and perhaps too a significant worsening of the growth-inflation trade-off?

In the rest of this chapter, we start by re-examining the first of these issues, by looking at alternative means of gauging the amount of spare capacity to see whether or not we can corroborate our own previous assessment of the scale of the hit to potential GDP from the crisis and the current scale of the output gap. Later, in Chapter 4, we consider the second issue, by examining how much current planned fiscal tightening might depress demand, and thereby perhaps also influence supply.

How the OBR attempts to gauge the 'output gap'

In the latest publication from the OBR – its *Economic and Fiscal Outlook* (or Autumn Forecasts in the parlance of the new government) – chapter 3 goes to some lengths to explain how the OBR attempts to gauge the output gap, as well as providing a robustness analysis. Basically, it effectively uses three different approaches to see how much spare capacity there is in the economy:

- Considering what other forecasters – such as the OECD, IMF, European Commission (EC) and National Institute of Economic and Social Research (NIESR) – are saying about how big the output gap is. (Researchers at these institutions all use production functions to gauge the amount of slack in the economy.)

- Using surveys to gauge both the level of capacity utilisation and the scale of recruitment difficulties, and then weight them accordingly (using as a basis for doing so the labour and profit shares of national income).

- Using principal components analysis to identify the common (cyclical) trend in a set of indicators, including survey-based measures of capacity.
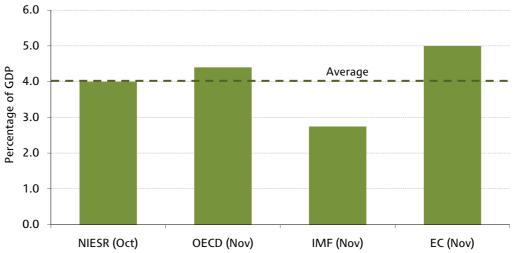
From these three different approaches, the OBR gauged that the output gap at the second quarter of 2010 was some 3¼% of potential national output, compared with the 4.2% of potential GDP that it estimated for 2009.

Taking the first of these approaches, Figure 1.4 shows the latest estimates of the 2010 output gap from the four external research teams cited by the OBR, along with their average. These estimates are similar to those that the OBR gathered together back in November, with the one significant change being the latest set of estimates from the EC. The EC, perhaps a little surprisingly when other bodies have been lowering their estimates over the past year, has decided to raise its estimate of the output gap, from about 4% of potential GDP to about 5%. Including the 5% figure, the average of the four external forecast groups' 2010 output gap estimates turns out at just over 4% of GDP, or

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[10] This thesis was first laid out by Olivier Blanchard and Lawrence Summers; for details, see 'Hysteresis and the European unemployment problem', in the National Bureau of Economic Research's *Macroeconomics Annual*, 1986.

smack on where the OBR chooses to put its own estimate. If one chooses to exclude the EC estimate, on the basis that it seems not only high compared with what it estimated back in the spring but to be bucking the trend, the average drops to 3.7%, suggesting perhaps a little downside risk to the OBR figure.

Figure 1.4. Comparing outside forecasters' assessments of the size of the 2010 output gap

Note: The OECD, IMF and EC all make their estimates available on their websites a month or so after publication of their new forecasts.
Sources: NIESR – *National Institute Economic Review*, October 2010 edition (for details, see http://ner.sagepub.com./); OECD – *OECD Economic Outlook*, December 2010 edition (for details, see http://www.oecd-ilibrary.org/economics/oecd-economic-outlook_16097408); IMF – *World Economic Outlook*, October 2010 edition (for details, see http://www.imf.org/external/pubs/ft/weo/2010/02/index.htm); EC – *European Economic Forecast: Autumn 2010* (for details, see http://ec.europa.eu/economy_finance/eu/forecasts/2010_autumn_forecast_en.htm).

Where our view differs from the OBR's

With the exception of some recent IMF research – which resulted in estimates of the output gap varying from 2% to 4% of potential national income – other external research teams use production-function-based approaches to infer how much spare capacity there is in the economy.[11] In last year's edition of the Green Budget, we also followed this (traditional) approach, i.e. using a production function to gauge potential GDP (or 'aggregate supply') and then calculating the output gap as the difference between actual GDP (or 'aggregate demand') and potential GDP as a percentage of the latter. (See Box 1.1.) To do this, however, requires one to make explicit assumptions regarding the hit to potential from the financial crisis (if any), with this hit coming via both impacts on the inputs to the production process (such as capital and labour) and to total factor productivity (TFP, i.e. the efficiency with which factor inputs are combined to produce value added).

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[11] For details of the IMF's new work, see 'Estimating the UK's output gap', in *UK: Selected Issues Paper*, Country Report 10/337, November 2010 (http://www.imf.org/external/pubs/ft/scr/2010/cr10337.pdf). Note that the estimate shown in Figure 1.4 comes from the IMF's World Economic Outlook database. For details of that estimate, see http://www.imf.org/external/pubs/ft/weo/2010/02/weodata/index.aspx.

Box 1.1. A production-function approach to estimation of potential GDP

A production-function approach to estimating potential GDP basically entails first regressing real GDP against measures of factor inputs (such as employment/total hours worked and the capital stock) in order to create a proxy for so-called total factor productivity (TFP), which is measured by the residuals from the model and acts as a gauge of the efficiency with which inputs are combined in order to produce value added (or 'output').

Once TFP has been gauged, it is possible to scale up actual employment to create a gauge of 'full employment' (say, by assuming that all unemployed workers might feasibly be as productive as currently employed ones if they had jobs), and then combine this with the capital stock data and the TFP estimates so as to produce a measure of aggregate supply, or potential GDP. This process is explained in some detail in last year's Green Budget.[a] The bottom line is that we use an equation of the following form to model potential GDP growth:

$$\Delta\log(YPOT) = \alpha \times [\Delta\log(TFPT) + \Delta\log(POWAT) + \Delta\log(LFPRT) + \Delta\log(1{-}NAWRU) + \Delta\log(HOURST)] + (1{-}\alpha) \times \Delta\log(K)$$

where the Δ term refers to the one-period (in our case, annual) rate of change of a variable.

The left-hand side of the equation is simply the annual growth rate of potential GDP (YPOT), with the right-hand-side terms providing a means of calculating contributions from the six variables that help determine it. These six are: total factor productivity (TFP), the population of working age (POWA), the labour force participation rate (LFPR), the non-accelerating wage rate of unemployment (NAWRU), the average hours worked per worker (HOURS), and the capital stock (K). The 'T' at the end of some variable acronyms on the right-hand side of the equation refers to the fact that we use trend measures of each of the driving variables.

a. See box 1.1 of M. Dicks, 'The UK's productive capacity: surveying the damage', in the February 2010 Green Budget (http://www.ifs.org.uk/budgets/gb2010/10chap1.pdf).

To help justify the adjustments that we made to the raw data as a 'guess-estimate' of the effects of the crisis, we looked at studies carried out by the OECD and the IMF that had used past crises to help ascertain what the impacts of past financial crises had been on various economies. Not surprisingly, the range of impacts was wide, implying that any such 'judgement-based' analyses should be treated with a large pinch of salt. For that reason, as well as updating last year's analysis, we believe that it is important to consider alternative approaches to gauging aggregate supply.
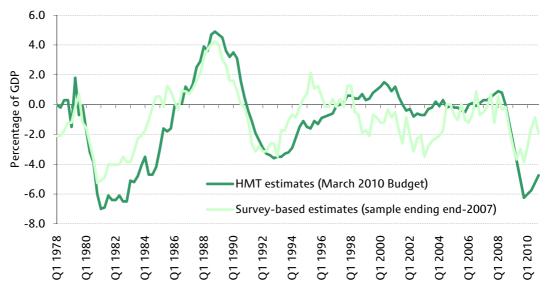
1.3 Using survey data to gauge 'supply'

In order to update last year's analysis, this year we start with a similar approach to the one that the OBR has adopted, by looking at the various survey measures compiled by the likes of the Confederation of British Industry (CBI), the British Chambers of Commerce (BCC), the Bank of England's agents (BoE), the European Commission's version of the CBI

survey[12] and a number of Grant Thornton sectoral series related to the willingness to boost investment spending in order to expand capacity. But rather than simply look for common trends in the survey data – as the OBR chooses to do – we take a different approach.[13]

First, we examined pre-crisis data to see if we could find a weighted average of the survey measures that provided a good fit to either production-function-based or filter-based estimates of the output gap.[14] Using the best such equations that we could find – which turn out to do a fairly good job in corroborating the traditional approach to gauging output gaps – we then 'ran the models forward', using data that cover both the financial crisis and the post-crisis period, to see what the models suggest has happened to the output gap over the past three years, given the survey data that have been collected over

Figure 1.5. Using survey-based measures to explain past Treasury estimates of the output gap and to provide estimates of the output gap since 2007

Notes: The HMT estimates come from last spring's Budget. The survey-based estimates come from our attempt to explain this series, using as explanatory variables a number of business survey series, and a sample that ended pre-crisis (in 2007).
Sources: Barclays Economics Research and HM Treasury, *Budget 2010: Securing the Recovery*, March 2010 (http://webarchive.nationalarchives.gov.uk/20100407010852/http://www.hm-treasury.gov.uk/budget2010.htm).
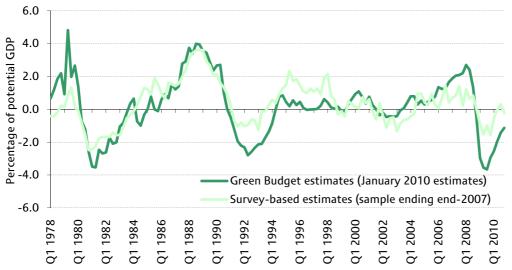
[12] The European Commission attempts to make the business survey results more easily comparable across countries by re-weighting some of the raw series responses that it receives from individual country data and by using its own seasonal adjustment processes to adjust the raw data. For the UK, it takes the raw data from the CBI surveys for the manufacturing sector. For further details of the EC's harmonisation efforts, see http://ec.europa.eu/economy_finance/db_indicators/surveys/index_en.htm.

[13] Note that we have not investigated a purely statistical approach to gauging output gaps, such as the principal components approach that the OBR used. However, a recent attempt by some IMF researchers to use a multivariate filter to measure potential output concluded – like our work – that the UK's output gap was probably only about 2% of potential GDP in mid-2010. For details, see J. Benes, K. Clinton, R. Garcia-Saltos, M. Johnson, D. Laxton, P. Manchev and T. Matheson, 'Estimating potential output with a multivariate filter', IMF Working Paper 10/285, 2010 (http://www.imf.org/external/pubs/ft/wp/2010/wp10285.pdf).

[14] Given that there was a strong consensus about the scale of the output gap pre-crisis – i.e. that it was small – it actually turns out to make little difference which set of output-gap estimates we use as the dependent variable in this exercise. So, we actually tried using both approaches, and checked for the robustness of our findings by using both the March Budget (Treasury) production-function-based output gap estimates and those that we published in last year's Green Budget as the dependent variables when building survey-based models of the output gap. The filter that we used to gauge potential GDP was the Hodrick–Prescott filter. For further details, see http://en.wikipedia.org/wiki/Hodrick-Prescott_filter.

that time. Interestingly, when using the Treasury estimates of the output gap as the dependent variable, as shown in Figure 1.5, this approach suggests that the output gap at the end of 2009 was more or less spot on what our judgement-aided production-function-based approach had suggested it was at that time (as published in last year's Green Budget). Running the model forward, through 2010, the survey-based model suggests that the output gap shrank to under 2% of potential GDP by end-year.
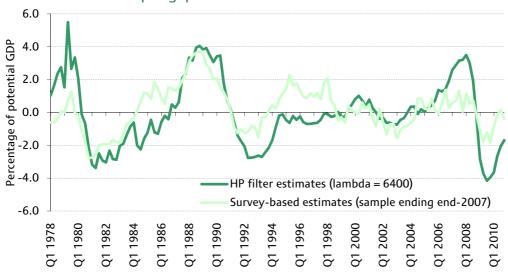
Figure 1.6. Using survey-based measures to explain our own 'old' production-function-based estimates of the output gap and to provide estimates of the output gap since 2007

Notes: The 'old' production-function-based output gap estimates are those that we published in last year's Green Budget. The survey-based estimates are the fitted values to that series, using a sample that ends in 2007, and using a number of business survey measures as explanatory variables.
Source: Barclays Economics Research.

Figure 1.7. Using survey-based measures to explain changes in a Hodrick–Prescott filter-based set of estimates of the output gap and to provide estimates of the output gap since 2007

Notes: The HP filter output gap estimates are based on a Hodrick–Prescott filter applied to actual GDP. Again, the survey-based estimates are the fitted values to that series, using a sample that ends in 2007, and using a number of business survey measures as explanatory variables.
Source: Barclays Economics Research.

When we use either our own estimates of the output gap (published in last year's Green Budget) as the dependent variable, or a filter-based series – as shown in Figures 1.6 and 1.7 respectively – we find a slightly more scary result, with both of the new survey-based models reckoning that the output gap was smaller than what we gauged it to be a year ago. At end-2009, for example, the two specifications point to a gap between aggregate demand and aggregate supply of only between 1½ and 2% of supply. Running the models forward, both suggest that the output gap has already effectively closed fully. This contrasts sharply with the OBR's assessment that the output gap was around 3¼% in the second quarter of last year.

Using both surveys *and* a production function

One potential problem with the approach set out in the previous subsection, as highlighted a few months ago by the IMF in its *Selected Issues Paper* on the United Kingdom,[15] is that, when asked about their operating rates or capacity utilisation, survey respondents may simply be thinking of how much output they could produce if they fully utilised existing capital, i.e. what might be called an only 'short-run' definition of an economy's supply capacity. As a result, the IMF's researchers suggest adjusting the methodology used to gauge TFP by allowing for the possibility that survey-based measures of capacity utilisation provide a better way of adjusting raw TFP for the economic cycle than simply passing them through a filter.[16]

From a practical perspective, the IMF found that TFP measures based on 'adjusted' TFP still showed a marked slowdown from late 2007, resulting in an output gap measure that is smaller than what a standard production-function-based approach – such as that used by the OECD – suggests was the case, but larger than that gauged when using a Hodrick–Prescott filter (or, for that matter, from a simple survey-based approach such as that we have just illustrated). For example, in the second quarter of 2010, the IMF estimated the output gap to be nearly 4% of GDP using this new approach, compared with its maximum value (in late 2009) of about 5%. The OECD's 'raw' production-function-based measure in the second quarter of 2010, by contrast, was a rather bigger 6.3% of GDP.

One potential – but, it turns out, quite important – problem with the IMF's approach is that it has used a manufacturing-based estimate of capacity utilisation (based on the European Commission's version of the CBI manufacturing survey results), whereas fluctuations in the aggregate economy's capital stock may well vary rather less than for this (very cyclical) sector. In services, for example, production processes are likely to be

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[15] 'Estimating the UK's output gap', in *UK: Selected Issues Paper*, Country Report 10/337, November 2010 (http://www.imf.org/external/pubs/ft/scr/2010/cr10337.pdf).

[16] In other words, rather than estimate TFP using a traditional decomposition of the form set out in Box 1.1, the IMF staff propose adjusting the key equation to take account of time-varying capacity utilisation. This basically involves adjusting the final term such that the measure of capital (K) is interacted with a measure of capacity utilisation (based on survey data). This result is an adjusted TFP measure (which is hopefully purged of the business-cycle-related variation in capacity utilisation). Or, more formally, rather than estimate TFP using a traditional ('Solow') decomposition of the form

$$\ln(Y) = \alpha \times \ln(POWA \times PR \times (1 - UR) \times H) + (1 - \alpha) \times \ln(K) + \varepsilon \qquad (1)$$

where ln stands for the natural logarithm, Y is output, POWA is the population of working age, PR is the participation rate, UR is the unemployment rate, H is average hours worked per worker and K is the capital stock, and with α being the labour share of income and ε the residual – i.e. the proxy for TFP – the IMF staff propose adjusting (1) to take account of time-varying capacity utilisation, using the formula

$$\ln(Y) = \alpha \times \ln(POWA \times PR \times (1 - UR) \times H) + (1 - \alpha) \times \ln(CU \times K) + \varepsilon^* \qquad (2)$$

where CU is capacity utilisation (based on survey data) and ε^* stands for the adjusted TFP measure (which is hopefully purged of the business-cycle-related variation in capacity utilisation).

Figure 1.8. Utilisation rates in manufacturing

Source: Confederation of British Industry.

Figure 1.9. Utilisation rates in services (proxied pre-1989)

Note: Prior to 1989, the utilisation rate for services has been proxied on the basis of movements in the manufacturing sector's utilisation rate.
Sources: Confederation of British Industry; British Chambers of Commerce; Barclays Economics Research.

rather more labour intensive, and the cyclical variation in output (in terms of the amplitude of the peak-to-trough shifts in output) is probably somewhat less than for manufacturers. Accordingly, the IMF's approach seems to bias its analysis.

In order to check for this possibility, we tried using a weighted average of manufacturing and services measures of capacity when adjusting the capital stock, and thus created our own (new) gauge of 'adjusted' TFP. First, however, we had to create a proxy series for the services component for the period prior to 1990, as survey data on this sector are only available since that time.[17] Figures 1.8 and 1.9 show the component series, including the inferred (proxy) services values for the 1970s and 1980s.

[17] To do this, we regressed the services component against the manufacturing one for the (overlap) period (starting in 1989 and ending in 2010), i.e. that period over which both series have been published. Then, using

Using this 'amended-IMF' approach to gauge 'adjusted' TFP, we are able to produce a new set of IMF-style potential GDP estimates. Comparing these with actual GDP, we find that the resultant output gap series is estimated to have been close to 4% of potential national income at its maximum during the recent recession – in the third quarter of 2009 – but to have dropped in size to around 2% of potential national income by the end of last year (Figure 1.10).[18] In the second quarter of 2010, our IMF-style output gap was estimated to be around 2¾% of potential GDP, or more than a full percentage point smaller than the IMF's estimate for this quarter. In other words, the bias that results from using just manufacturing data, as the IMF did, appears to be considerable, and failing to adjust for this factor seems to result in a significant overestimate of the amount of spare capacity that is available in the economy today.
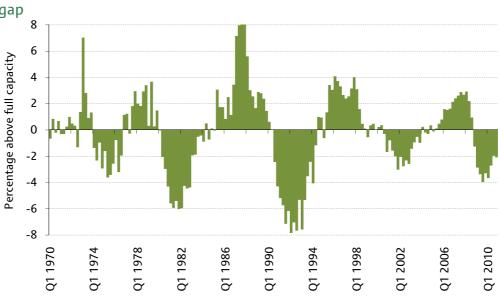
Figure 1.10. An IMF-style 'adjusted-TFP-based' measure of the output gap

Notes: The approach that we adopt here is similar in spirit to that used by some IMF researchers in a *Selected Issues Paper*. The main text provides further details.
Sources: For the IMF paper, see http://www.imf.org/external/pubs/ft/scr/2010/cr10337.pdf. The estimates shown in the chart have been made by Barclays Economics Research.

When it comes to the rate of potential GDP growth, the new survey-adjusted production function suggests there were two years during which aggregate supply only expanded by a little over ¼% per annum (i.e. 2008 and 2009), followed by a year in which potential growth picked up to about 1%. Looking ahead, it – like our analysis last year – predicts potential GDP growth of around 1¾% per annum.

It is important to recognise, however, that this assessment is sensitive to what one assumes will happen to 'trend' TFP going ahead and/or what will happen to 'trend' capacity utilisation. We assume both change little from their current values. But we could easily be wrong. For example, as Figure 1.11 makes clear, the trend in TFP has been downward for some time, and it is certainly possible that this trend persists, which would

this regression, we were able to back out proxy values for the services capacity utilisation series for the period 1970 to 1988, i.e. for the years prior to the series being available. We were then able to create a weighted average of the manufacturing and services utilisation rates to create a whole economy proxy, using weights of two-thirds and one-third, reflecting their broad shares in overall economic activity.

[18] Interestingly, this gauge of the output gap suggests that the recession of the early 1990s actually saw a rather bigger output gap open up than did the recent recession. If so, then the supply hit from the financial crisis must have been *very* big.

drag potential GDP growth below our central estimate. On the other hand, actual TFP has actually bounced back smartly of late – as Figure 1.11 illustrates – and this could mark the beginnings of a trend towards higher TFP, and a more optimistic assessment of potential GDP in the future. We have tried to steer a middle course through these opposing views. Given, however, that our proxy is based on the residuals from a regression – and thus represents an explicit measure of what we *don't* know about moves in supply – we should accept that any forecast for TFP ought to have wide error bands. In other words, we should have little conviction in any point forecast, and wide confidence levels around *all* such predictions.

Figure 1.11. Total factor productivity

Notes: TFP residuals are calculated by regressing actual GDP against measures of capital and labour. They therefore provide a gauge of the efficiency with which inputs are combined to produce value added. For further details, see the main text.
Source: Barclays Economics Research.

Figure 1.12. Actual and trend capacity utilisation rates

Notes: The utilisation rate shown here is a whole-economy measure, comprising a weighted average of the two series, for manufacturing and services, graphed earlier (in Figures 1.8 and 1.9). Trend values have been calculated using a Hodrick–Prescott filter.
Sources: Confederation of British Industry; British Chambers of Commerce; Barclays Economics Research.

Much the same sort of remarks can be made about the trend in capacity utilisation, shown in Figure 1.12. Again, a sharp drop in utilisation rates has been followed by a bounce back which could, reasonably, be seen as a process that takes the percentage of firms operating at full capacity back to the sorts of levels that were common before the crisis. Were that to happen, then the trend in utilisation would gradually recover, as indeed we assume it will. However, it might be the case that the role of financing has shifted, with, say, firms choosing to maintain bigger buffers against fluctuations in demand by operating at less than full potential (say because the cost of finance turns out to be permanently higher post-crisis). Certainly there have occasionally been long periods in the past, such as the 1970s, when utilisation rates trended lower and lower. So, again, it seems reasonable to think that there are significant downside risks to our central trend-rising projection.

1.4 How we expect potential GDP to evolve

All in all, we remain convinced that the survey-based approaches and the survey-augmented production-function approaches confirm our basic thesis – that the OBR is probably being a little optimistic about the degree of spare capacity. (We judge that the output gap was close to 2% of potential GDP in the third quarter of 2010, whereas the OBR reckoned on it being around 3%.) We have less conviction in our view that potential growth in the years ahead will be lower than what it is assuming. (We judge that aggregate supply will expand at an annual rate of near to 1¾% rather than the 2.35% that the OBR is pencilling in for the period up to the end of 2013, and 2.1% thereafter.) Our lower conviction on this view reflects the fact that there are a lot more moving parts to the forecast of potential growth, as well as an inherent difficulty of disentangling the contributions to past fluctuations when the best that one can hope to do with any attribution analysis is end up with an estimated output gap that helps explain some other variable – such as inflation (which is something that we attempt in Section 1.5).

Below, we detail our best guesses of how potential GDP will evolve going ahead, using the same basic building blocks that we did last year. Table 1.1 shows how the various contributions to what might be termed 'potential labour' are expected to evolve, along with some charts showing the extent to which fluctuations in the main drivers are due to cyclical and trend changes, with the partitioning between the two carried out using statistical filters (Figures 1.13 through 1.16). The estimated contribution of labour to aggregate supply has shifted a little from what we showed last year. (The latest estimates of the population of working age reveal that the number of people in this category expanded a little faster in recent years than previous estimates suggested had happened, but our calculations suggest that this was broadly offset by a small upward revision to our estimate of the NAWRU, or non-accelerating wage rate of unemployment.[19]) All in all, though, it still seems that the contribution that labour was providing to potential GDP growth a decade ago, of about ½% per annum, has now become a small drag. And it looks likely to stay that way for a while yet.

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[19] This is the rate of unemployment consistent with a constant growth rate of wages. When actual unemployment is higher than the NAWRU, wages decelerate. When it is lower, they accelerate.

Table 1.1. The contribution of labour inputs to UK potential GDP growth (percentage points)

Factors:	Participation rate	Population of working age	Employment (NAWRU)	Hours worked	Total
1971–2009	0.0	0.5	–0.1	–0.3	0.2
1996–2009	0.1	0.6	0.1	–0.3	0.5
2001–2009	0.1	0.8	–0.1	–0.3	0.3
2001	0.1	0.6	0.4	–0.5	0.6
2002	0.2	0.7	0.2	–0.5	0.6
2003	0.2	0.7	0.1	–0.4	0.6
2004	0.1	0.8	0.0	–0.3	0.6
2005	0.1	0.8	–0.2	–0.2	0.5
2006	0.1	0.8	–0.3	–0.2	0.4
2007	0.0	0.8	–0.4	–0.3	0.2
2008	–0.1	0.8	–0.5	–0.3	–0.1
2009	–0.1	0.8	–0.5	–0.4	–0.3
Forecasts					
2010	–0.2	0.7	–0.5	–0.4	–0.4
2011	–0.2	0.7	–0.4	–0.4	–0.4
2012	–0.2	0.6	–0.3	–0.4	–0.2
2013	–0.1	0.6	–0.2	–0.3	–0.1
2014	–0.1	0.5	–0.1	–0.3	0.1
2015	0.0	0.5	0.0	–0.3	0.2
2016	0.0	0.4	0.0	–0.3	0.2

Note: The trend rates of the underlying components from the production function are calculated using an HP filter, which aims to decompose output into a permanent ('trend') component and a cyclical factor.
Source: Barclays Wealth Research estimates.

Figure 1.13. The participation rate

Note: Trend values have been calculated using a Hodrick–Prescott filter.
Sources: Office for National Statistics; Barclays Economics Research.

Figure 1.14. The population of working age

Note: Trend values have been calculated using a Hodrick–Prescott filter.
Sources: Office for National Statistics; Barclays Economics Research.

Figure 1.15. The unemployment rate

Note: Trend values have been calculated using a Hodrick–Prescott filter.
Sources: Office for National Statistics; Barclays Economics Research.

Figure 1.16. Average weekly hours

Note: Trend values have been calculated using a Hodrick–Prescott filter.
Sources: Office for National Statistics; Barclays Economics Research

Table 1.2. The contribution of labour, capital and total factor productivity to UK potential GDP growth (percentage points)

Factors:	Capital deepening	TFP growth	Total contribution from labour variables and population (from Table 1.1)	Overall potential GDP growth from sum of filtered contributions	Actual or forecast GDP growth
1971–2009	0.9	1.3	0.1	2.2	2.2
1996–2009	1.0	1.2	0.3	2.5	2.2
2001–2009	0.8	1.0	0.2	2.0	1.5
2001	1.4	1.3	0.4	3.1	2.5
2002	1.1	1.2	0.4	2.7	2.1
2003	0.9	1.2	0.4	2.5	2.8
2004	0.8	1.1	0.4	2.3	3.0
2005	0.8	1.1	0.4	2.2	2.2
2006	0.8	1.0	0.3	2.0	2.9
2007	0.9	0.8	0.1	1.8	2.7
2008	0.5	0.7	–0.1	1.1	–0.1
2009	–0.2	0.7	–0.2	0.3	–4.9
Forecasts					
2010	–0.3	0.8	–0.3	0.2	1.4
2011	0.1	0.8	–0.2	0.7	1.8
2012	0.5	0.9	–0.2	1.2	2.1
2013	0.7	0.9	–0.1	1.6	2.2
2014	0.9	0.9	0.0	1.9	2.3
2015	1.1	0.9	0.1	2.1	2.5
2016	1.2	0.9	0.2	2.2	2.4

Note: The trend rates of the underlying components from the production function are calculated using an HP filter, which aims to decompose output into a permanent ('trend') component and a cyclical factor.

Table 1.2 combines the contribution of labour to potential growth with that from capital and total factor productivity (TFP). Rather than use the IMF-style survey-based measures of capacity utilisation to measure the effective capital stock, we repeated the approach that we employed last year, basing the input from capital on the Office for National Statistics' estimates of the services provided by capital. Accordingly, the numbers in Table 1.2 are very similar to those we produced a year ago.

1.5 Are output gaps actually useful?

Having convinced ourselves that the output gap analysis that we carried out last year seems to be broadly on track, we provide one last (but very important) check on its usefulness: we assess whether our output gap measure helps explain, in statistical terms, inflation. After all, if our pressure-of-demand gauge (i.e. the output gap) really is accurate, then it ought to help tell us when price pressures are building or stable or decreasing, even though it will be important to take account of other factors that also might influence inflation, such as the level of commodity prices, the value of sterling and tax rates.

The Treasury has clearly been concerned about the same issue and published a Working Paper on the subject in the spring of this year.[20] The authors concluded that 'the level of the output gap has an important role in explaining inflation', with this result being 'robust across a range of output gap measures and for the all items CPI, goods CPI and services CPI'. Using their preferred model specification, based on their assessment that the output gap was in line with the official Treasury assessment made at the time of the Spring Budget and using Treasury projections for the main inputs to the model (such as input prices and known past shifts in VAT rates), the researchers produced an inflation forecast that was very benign, with price pressures set to gradually diminish during 2010 (to result in an annual rate of CPI inflation of a little under 2% by year-end) and with inflation set to remain close to the Bank of England's target right through 2011 and 2012.

Of course, this projection was based on a gauge of the output gap that suggested that there was a huge amount of spare capacity at the trough of the recession: more than 6% of potential output. Thus, it is hardly surprising that the Treasury Working Paper concluded that 'there is likely to be sustained disinflationary pressure over the next few years that can be attributed to a persistent negative output gap'. In reality, inflation has been rather higher than the Treasury predicted, with the targeted (CPI) rate having turned out to be rather more 'sticky' than expected, averaging the year at slightly above 3% and ending it at 3.7%.[21] Worse still, the average of independent forecasts today is that CPI inflation will average 3.3% in 2011, implying that they have limited faith in the Treasury's assessment that output-gap-induced disinflationary pressures will prove to be powerful. Naturally, given these developments, it is worth asking what went wrong. Might it be that the Treasury is using an inaccurate gauge of spare capacity? Or is some other driving factor of inflation turning out different from what it expected? Or has the model just broken down in some way?

In order to help answer these questions, we first tried replicating the preferred specification that the Treasury economists came up with (equation 2 in table B.1 of their Working Paper). Using the same set of inflation drivers, we could straightforwardly estimate a near-identical model to theirs.[22] In running the model forward, so as to see how it performed during 2010, we discovered that the model under-predicted price pressures all year, and by a large amount. For 2010 as a whole, the average error looks to have amounted to some 1¾ percentage points, with the model reckoning on the CPI having risen about 1½% compared with its average level in 2009, but reality having delivered an average inflation rate this year of 3.3%.

The main reason why the model did poorly was two large residuals in a row, at the end of 2009 and the start of 2010. The first of these was nearly two standard errors in size – the sort of thing that has to be expected about once in every five years. In the following quarter, however, the equation not only under-predicted price pressures again, but this

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[20] For details, see A. Dwyer, K. Lam and A. Gurney, *Inflation and the Output Gap in the UK*, Treasury Economic Working Paper 6, 2010 (http://www.hm-treasury.gov.uk/d/inflation_output_gap_uk.pdf).

[21] The Bank of England's record in forecasting has been no better. In its November 2009 *Inflation Report*, for example, it argued that 'persistent spare capacity' would result in inflation dropping back to its 2% target by mid-2010. Its February 2010 projections were almost as sanguine.

[22] The only issues we came across were whether or not to include an additional dummy variable, to capture the one-off inflationary impact of the ERM crisis, and what lag structure to use when modelling the impact of VAT changes on the CPI. As regards the former, the t-value obtained on the relevant dummy variable was a massive 5.8. So, excluding it results in significant bias of some of the estimated coefficients pertaining to other explanatory variables. As regards the VAT effects, we discovered that the model fitted better if we permitted the VAT effects to come through with a one-quarter lag. Details are available on request.

time by 4.7% (at an annual rate), which is more than three standard errors in scale. Thereafter, the model got broadly back on track again. But these two successive errors meant that the 2010 full-year forecast error of at least 1 percentage point was more or less set in stone.

Re-estimating the Treasury model but incorporating our own gauge of the output gap in it – which obviously entails using a model that assumes that there was a much smaller amount of spare capacity throughout the past several years – helps to deal with the under-prediction problem to a degree. It is not a perfect solution to the issue, however. One reason why is that the re-estimated model does not provide a full explanation for the big forecasting error at the start of 2010. We therefore experimented with letting VAT effects work their way through over two quarters, instead of instantly (as in the Treasury model) and also using a dummy variable to permit a one-off (downward) 'crisis' effect to come through on prices in the fourth quarter of 2008.[23] Once these two slight shifts are made to the model's specification, we find the resultant equation does a pretty good job in tracking the quarter-on-quarter changes in the CPI, as shown in Figure 1.17.[24] The residuals of the equation have been a little bit bigger than normal in recent years, as one might expect, but there is nothing dramatic about the shift. So, on most reasonable grounds, it appears that there is compelling evidence to suggest that a model with a small output gap does a somewhat better job at explaining recent events, in the CPI space, than one that incorporates a big one.[25]
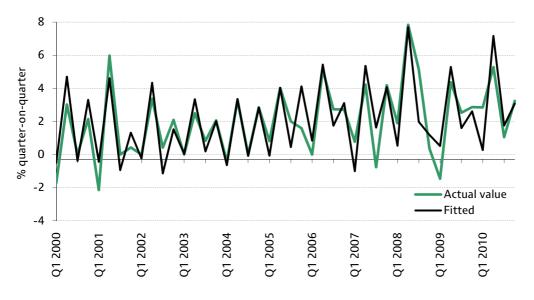
Figure 1.17. Recent actual and fitted values for our model of inflation

Notes: These data are not seasonally adjusted. The model used to explain past changes in the CPI is discussed in the main text.
Sources: Office for National Statistics; Barclays Economics Research

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[23] In other words, rather than assume that all firms pass on the impact of a hike in VAT to consumers instantly, we found that the data can be better explained if one assumes instead that a minority of firms wait a while before deciding to raise prices (say because they want to monitor demand/competitors' actions) or else, simply, that the implementation process takes time (say because of so-called 'menu' costs).

[24] Details of the model are available on request.

[25] Note that, as we are treating the fourth quarter of 2010 as 'data' – i.e. assuming that the December reading comes in exactly in line with consensus expectations – these comparisons are *not* flattered by the inclusion of the dummy variable for the fourth quarter of 2008 in the new model. The period of comparison is all of 2009 and all of 2010.

All of these comparisons are on the basis of quarter-on-quarter changes in the CPI. But what matters most, from the perspective of most professional inflation forecasters, is really year-on-year rates of change, i.e. annual inflation rates. On that basis, the difference between the two models is stark, with the Treasury specification having predicted an annual inflation rate in 2010 of slightly less than 1½%, whereas our revised model reckoned on an outcome of 3%, or only about one-third of a percentage point shy of reality.

All in all, it would seem that a model for forecasting inflation based on using our own, more pessimistic, assessment of the amount of spare capacity in the economy does a good job at explaining past events, especially compared with the Treasury's equation. The same would likely be true for the OBR's output gap estimate, as it, like the Treasury's, is bigger than our estimate. However, we are unable to test this formally as the OBR has not produced output gap estimates for years before 2009. Accordingly, we feel that our more pessimistic assessment than the OBR's is robust. We also feel comfortable using our inflation model when forecasting future price pressures, as we do in Chapter 4.

1.6 Conclusion

A year ago, we took what seemed to many to be an extreme view, that the financial crisis had had a big impact on the economy's ability to supply goods and services. Consequently, we considered that there was much less spare capacity around than the Treasury suggested was the case. A year on, and the official view on this issue has shifted markedly, with the OBR much closer to our thinking than was the Treasury. We suspect, however, that the OBR is still a tad optimistic.