

# 1. The UK's productive capacity: surveying the damage

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## Summary

- Typically, past financial crises have had a marked impact on the level of potential GDP, with the effects building up gradually over a four- to five-year period.
- The overall impact varies from one crisis to another depending, among other things, upon: how the economy was performing pre-crisis; how severely the economy first contracted when the crisis struck; the level of pre-crisis 'imbalances' (such as the current account balance); whether or not the currency also came under severe pressure; and how other countries were faring when the crisis struck.
- Judged against these yardsticks, the UK currently looks very poorly placed. Most likely it will therefore suffer a further, and marked, deterioration in its productive capacity, and one that leaves the total decline in potential GDP greater than the 5% that the Treasury has assumed when making its projections. Our central estimate is for a 7½% fall; under a more pessimistic scenario, it could be 10%.
- More worryingly still, the growth rate of potential GDP will probably also be significantly reduced. Rather than the 2¾% per annum that the Pre-Budget Report suggests as a central estimate, it is more likely that potential GDP growth will run at something close to 1¾% per annum.
- The labour market is likely to be severely affected too, with the non-accelerating wage rate of unemployment (or 'natural' rate of unemployment) set to rise markedly – perhaps by 3 percentage points, to around the 9% mark at end-2015.
- The precise impact will depend upon how fast fiscal policy is tightened, and the policies used to achieve this tightening. A government that tightens fiscal policy aggressively, and relies more upon spending cuts than tax hikes to do so, is likely to experience a lower rise in the NAWRU, other things being equal.
- All in all, it would now appear that the output gap is rather smaller than many analysts imagine (at less than 4% of potential national income) – and that the structural cost of the crisis will therefore be greater than generally envisaged.

## 1.1 Introduction

Recessions inflict two sorts of economic costs. First, there are 'cyclical' (or 'short-term') costs, such as the rise in unemployment that always goes hand in hand with a marked drop in aggregate demand (i.e. actual GDP). This might well prove to be short-lived if the shortfall in demand can be eradicated fairly quickly. Second, there are 'structural' (or 'long-term') costs. These may take the form of a one-off fall in the level of potential GDP or of a reduction in its growth rate. Even worse, they may take *both* forms.

'Potential GDP' is defined here to mean the level of output that the economy can produce if there is full utilisation of both capital and labour. In other words, it is that level of output that could be produced if all fixed capital – such as plant and machinery – is used effectively, and if unemployment is at its 'natural' rate, i.e. the level consistent with a stable rate of change of wages. (Economists sometimes refer to this rate of unemployment as being the non-accelerating wage rate of unemployment, or NAWRU for short.) Another term for potential GDP, which perhaps better describes its meaning, is 'aggregate supply' – in other words, the total capacity of the economy to supply goods and services in a sustainable (non-inflationary) way.

A central bank that seeks to keep inflation low and stable (such as the Bank of England) will try to keep aggregate demand in line with aggregate supply. If a recession reduces aggregate supply, it follows that the central bank will have to aim for a lower path of aggregate demand looking forward than would otherwise have been the case. This means that a recession that has little or no impact on potential GDP is much less costly overall than one that significantly reduces either its level or its growth rate (or both).

We illustrate the case in which the recession leaves potential GDP unaffected in Figure 1.1. The actual level of GDP falls temporarily below potential as the recession bites (moving from the height of the boom at point A to the depth of the recession at point B), with unemployment rising temporarily above the natural rate. Over the subsequent upswing, activity increases rather faster than potential as the so-called 'output gap' – the difference between actual and potential GDP as a percentage of the latter – is closed, with the economy moving from point B to point C. Unemployment drops back to the natural rate, leaving the economy suffering little, if any, in the way of long-term (structural) costs.

Contrast this with the situation in which the recession reduces the *level* of potential GDP. Figure 1.2 shows a fairly extreme case, in which the decline is so great that actual and potential GDP move down by almost the same amount. In such a situation, the long-term (structural) fall in GDP is more or less equivalent to the depth of the recession. In practice, the relationship between the fall in aggregate demand and the damage done to aggregate supply varies enormously, depending among other things on the causes of the slowdown and the response to it. Much of this chapter is devoted to attempting to

Figure 1.1. A stylised recession with no long-run structural costs

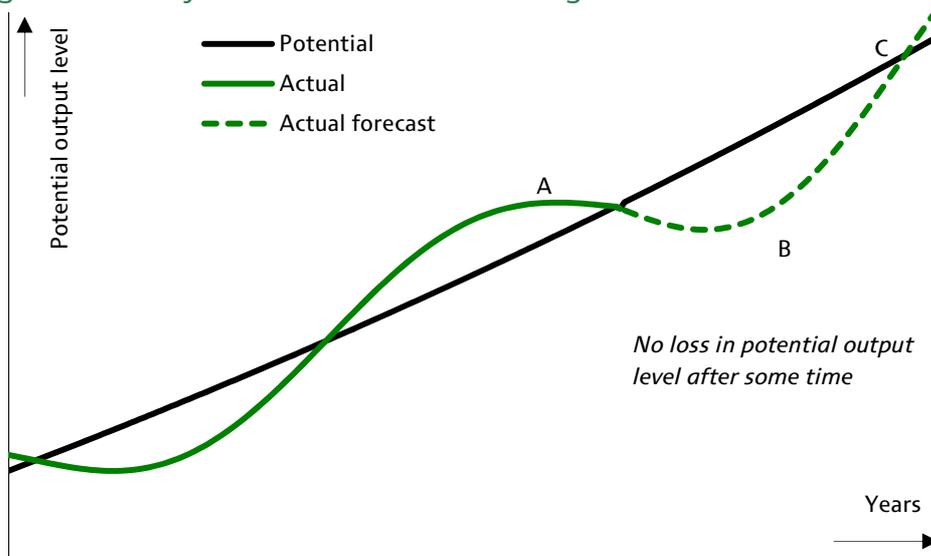
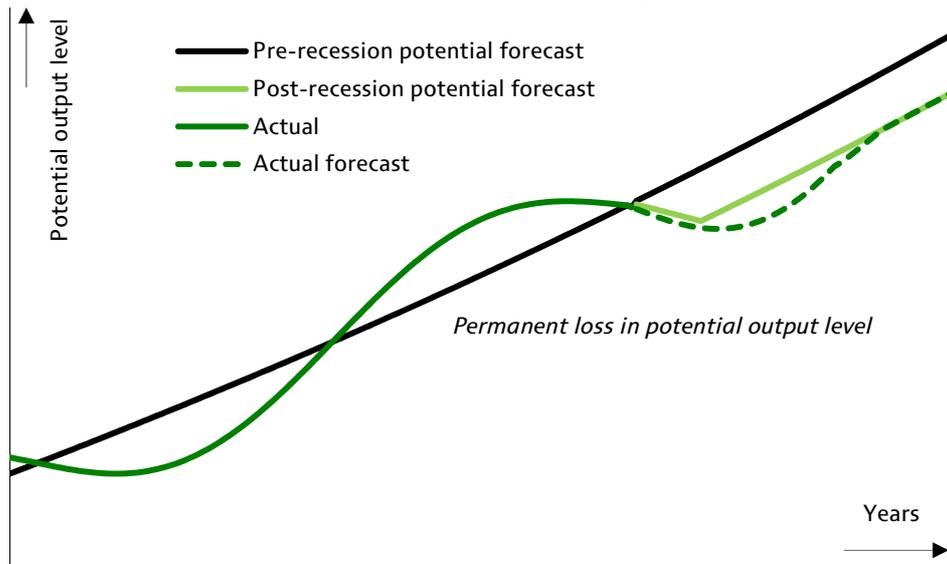


Figure 1.2. A stylised recession with constant long-run structural costs

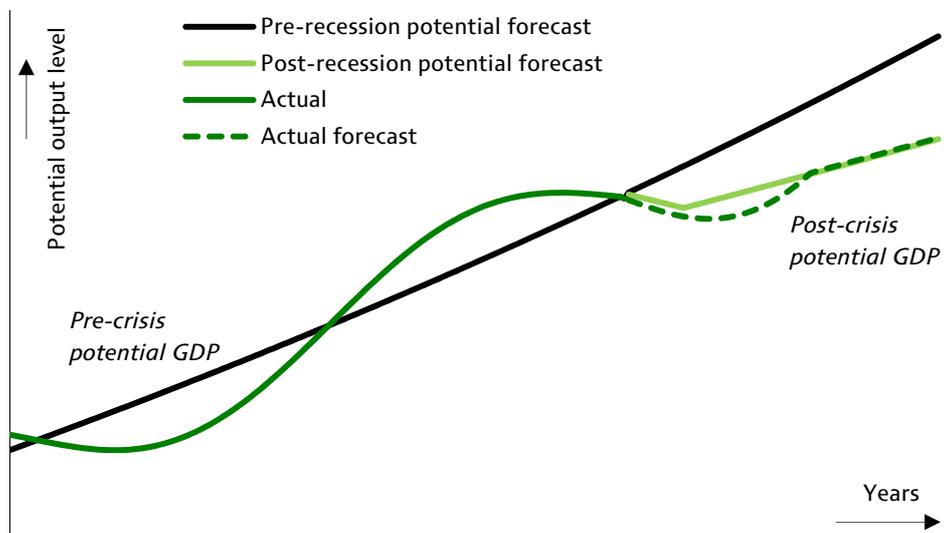


discover whether the current (deep) crisis-induced recession may entail a 'big' or a 'small' fall in potential GDP.

Worst of all possible outcomes, illustrated in Figure 1.3, is the situation where the recession reduces both the level of potential GDP *and* its growth rate. Under this scenario, the recession not only creates a permanent gap between the path of potential output expected prior to the recession and that expected after it, but this gap continues to widen year after year. To eradicate this effect, the authorities would need to make structural, or microeconomic, reforms, in order to raise the economy's potential growth rate. These might, for example, include labour market measures designed to lower the NAWRU. Or they might include policy changes designed to improve the functioning of product markets, such as measures designed to promote greater competition.

The different economic costs implied by these three scenarios are reflected in their implications for the government's finances. Under the first scenario, the recession temporarily subdues tax revenues and increases government spending on such things as

Figure 1.3. A stylised recession with increasing long-run structural costs



unemployment benefits, thereby temporarily increasing government borrowing and producing a one-off addition to government debt (which will need to be financed going forwards). Under the second scenario, the permanent (but constant) loss of potential GDP relative to the pre-recession path implies a permanent loss of tax revenues and a permanent increase in welfare costs. This in turn implies a permanent, but stable, addition to government borrowing – an increase in the so-called ‘structural’ budget deficit – and ongoing additions to government debt. The third scenario implies an increase in the structural budget deficit that itself increases in size over time, thereby generating larger and larger additions to the stock of government debt if left unaddressed.

When it comes to deciding how to repair the fiscal damage associated with the recession, all this goes to show just how important it is to understand the cyclical and structural components. The rest of this chapter attempts to do just that, in two ways.

- **First, we look at recent research by the OECD and by the IMF to see how the level of potential GDP might be affected.** The OECD study uses its own estimates of potential GDP to gauge how past financial crises have affected economies’ structural performance in terms of the fall in the level of potential GDP. We extend that work by considering a much longer run of UK data than the OECD employed. We find that severe crises, such as that which the UK is currently suffering, tend to reduce the level of potential GDP by around 7½%, with most of the decline being felt by the fifth year (first part of Section 1.2). Recent IMF research attempts to gauge the fall in the level of potential GDP in 88 past financial crises, but also tries to identify which factors influence whether a particular country suffers by more or less than the average. It finds a long-run average cost of about 10% of potential GDP. On the basis of the IMF work, we construct a scorecard to assess how well the UK will fare this time round. The answer, unfortunately, is ‘not well’. If the IMF model of what determines the scale of damage done by crises is correct, then it looks as if the UK ought to do worse, not better, than average (second part of Section 1.2).
- **Second, we assess whether the growth rate of potential GDP might be affected, in addition to its level.** To do this, we consider some recent OECD research into what drives NAWRUs – extending the OECD analysis to explain better past shifts in the UK’s natural rate of unemployment. Using this model, we illustrate how much increased tax rates and higher long-term bond yields might raise the structural level of unemployment, and illustrate the sensitivity of our forecast to assumptions about these two variables. This suggests that the long-term implications of recession for the public finances will depend, quite sensitively, on how the authorities set tax rates in response to the need to reduce the budget deficit, and on how markets react. If the government does not tighten policy sufficiently quickly or aggressively to allay investors’ fears, the resulting increase in market interest rates may increase, and appreciably so, the long-term costs to the economy (and thereby to public finances). By way of illustration, in the extreme situation in which no public spending cuts are made, and the authorities rely solely on tax hikes to eradicate the structural budget deficit, and in which the real long-term interest rate rises to where it was in the mid-1980s (at about 7%) – instead of remaining at the near-2% level where it stands today – the natural rate of unemployment would be about 1½ percentage points higher (Section 1.3).

These two analyses lead us to take a more pessimistic view than the Treasury of the impact that the current crisis will have on potential GDP (Section 1.4). The Treasury’s

latest public finance forecasts are based on the assumption that the crisis will reduce the level of potential GDP from previously expected levels by around 5% over the three years from mid-2007 to mid-2010, but that it will leave the growth rate of potential GDP unaffected thereafter at 2¾% per year (although the Treasury assumes that it will be only 2½% for the purposes of forecasting the public finances).<sup>1</sup> We estimate not only that the fall in the level of potential GDP will be larger than the Treasury expects, at around 7½% over five years, but also that, thereafter, potential GDP will grow by only about 1¾% per year. The implications of these scenarios for the public finances are discussed in Chapter 2.

## 1.2 Financial crises and the level of potential GDP

The level of potential GDP cannot be observed directly in data. Rather, it has to be inferred, typically through one of two techniques. First, potential GDP can be estimated from a 'production function', which seeks to explain how factor inputs are combined to generate value added (or 'output'). Second, potential GDP can be estimated by using statistical techniques (such as filters) to draw a trend through actual GDP.

### The OECD approach

The OECD has been carrying out such exercises for decades, generally preferring the first of these approaches as it entails putting structure into the model, i.e. combining economic theory with empirical data. Thus, this approach involves considering what factors may affect the quantity of inputs of labour and capital that firms choose to use. It also requires consideration of what might determine the efficiency with which these inputs are combined: so-called 'total factor productivity' (TFP). Box 1.1 provides more details.

In recent OECD research, Furceri and Mourougane (2009) use the organisation's potential GDP estimates, based on production functions, to gauge how financial crises have typically affected potential output.<sup>2</sup> Their sample covers 30 countries for which potential GDP estimates are available since 1960. They calculate the long-term impact of the financial crises, identified by Laevan and Valencia (2008),<sup>3</sup> on potential GDP and also trace out the profile of how the destruction typically takes place.

Furceri and Mourougane (2009) find that the overall decline in the level of potential GDP from financial crises is quite large – with an average deterioration, for all the crises that they consider, at 2.4%, as shown in Figure 1.4. For a severe crisis – defined in the same manner as employed by Reinhart and Rogoff (2009)<sup>4</sup> – they find the total effect amounts to 3.8% (Figure 1.5). We say the effect is 'quite large' as it implies about one year's lost output growth for a typical developed economy crisis. This rises to about one-and-a-half years' lost output growth for a severe crisis.

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<sup>1</sup> Page 143 of HM Treasury, *Pre-Budget Report 2009*, December 2009, [http://hm-treasury.gov.uk/d/pbr09\\_annexa.pdf](http://hm-treasury.gov.uk/d/pbr09_annexa.pdf).

<sup>2</sup> D. Furceri and A. Mourougane, 'The effect of financial crises on potential output: new empirical evidence from OECD countries', OECD Economics Department Working Paper 699, May 2009, <http://oberon.sourceoecd.org/vl=2631349/cl=20/nw=1/rpsv/cgi-bin/wppdf?file=5ksj3lqk2h40.pdf>.

<sup>3</sup> L. Laevan and P. Valencia, 'Systemic banking crises: a new database', IMF Working Paper 08/224, 2008, <http://www.imf.org/external/pubs/ft/wp/2008/wp08224.pdf>.

<sup>4</sup> C. Reinhart and K. Rogoff, *This Time Is Different: Eight Centuries of Financial Folly*, Princeton University Press, Princeton, NJ, 2009. The severe crises are defined as those that hit Spain in 1977, Norway in 1987, Finland in 1991, Sweden in 1991 and Japan in 1992.

### Box 1.1. Estimating the impact of financial crises on potential GDP

To produce estimates of potential GDP, it is first necessary to quantify the inputs to the production process, i.e. the amounts of ‘labour’ and ‘capital’ available at the whole economy level. To quantify the total amount of labour input, one needs an assessment of:

- i) population trends;
- ii) the proportion of people of working age actually in, or actively seeking, paid work (the so-called ‘labour force’);
- iii) the normal hours of work of those in employment; and
- iv) the natural rate of unemployment (the NAWRU) if we presume that gaps between actual and natural rates of unemployment influence the rate of changes of workers’ average earnings, or wages.

In practice, this means that some smoothing of actual data is required to produce potential GDP estimates. For example, normal hours are usually estimated from a smoothed version of actual hours, and ‘trend’ participation rates from a smoothed version of actual ones.

As regards capital, most studies of potential GDP assume that all capital is fully utilised, although a few people have questioned such an assumption.<sup>a</sup> Thus, the capital available to produce potential GDP is usually assumed to be equal to the Office for National Statistics (ONS)’s estimate of the capital stock. Looking ahead, this stock is presumed to depreciate gradually, while being supplemented by new (gross) fixed investment. In some cases, however, the services that flow from the stock of capital may vary through time, depending upon such things as scrapping rates, as well as depreciation. The efficiency of capital will depend in part on its vintage, rather as the services that flow from a bottle of wine vary according to its vintage, the conditions in which it has been stored and so on.

Whatever the precise means of gauging capital services and labour inputs, these are usually combined in the form of a simple production function, such as the so-called ‘Cobb–Douglas’ production function of the form:

$$Y = (TFP \times EMP \times HOURS)^\alpha (K)^{1-\alpha} \quad (1)$$

where  $Y$  is total output (real GDP),  $TFP$  is total factor productivity,  $EMP$  is total employment,  $HOURS$  is hours worked per worker and  $K$  is the capital stock. The parameter  $\alpha$  is the weight placed on labour versus capital, usually taken as the average of the wage share in GDP over the full sample period (i.e. a long period of time, so as to abstract from the business cycle). Defining the labour force ( $LF$ ) as the sum of employment and unemployment, the labour force participation rate ( $LFPR$ ) as the ratio of the labour force to the population of working age ( $POWA$ ), and the unemployment rate ( $UR$ ) as the ratio of the number of unemployed to the labour force allows (1) to be rewritten as:

$$Y = (TFP \times POWA \times LFPR \times (1-UR) \times HOURS)^\alpha (K)^{1-\alpha}. \quad (2)$$

In order to generate estimates of potential GDP using (2), we need only substitute in ‘trend’ versions of all the right-hand-side variables, with the exception of  $K$  (which is assumed always to be fully utilised). Filtered (i.e. smoothed) versions of  $TFP$ ,  $POWA$  and  $HOURS$  are usually used to create these ‘trend’ versions, with a ‘ $T$ ’ suffix added to their names for clarity. To move from the actual unemployment rate to its structural brethren, a filter can also be applied, although the OECD usually tries to do better than that, by

checking whether its NAWRU estimates are actually useful, in the sense that the gaps between the actual and the structural level of unemployment actually help explain, statistically speaking, changes in the rate of growth of wages. This it can do by estimating a wage equation of the form:

$$\Delta w_t = \alpha_1 + \beta_1 \Delta w_{t-1} + \dots + \beta_m \Delta w_{t-m} + \gamma_1 (UR_{t-1} - NAWRU_{t-1}) + \rho_1 Z_{t-1} \quad (3)$$

where  $\Delta$  refers to the one-period rate of change of a variable,  $w$  refers to wages and  $Z$  refers to any other variable deemed to be important. ( $Z$  would generally, for example, include prices if the dependent variable is in nominal wages and might also include tax variables, or gauges of income and wages policies.)

To start with, the NAWRU estimates in (3) might be inferred by filtering the actual series. Having done this once, the optimal degree of smoothing can then be gauged on the basis of seeing how well the resultant unemployment 'gap' variable (i.e.  $UR - NAWRU$ ) does in helping to explain, in statistical terms, developments in wages. For example, trying out a smoother NAWRU estimate will either make the resultant gap better at explaining past wage developments, or it will make it worse. If the former, then it should replace the original NAWRU estimate, and the exercise be repeated, with another, still smoother, version of the filtered unemployment rate used as an estimate of the NAWRU.

Substituting trend variables into (3) allows one to ascertain the level of potential GDP ( $YPOT$ ), i.e. the aggregate supply potential of the economy:

$$YPOT = (TFPT \times POWAT \times LFPRT \times (1-NAWRU) \times HOURST)^\alpha (K)^{1-\alpha} \quad (4)$$

and the output gap ( $OG$ ) can be defined as the difference between actual and potential GDP as a percentage of the latter:

$$OG = 100 \times (Y - YPOT) / YPOT. \quad (5)$$

As a check on the accuracy of the potential GDP estimates, one can also consider the usefulness of the resultant output gap estimates in a price equation of similar form to (3), but in which prices take the place of wages, the lagged value of  $OG$  takes the place of the (lagged) unemployment gap and  $Z$  includes firms' costs, such as unit labour costs and imported materials costs. Thus the new model is for the mark-up of prices over costs, with the assumption being that pressure of demand variables helps determine such a mark-up. Again, one can consider varying the various smoothing parameter values and choosing those that maximise the ability of the resultant output gap estimates to explain past variation in the data.

What this amounts to, in practice, is using the following equation to determine the growth rate of potential GDP:

$$\Delta \log(YPOT) = \alpha \times [\Delta \log(TFPT) + \Delta \log(POWAT) + \Delta \log(LFPRT) + \Delta \log(1-NAWRU) + \Delta \log(HOURST)] + (1-\alpha) \times \Delta \log(K) \quad (6)$$

where the  $\Delta$  term again refers to the one-period (say annual) rate of change of a variable. Thus, the left-hand side of (6) is equal to the annual growth rate of potential GDP, with the right-hand-side terms providing a means of calculating contributions from the six variables that help determine it.

Having constructed estimates of productive potential, Furceri and Mourougane (2009)<sup>b</sup> use them to estimate how financial crises affect their levels and growth rates. They do this by estimating univariate autoregressions of the form:

$$\Delta \log(YPOT)_{i,t} = \alpha_i + \beta_1 \Delta \log(YPOT)_{i,t-1} + \dots + \beta_4 \Delta \log(YPOT)_{i,t-4} + \delta_0 D_{i,t} + \dots + \delta_4 D_{i,t-4}$$

where  $\Delta \log(YPOT)_{i,t}$  is the annual growth rate of potential GDP (of country  $i$  at time  $t$ , taken from equations similar to (6) above) and  $D_{i,t}$  is a ‘dummy variable’ that takes the value 1 when a financial crisis strikes country  $i$  and 0 at all other times.<sup>c</sup> The lag lengths on both the  $YPOT$  and  $D$  variables were chosen using standard statistical tests, so as to ensure a good fit of the data set examined.<sup>d</sup>

From such a model, we can derive so-called impulse response functions for each country, to see how potential GDP evolves once a financial crisis hits – with the estimated parameter  $\delta_0$  providing a best guess of the typical first-period decline in the growth rate of potential GDP, the typical second-period decline being equal to  $\delta_1$ , etc. Of course, this means that the overall impact on potential GDP growth is equal to  $\delta_0$  by the end of the first period, but that it rises to  $[\delta_0 + (\delta_1 + \beta_1 \times \delta_0)]$  by the end of the second period. From such a model, it is also possible to trace out the impacts of a crisis on the level of potential GDP. Note that, in the case in which an economy’s potential growth rate is constant pre-crisis, the structure of the model means that the long-run impact on potential GDP growth of a crisis will be forced to be zero because all the  $D_{i,t}$  terms are zero post-crisis. (For country  $i$ , potential GDP growth will be equal to  $[\alpha_i / (\beta_1 + \beta_2 + \beta_3 + \beta_4)]$ .)

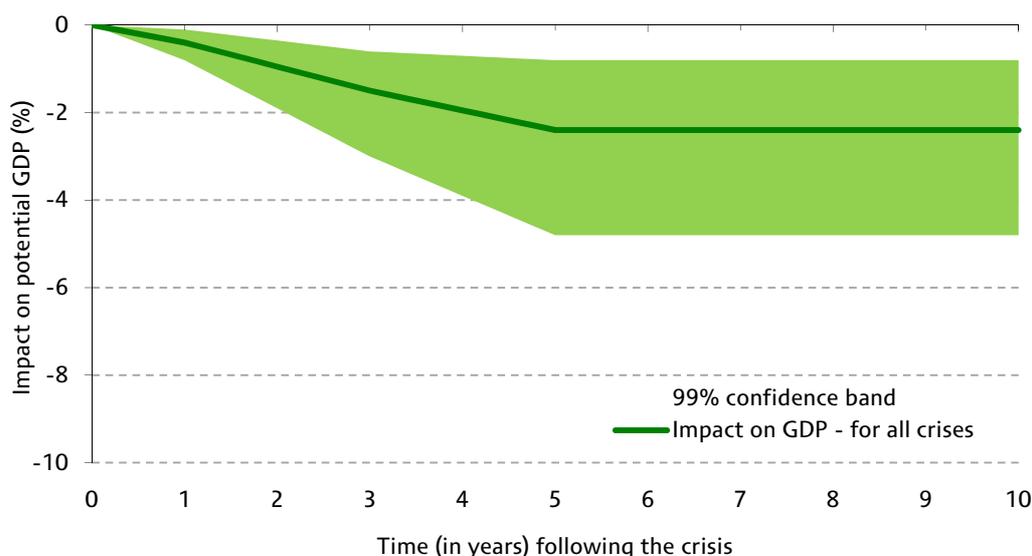
a. See, for example, J. Fernald, ‘A quarterly, utilization-adjusted series on total factor productivity’, and the references therein, available at <http://www.frbsf.org/economics/economists/jfernal.html>.

b. D. Furceri and A. Mourougane, ‘The effect of financial crises on potential output: new empirical evidence from OECD countries’, OECD Economics Department Working Paper 699, May 2009, <http://oberon.sourceoecd.org/vl=2631349/cl=20/nw=1/rpsv/cgi-bin/wppdf?file=5ksj3lqk2h40.pdf>.

c. The definition of financial crisis is taken from L. Laevan and P. Valencia, ‘Systemic banking crises: a new database’, IMF Working Paper 08/224, 2008, <http://www.imf.org/external/pubs/ft/wp/2008/wp08224.pdf>, who define a systemic crisis as occurring when ‘a country’s corporate and financial sectors experience a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time. As a result, non-performing loans increase sharply and all or most of the aggregate banking system capital is exhausted’. To make this definition practicable, they combine quantitative data on arrears, defaults, etc. but also make some qualitative judgements.

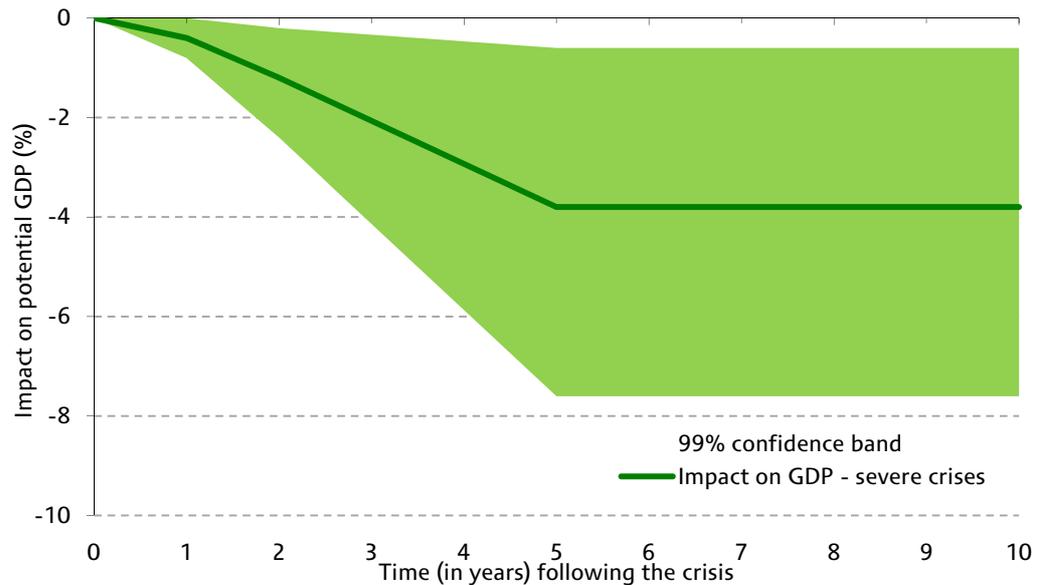
d. Note that, as their sample ended in 2007, they did *not* include any dummies for the most recent financial crisis, as they did not want to bias their results, given that we do not yet know how the current financial crisis will play out.

Figure 1.4. OECD estimates of the effects of a typical financial crisis



Source: D. Furceri and A. Mourougane, ‘The effect of financial crises on potential output: new empirical evidence from OECD countries’, OECD Economics Department Working Paper 699, May 2009, <http://oberon.sourceoecd.org/vl=2631349/cl=20/nw=1/rpsv/cgi-bin/wppdf?file=5ksj3lqk2h40.pdf>.

Figure 1.5. OECD estimates of the effects of a severe financial crisis

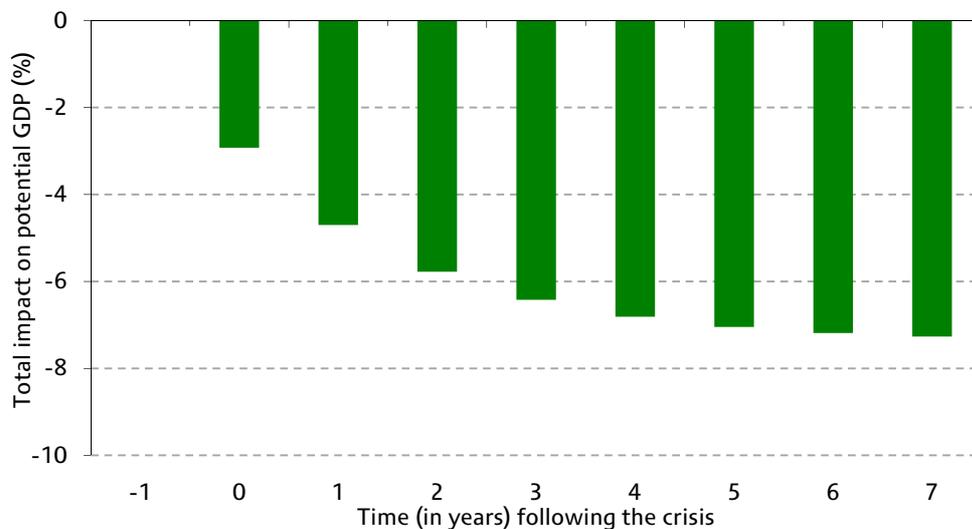


Source: As for Figure 1.4.

There is, however, wide variation in individual countries' experiences. Accordingly, it is not surprising to find that the 99% confidence intervals are wide – from just under 1% to just under 5% for the average crisis and from just under 1% to over 7% for a severe one. Figures 1.4 and 1.5 illustrate, showing both the two model's 'best guess' of the impacts of a crisis (the green lines) and the confidence intervals around them (the light green shaded regions).

The OECD researchers also find that the impact of a crisis typically takes quite some time to work its way through – with the maximum damage to the level of potential GDP occurring after about five years. Accordingly, it would be premature to think that the recent financial crisis's impact on the UK's productive potential has been fully felt. It could well be 2012 or 2013 before potential GDP stops being affected by it.

Figure 1.6. Barclays estimates of the effects of a severe financial crisis on UK potential GDP



As a check on these results, we have extended the sample of UK GDP data used by the OECD researchers right back to 1870, using non-structural techniques (such as filtering the actual GDP data to produce an estimate of potential GDP) and adopting the dates of financial crises identified by Reinhart and Rogoff (2009) prior to 1970.<sup>5</sup> Our results are even more worrying than those of Furceri and Mourougane, for they suggest that the average first-year impact of a financial crisis on the UK's potential GDP growth rate has been around 3 percentage points, with a full, long-run impact on the level of potential of around 7½% (with most of the decline being felt by the fifth year). Figure 1.6 illustrates.

Of course, one possible explanation for this finding is that the deterioration in potential GDP from financial crises is getting smaller over time – say, because we respond better, and/or faster, than we used to once crises strike. (On the surface, this might explain why the UK long run of data suggests a bigger impact than did the panel data, cross-country study.) In fact, however, the impacts of crises pre-1970 on our long run of UK data appear to have been smaller, generally speaking, than those post-1969, not bigger. More generally, in the 1970s-to-2006 UK data set, the impact of crises appears to be rather bigger than the OECD found for its cross-country data set. So it would seem the main lesson to be learnt from these data is that the UK is typically worse affected by its financial crises than other countries are.

There are several reasons to take these new, UK, results with a large pinch of salt. For a start, they are based on a *very small* sample of additional crises, compared with what the OECD study used. Second, they are not very robust – varying, for example, according to the precise sample period covered and the way that potential GDP is gauged. Third, as GDP and inflation volatility both fell markedly during the 20<sup>th</sup> century, it may be that the model is attributing some of the natural variation in the GDP data during the earlier periods to financial crises, as opposed to other factors. (In other words, there may be an omitted variable problem.) Nevertheless, the results are a cause for concern. The UK may be more prone to financial cycles than other economies on average. And it may be that such crises typically have a greater impact on potential GDP in the UK than elsewhere.

## The IMF approach

A second recent study into the long-term costs of the crisis has been carried out by the IMF, using data relating to 88 banking crises and covering a wider group of countries than the OECD study.<sup>6</sup> The major methodological difference between the two studies was that the IMF study used the seven-year pre-crisis trend growth rate of actual GDP as a proxy for the potential GDP growth rate, rather than estimating a production function. Bearing in mind that the OECD researchers found that switching to a trend-fitting technique to proxy potential GDP made little difference to their results, there seems little to choose between them on methodological grounds. The IMF analysis may therefore offer a better guide to the cost of a financial crisis on potential GDP simply by virtue of its larger sample.

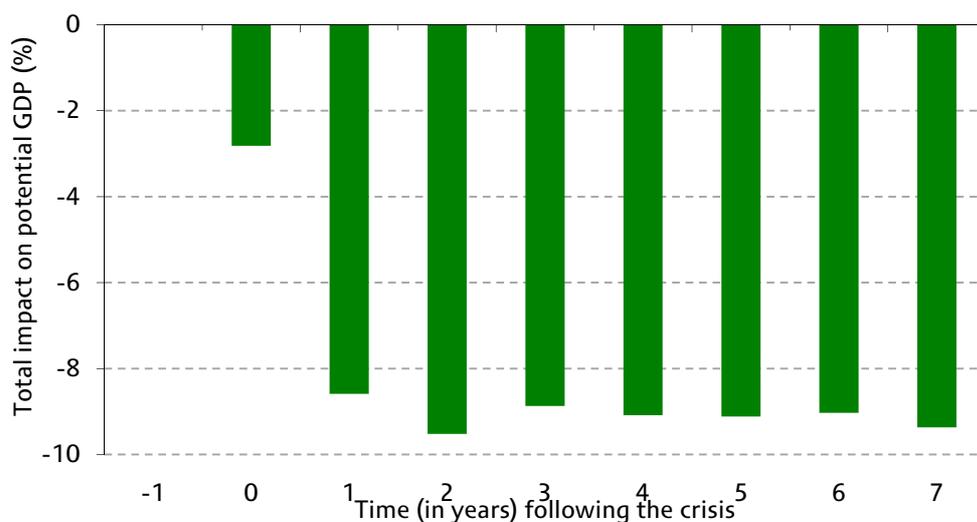
The IMF study's findings were rather more pessimistic than the OECD's:

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<sup>5</sup> Using a Hodrick–Prescott filter seems a reasonable way to proceed, as Furceri and Mourougane found that using a Hodrick–Prescott filter, with a smoothing parameter of 6.25, to proxy potential GDP gave similar results to when they adopted a production function approach. We also tried simple averaging of pre-crisis actual growth as a proxy for potential GDP growth, with similar results.

<sup>6</sup> R. Balakrishnan, P. Brooks, D. Leigh, I. Tytell and A. Abiad, 'What's the damage? Medium-term output dynamics after financial crises', chapter 4 of IMF, *World Economic Outlook: Sustaining the Recovery*, October 2009, <http://www.imf.org/external/pubs/ft/weo/2009/02/pdf/c4.pdf>.

Figure 1.7. IMF estimates of the effects of a typical financial crisis on potential GDP



Note: Estimates based on a sample of 88 financial crises.

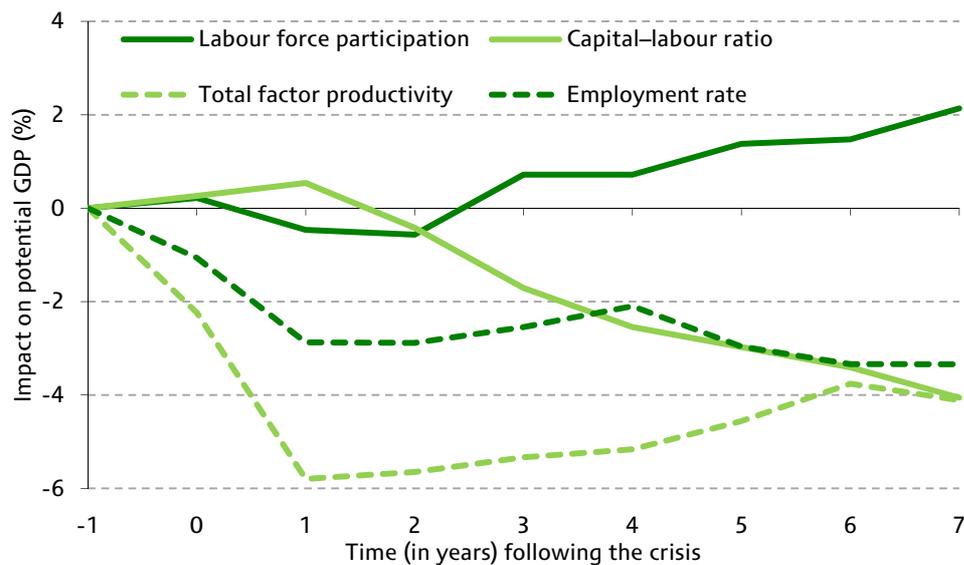
Source: R. Balakrishnan, P. Brooks, D. Leigh, I. Tytell and A. Abiad, 'What's the damage? Medium-term output dynamics after financial crises', chapter 4 of IMF, *World Economic Outlook: Sustaining the Recovery*, October 2009, <http://www.imf.org/external/pubs/ft/weo/2009/02/pdf/c4.pdf>.

- **The deterioration in the level of potential GDP of a financial crisis is, on average, around the 10% mark.** Like the OECD study, the IMF researchers found that the impact took four to five years to reach its maximum, as illustrated in Figure 1.7. And the typical pattern is for the loss to remain at about 10% for the fifth, sixth and seventh years after the crisis struck. So, for a typical developed economy, with a potential growth rate of around the 2½%-a-year mark, the cost of a banking crisis is about four years' lost growth in output.
- **The impact on potential GDP varies, depending upon both the demand and supply structures of an economy.** As with the OECD study, the IMF researchers found there to be considerable variation across the sample regarding the scale of the fall in potential GDP that occurs following a financial crisis. In order better to understand why, they therefore tried seeing which drivers of potential GDP growth (in terms of labour, capital and TFP) and which elements of aggregate demand appeared to be impacted most, if at all. These splits allow not just a better narrative to be told regarding how crises affect an economy, but permit one to take a first step in determining whether, in a particular instance, an economy is likely to be affected more or less than a typical economy would be. If, for example, it is mainly capital and investment which get hit by a financial crisis, this provides a strong hint that capital-intensive, investment-heavy economies will witness their potential GDP depressed by more than 10% on average by financial crises.

#### *What sources of supply are most affected?*

The IMF researchers calculated output decompositions based on a production function analysis, similar to that laid out earlier in Box 1.1. In other words, they took advantage of the fact that changes in per capita GDP can be split (exactly) into changes in four components: the employment rate, the labour force participation rate, the capital-labour

Figure 1.8. IMF estimates of factors responsible for effects on potential GDP



Note: As for Figure 1.7.  
Source: As for Figure 1.7.

ratio and TFP, as illustrated by equation (6) in Box 1.1 (but having first divided by population and subsuming changes in normal hours into the TFP contribution).

Of these four factors, it turns out that labour force participation typically rises a little after a financial crisis – helping to *boost* potential GDP – as a bigger fraction of the workforce start looking for work compared with pre-crisis; one of the few financial ‘benefits’ to flow from a crisis.<sup>7</sup> The other three factors, by contrast, all work to depress potential GDP, with each accounting for close to one-third of the ultimate overall decline in aggregate supply. Figure 1.8 illustrates.

As regards the dynamics of the destructive forces at work, the initial deterioration comes predominantly from a reduction of TFP, and, to a slightly lesser extent, a drop in the employment rate. In time, however, the capital–labour ratio also grinds lower, while TFP actually stages a slight pick-up. Most of the decline in employment comes through within the first year after the crisis starts. It then ‘goes sideways’, as it were, with the effect on the level of potential broadly constant thereafter.

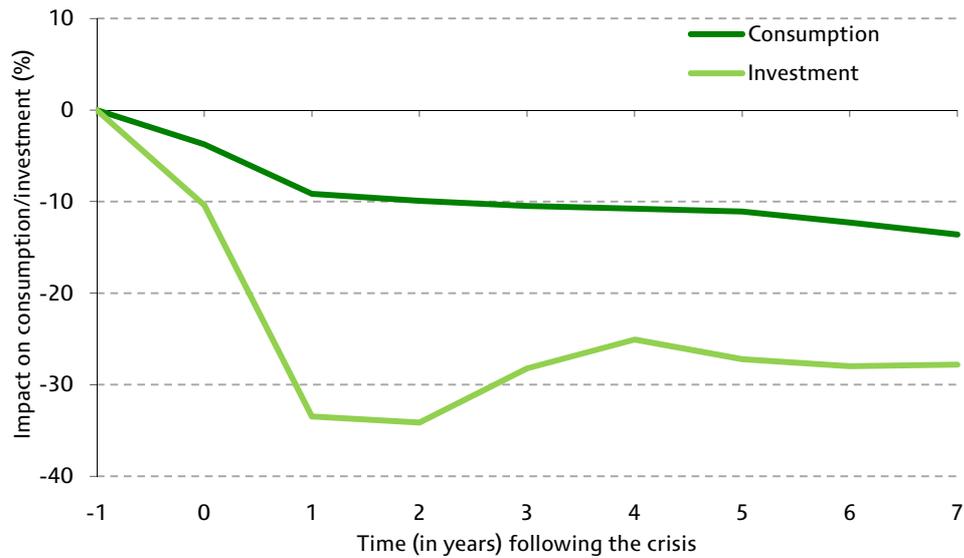
### How do the various demand components react?

Carrying out a similar decomposition of the demand components of GDP, the IMF researchers find that the really big damage usually comes via a collapse in fixed investment. On average, gross fixed capital formation declines by about one-third in the year after the crisis breaks. Six years on, the volume of investment is typically still around 30% below the level implied by the pre-crisis trend, as illustrated in Figure 1.9.

Household consumption also suffers post-crisis, but here the effect slowly accumulates over time – at an average rate of close to 2% per annum. Thus, after seven years, the

<sup>7</sup> Of course, the reason for the rise in participation may be that people feel less well off as a result of the crisis – and choose to work longer and retire later. So, ‘benefits’ is perhaps not the right word.

Figure 1.9. IMF estimates of the effects of a typical financial crisis on consumption and investment

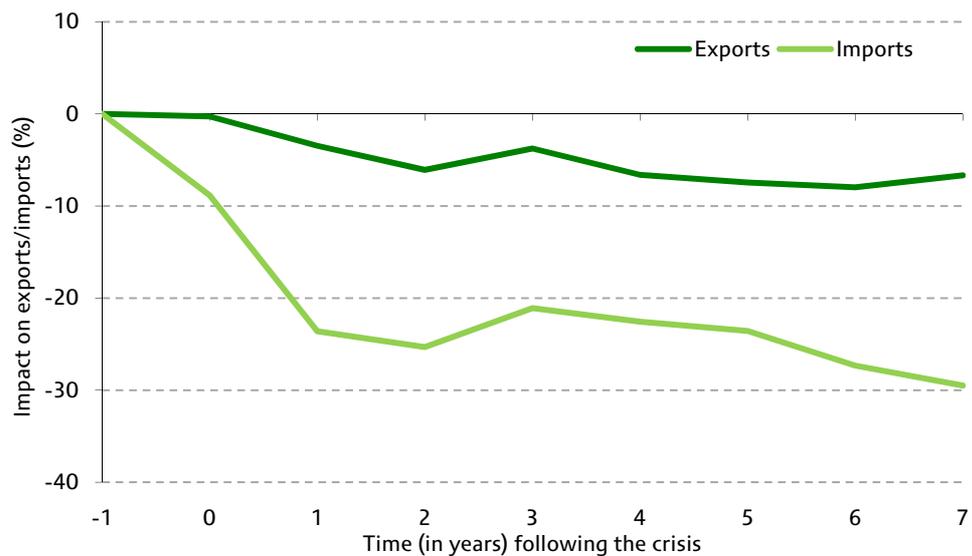


Note: As for Figure 1.7.  
Source: As for Figure 1.7.

volume of consumer spending is nearly 15% below where it would have been had there been no crisis and the pre-crisis trend been sustained. Again, Figure 1.9 illustrates.

Finally, it is interesting to note that net trade usually ends up *adding* to the level of potential GDP after a banking/financial crisis. Much of this is due to the fact that imports slump – dropping at a rate of close to 4% per annum over the next seven years. Exports, by contrast, only fall moderately – by close to 1% per annum on average over the seven years following the crisis, as shown in Figure 1.10. One reason for this differential is that

Figure 1.10. IMF estimates of the effects of a typical financial crisis on export volumes and on import volumes



Note: As for Figure 1.7.  
Source: As for Figure 1.7.

a country's currency usually depreciates when it goes into a crisis, or soon after it has done so.

This might seem like one silver lining when clouds are filling the sky. After all, sterling has declined in value dramatically over the past 12 months or so (see Chapter 5 for a discussion). So, surely its depreciation will persist and, in time, benefit the UK's net trade performance? Unfortunately, given that the current financial crisis has been more or less global in nature, this avenue may not prove to be as beneficial for the UK on this occasion as the IMF's figures suggest typically happens. For not every country can end up importing a lot less while only exporting a little less. And many other countries are likely to find that their currencies come under (downward) pressure too. (The dollar is one case in point, with the pound having risen by 20% against it since March 2009. In 2010, it may well be the turn of the euro and/or the yen and/or the Swiss franc to depreciate versus sterling.) At best, countries suffering more severe downturns might enjoy a depreciation of their currencies relative to those less severely affected. Or, to put it another way, in our modal forecast, we expect trade-weighted sterling to appreciate during 2010 and 2011, offsetting some of the benefits to UK exporters of last year's depreciation.<sup>8</sup>

### *Which factors affect the scale of the deterioration in potential GDP?*

Having recognised that an estimate of an average crisis on the average country's potential GDP is not necessarily especially helpful in predicting the impact in a specific case – because there is wide variation, both from country to country and from crisis to crisis, in the scale of the damage done – the IMF researchers also attempt to explain this variation, statistically speaking, by seeking factors that are related to the scale of the output losses.

Their analysis reveals that there are a number of variables which appear to matter, although in some cases the robustness of the findings is questionable. Those that describe the pre-crisis state of the economy appeared especially important. But a number of other factors were also found to be significant, with the full list comprising:

- **Output levels versus potential.** If the actual level of GDP is below its potential (or trend) level as the crisis breaks, the costs appear to be greater, in terms of the long-term fall in potential GDP. Note that this is in stark contrast to the cyclical costs of a crisis. (After all, when a boom has been allowed to develop, and GDP permitted to rise above potential, extra costs are borne post-crisis during the bust, as actual GDP usually falls further below potential the greater that GDP was permitted to be above potential pre-recession.) One reason for the pre-crisis level of output being important could be that, in an economy with GDP below its potential level, demand may be more vulnerable to a further negative shock. Firms may already be trimming investment or earning below-average profits growth. And households may be raising their saving rates.
- **Growth at the start of the crisis.** If the economy contracts during the first year of the crisis, that appears more likely to signal long-term costs than when growth is maintained in the first year. Note that the IMF study uses annual data, and so cannot be more specific concerning whether or not intra-year patterns also matter. For example, a one-year decline in GDP usually goes hand in hand with 'recession' (with 'recession' used in the sense of two successive quarters of decline). But it need not necessarily do so. So, when the IMF (annual) data show that a crisis and a contraction

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<sup>8</sup> For more on this, and on the other drivers of UK growth, see Chapter 4.

happen at the same time, it is actually possible for the financial crisis to be occurring before, after or at the same time as the economy actually starts to contract in a quarter-on-quarter sense. Again, this finding may well illustrate the importance of vulnerability pre-crisis.

- **Investment shares of GDP.** Given that investment accounts for such a large share of the decline in demand following a financial crisis, it comes as little surprise to learn that economies in which the investment share is high pre-crisis tend to suffer most when a crisis strikes. Interestingly, it does not seem to matter whether the investment has been financed via foreign or domestic savings. That rather suggests that the more investment has taken place, the more likely it is that some of it was poorly allocated and the less likely it is that it will return profits to the investor. Instead, some write-down of the economic value of the capital stock is likely to be required.<sup>9</sup>
- **Macroeconomic imbalances.** The IMF finds some, but less than fully convincing, evidence that imbalances matter. But there is some support for the notion that countries in which inflation has been rising, the current account deficit is large and the fiscal accounts have been deteriorating all suffer bigger losses to their long-term GDP performance than those for whom there are smaller or no imbalances. Also relevant is how much room the monetary authorities have, if any, to cut interest rates to help bolster demand. Less output is lost if rates start out 'high' and inflation is on target.
- **The level of financial development.** Here the IMF used the ratio of bank credit to GDP as a proxy for measuring financial development, finding that countries with a high dependence on credit often suffer more long-term damage than those with less dependence. Of course, this might also be indicative of whether an asset price bubble has occurred, as a high ratio of credit to GDP correlates with elevated ratios of house prices to household incomes.
- **Openness and external conditions.** The IMF found that countries with deeper financial integration are less prone to losing sources of foreign financing after a crisis, and so are better able to weather the storm. However, those that have recently suffered a currency crisis (perhaps simultaneously with some other form of financial crisis) tend to suffer a greater long-term decline in potential GDP. And likewise for those that suffer a banking crisis when external demand is simultaneously weakening – presumably as the potential benefit of a depreciating currency is less than usual if overseas demand is soft.
- **Structural policy factors.** Here the researchers failed to obtain very convincing evidence. But those countries with higher pre-crisis levels of employment protection appear to suffer bigger long-term falls in employment rather than smaller ones. Presumably this is because the costs of postponing redundancies are ultimately higher in such countries.

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<sup>9</sup> Such findings are consistent with the so-called Austrian school of economics, which viewed the business cycle as driven by overinvestment – a 'glut' of supply sometimes occurring which necessitated a slowdown in order to restore equilibrium between savings and investment. Friedrich Hayek's 1931 book *Prices and Production* is the classic text.

**What does this all mean for the UK, going ahead?**

Bringing all this research together, the UK does not look likely to perform especially well relative to the average post-crisis experience. We have devised a scorecard based on the seven factors (and 11 separate variables that cover them) that the IMF study finds to be associated with potential GDP losses. It shows the UK as scoring slightly worse than average for the group as a whole, i.e. implying a bigger output loss than average. This is shown in Table 1.1. This suggests that, if the average deterioration in potential GDP in the current crisis turns out to be 10% – as the IMF study suggests might be likely – then it would be reasonable to expect the UK to suffer a slightly greater decline than this.<sup>10</sup>

**Table 1.1. A scorecard for the UK**

Variable	Importance	Score
Pre-crisis output	2	0
First-year GDP growth	3	-3
Investment share	3	-3
Current account	1	0
Inflation	1	+1
Fiscal deficit	1	0
Monetary conditions	2	+2
Credit/GDP	2	-2
Currency crisis	2	-2
Financial openness	1	+1
External shock	2	-2
<b>Total</b>		<b>-8</b>

Notes: For full details, see R. Balakrishnan, P. Brooks, D. Leigh, I. Tytell and A. Abiad, ‘What’s the damage? Medium-term output dynamics after financial crises’, chapter 4 of IMF, *World Economic Outlook: Sustaining the Recovery*, October 2009, <http://www.imf.org/external/pubs/ft/weo/2009/02/pdf/c4.pdf>. We use a scale of 1 to 3 to determine importance, based on the statistical significance and coefficients obtained in the IMF study. We score the UK by comparing its performance in each regard to other OECD countries, with a range of scores chosen to lie between -1 (‘bad’) and +1 (‘good’), and these scores are then weighted using the ‘importance’ numbers. So, an overall negative score implies a greater output loss than the average country following a typical crisis.

All of this seems like an especially gloomy place to end up – reckoning on a more than double-digit decline in potential output being possible, and extended over the next four or five years: i.e. the next full business cycle, assuming no ‘double-dip’ scenario. Both our own extension to the OECD work and the IMF study come up with the same conclusion – that the decline in potential output is likely to be somewhat greater than assumed by the Treasury in last year’s Budget and Pre-Budget Report (PBR). Indeed, the true effects may be more than double what HMT suggests.

Before making a final decision as regards precisely what estimate of the damage done to the level of potential GDP growth we should use, it is worth mentioning one other approach to gauging the impact, as carried out by Ray Barrell of the National Institute of Economic and Social Research (NIESR).<sup>11</sup> This involves using a more general form of

<sup>10</sup> We would very much like to thank Ravi Balakrishnan, Petya Koeva Brooks and Daniel Leigh – three of the authors of the IMF study – for making available both the data set and the models used by the IMF. This permitted us to check that the models that they have developed do indeed suggest the UK would have been expected to experience a bigger-than-average output loss from the recent crisis. In other words, their findings are in accordance with our simple scorecard.

<sup>11</sup> See R. Barrell, ‘Long-term scarring from the financial crisis’, *National Institute Economic Review*, 210, October 2009.

production function than the Cobb–Douglas one, known as the constant elasticity of substitution (CES) form. This elasticity measures the responsiveness of firms' input mixes to changes in their relative price. A Cobb–Douglas production function assumes an elasticity of unity. A CES form allows for the possibility that it is smaller than that, which most data suggest is a more realistic model to use. (A value of one-half may be more appropriate than one of unity.<sup>12</sup>)

Using a sample of 12 euro-area countries, the NIESR study finds that the higher the elasticity of substitution, the greater the output loss associated with a financial crisis (and an associated rise in the user cost of capital).<sup>13</sup> The rough rule of thumb seems to be that a country with an elasticity of substitution of around one-half might expect to see an impact on potential GDP of about two-thirds that of one with an elasticity of unity. However, the estimates are sensitive to how one defines the user cost of capital – a weighted average of the (after-tax) cost of borrowing from retained earnings, bank borrowing and accessing capital markets. In particular, these will depend, sensitively, on the assumed 'risk-free' real interest rate, which is usually proxied using the real yield on long-term government bonds (say, that on 10-year gilts). The fact that these yields have backed up markedly of late, taking them already to NIESR's end-2011 forecast value, illustrates the problem – and suggests that NIESR's assessment (like that of the Treasury) that the financial crisis will reduce potential GDP by around 5% is likely to be an underestimate.

Taking this altogether, for the purposes of our own forecasts in Chapter 4, and for the scenarios for the public finances described in Chapter 6, we have decided to assume a slightly less devastating impact in our central scenario than the IMF research suggested, to take account of the possibility that the true elasticity of substitution may well be under unity. So we phase in a decline of 7.5% over the next five years. In our 'optimistic' scenario, we stick with the Treasury's assessment of a 5% decline. In our 'pessimistic' scenario, we go with a larger deterioration of 10%.

### 1.3 How fast will potential GDP grow beyond the crisis?

In addition to considering the damage done to the level of potential GDP by financial crises, the IMF analysts allowed for the possibility that crises might also affect the long-run potential *growth* rate – the type of situation illustrated earlier in Figure 1.3. In fact, they found little evidence that economies generally suffer a deterioration in their trend rate of growth. Or, to be precise, the average impact they estimated was fairly small – at 0.2 percentage points – and not significantly different from zero in statistical terms. As with the estimated deterioration in the level of aggregate supply, however, the variation across the sample was high. For example, slightly more than one-fifth of the crisis-affected countries suffered losses in their medium-term growth rates of 2 percentage points or more. So, it is certainly feasible that some developed economies, such as the UK

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<sup>12</sup> See, for example, J. Rotemberg and M. Woodford, 'The cyclical behaviour of prices and costs', in J. Taylor and M. Woodford (eds), *Handbook of Macroeconomics*, volume 1B, Elsevier, Amsterdam, 1999.

<sup>13</sup> The basic idea here is that in the extreme case, where no substitution between factors of production is feasible, then output would be unaffected by a rise in capital costs, which would instead be absorbed into profits.

– which would normally be expected to have potential growth rates in the 1½% to 3% range – might nevertheless be significantly impacted.

We next consider whether the IMF’s finding that the growth rate of potential GDP is typically unaffected by financial crises is likely to be true of the UK currently. We begin by updating the same sort of approach used by David Miles and his former colleagues at Morgan Stanley in recent editions of the IFS Green Budget, decomposing shifts in potential GDP into contributions from labour, capital and the efficiency with which these are combined (TFP). And we also split the contribution from labour into its major components, i.e. those from population, labour participation, employment and hours worked.<sup>14</sup> We then move on to consider structural models of the NAWRU, finding that some of these are sensitive to variables such as the long-term interest rate and tax wedges – which may continue shifting in such a way as to lower potential growth for years to come, and perhaps even permanently. As in Morgan Stanley’s estimates in last year’s Green Budget,<sup>15</sup> our best guess for the UK’s potential growth rate is rather lower than the Treasury’s is, even looking four or five years down the road – to a period after all the ‘levels’ impacts of the financial crisis are likely to have worked their way through.

### The contribution of labour inputs

Table 1.2 shows contributions for each of the labour variables to potential GDP growth. We have used a Hodrick–Prescott (HP) filter to smooth the past path of the various contributions in order to generate estimates of the underlying trends. As in earlier analyses, we assume that population growth will slow slightly in the years ahead – reflecting, amongst other things, the impact of reduced migration. Our projections are fairly similar to those made recently by the OECD.<sup>16</sup> Like the OECD, we also expect the contribution from participation to be close to zero. The same is true of the average working week, which leaves only the natural rate of unemployment (or NAWRU) to consider as a driver of the labour contribution to GDP.

The OECD estimates that the UK NAWRU will grind higher, from its pre-crisis rate of just under 5½% to just over 6% by 2011. This would be consistent with the employment contribution to potential growth slipping by a little over ½ percentage point per annum over the next several years compared with its pre-crisis impact. Unlike most of the other contributors to potential GDP, there is quite a big literature on drivers of the natural rate – going back to the work of Layard, Nickell and Jackman (1991).<sup>17</sup> Our own research into this area has suggested that an eclectic ‘shocks’ and ‘structural’ model helps explain a lot of the combined cross-country and time variation in structural levels of unemployment.<sup>18</sup>

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<sup>14</sup> Note that the employment contribution can be thought of as the inverse of the NAWRU component. In other words, if the natural rate of unemployment rises, then the ratio of people looking for work falls – i.e. the employment rate drops.

<sup>15</sup> D. Miles with M. Baker, ‘The economic outlook’, in R. Chote, C. Emmerson, D. Miles and J. Shaw (eds), *The IFS Green Budget: January 2009*, <http://www.ifs.org.uk/budgets/gb2009/09chap4.pdf>.

<sup>16</sup> See, in particular, ‘Beyond the crisis: medium-term challenges relating to potential output, unemployment and fiscal positions’, chapter 4 of OECD, *Economic Outlook*, no. 85, June 2009, <http://www.oecd.org/dataoecd/36/35/43117806.pdf>.

<sup>17</sup> R. Layard, S. Nickell and R. Jackman, *Unemployment: Macroeconomic Performance and the Labour Market*, Oxford University Press, Oxford, 1991.

<sup>18</sup> See M. Dicks and P. Papadavid, *The Causes of Unemployment*, Lehman Brothers Structural Economics Research Paper no. 5, 2002.

Table 1.2. The contribution of labour inputs to UK potential GDP growth (percentage points)

Factors:	Participation rate	Population	Employment (NAWRU)	Hours worked	Total
1972–2008	0.0	0.4	–0.1	–0.2	0.1
1996–2008	0.0	0.4	0.1	–0.2	0.3
2001–2008	0.0	0.5	–0.1	–0.2	0.2
2001	0.1	0.5	0.3	–0.4	0.4
2002	0.1	0.4	0.2	–0.4	0.3
2003	0.1	0.5	0.1	–0.3	0.3
2004	0.1	0.5	0.0	–0.2	0.4
2005	0.1	0.6	–0.1	–0.2	0.4
2006	0.0	0.6	–0.2	–0.2	0.2
2007	0.0	0.6	–0.4	–0.2	0.1
2008	0.0	0.6	–0.5	–0.2	–0.1
<i>Forecasts</i>					
2009	0.0	0.5	–0.6	–0.3	–0.3
2010	–0.1	0.5	–0.6	–0.3	–0.5
2011	–0.1	0.5	–0.3	–0.3	–0.2
2012	–0.1	0.4	–0.2	–0.2	–0.1
2013	–0.1	0.4	–0.2	–0.1	0.0
2014	–0.1	0.3	–0.1	–0.1	0.0
2015	–0.1	0.2	0.0	–0.1	0.1

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.

More recent research into drivers of the NAWRU, carried out by researchers at the OECD and also based on panel data, has re-examined this issue, and come to a similar conclusion.<sup>19</sup> It argues that much of the rise and fall in natural rates for developed countries comes about as a result of shifts in five main indicators:

- **Tax wedges** – defined as the amount of extra tax that a firm has to pay in order for an employee to have an additional £1 in spending power, and thus comprising taxes he/she will have to pay (e.g. income tax, employee National Insurance contributions, VAT) as well as taxes formally incident on the firm (e.g. employer National Insurance). The higher the wedge the higher the NAWRU, or natural rate of unemployment, other things being equal.
- **Benefit replacement ratios** – defined as the typical level of unemployment benefits that someone who loses their job receives as a proportion of their former salary. Again, both theory and empirical evidence suggest a positive relationship, with a more generous benefit system usually resulting in a higher NAWRU.
- **Union density** – measured by the proportion of workers covered by union agreements, or sometimes by the proportion of workers who are actually members of

<sup>19</sup> See C. Gianella, I. Koske, E. Rusticelli and O. Chatal, 'What drives the NAIURU? Evidence from a panel of OECD countries', OECD Economics Department, Working Paper 649, April 2009, [http://www.oilis.oecd.org/oilis/2008doc.nsf/LinkTo/NT00005F8A/\\$FILE/JT03262428.PDF](http://www.oilis.oecd.org/oilis/2008doc.nsf/LinkTo/NT00005F8A/$FILE/JT03262428.PDF).

unions. (Sometimes, as in the case of France, the two can differ quite substantially.) The more powerful unions are, other things being equal, the higher the natural rate of unemployment.

- **Product market regulation** – measured from indices of regulatory impediments to product market competition in seven non-manufacturing industries. The basic idea here is that the less competition there is in a market, the easier it is for firms to raise prices, and therefore the easier it is for them to pay more for workers' services, and thus the higher the natural rate of unemployment.
- **The long-term real interest rate** – defined as the 10-year government bond yield minus the one-year inflation rate. Here the evidence is especially compelling that higher real interest rates typically go hand in hand with higher structural levels of unemployment.

Importantly, of these various drivers, it is the real interest rate, the tax wedge and the level of product market regulation that turn out to be the most important, quantitatively speaking. For the UK over the next business cycle, two of these may well depend quite sensitively on how fiscal policy evolves. For example, big hikes in tax rates on earnings or on consumer spending could raise the natural rate significantly. But so might a failure to tighten fiscal policy, if rising budget deficits and/or public debt raise the long-term interest rate significantly.

The OECD's general cross-country specification does not fit the UK especially well. So we have estimated an error-correction form of the NAWRU model using UK data. We find that both the real interest rate and the tax wedge play a big part in driving long-run shifts in the NAWRU, with coefficients on each of close to one-half.<sup>20</sup> (So, for example, a permanent rise in the long-term interest rate of 1 percentage point would, if our model is correct, ultimately add ½ percentage point to the natural rate.) A smaller role was discovered for union density, which obtained a coefficient of about one-eighth.

Around this long-run model, we discovered that changes in product market regulation appeared to help drive short-lived (i.e. temporary) changes in the NAWRU, as did shifts in real interest rates and the tax wedge.<sup>21</sup> The low coefficient on the error-correction term implied very slow dynamics following shocks to the various drivers of the NAWRU: for example, following a permanent shift in real interest rates, it takes a good six years before two-thirds of the long-run impact has taken place.

In order to test whether the rate of increase in the UK NAWRU predicted by the OECD is a reasonable assessment, we first used the new model to produce a forecast assuming that fiscal tightening takes the form laid out in the December 2009 PBR; that union density drifts higher; and that real interest rates trend gently higher, with the 10-year nominal gilt yield reaching 5.5% at end-2011, 6.0% by end-2012 and drifts higher thereafter. (Inflation is predicted to average close to 2% over the next five years.) In this scenario, the NAWRU moves up more sharply than in the OECD medium-term scenario – rising to

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<sup>20</sup> We would very much like to thank Jørgen Elmeskov, Andrew Dean and the authors of the OECD Working Paper for making the data available to us in order to help us to do this.

<sup>21</sup> The basic specification of the model is:

$$\Delta NAWRU_t = \alpha_0 + \alpha_1 \Delta RLR_t + \alpha_2 \Delta WEDGE_t + \alpha_3 \Delta_3 PMR_t - \alpha_4 \Delta ECT_{t-4}$$

where *RLR* is the real interest rate, *WEDGE* the tax wedge, *PMR* an index of product market regulation and *ECT* is an error-correction term (i.e. the residuals obtained by regressing NAWRU against *RLR*, *WEDGE* and union density). Further details are available from the author on request.

about 9% by the end of the projection (i.e. at end-2015), and rising at an average annual rate of close to ½ percentage point per annum.<sup>22</sup>

Next, we considered a case in which the gilt yield surges upwards, as might happen if a government tried to avoid fiscal tightening – in any substantive form – or even if markets deemed that it might fail in its endeavours and took fright. To scale how much yields might rise, we use a gilt model in which both the structural budget deficit and the public debt to GDP ratio affect bond yields, and in multiplicative fashion – i.e. with the two interacting so that, in a situation where the deficit and debt burdens are both rising together, the impact on yields can be very large, and fast-acting. (For more details on this specification, see Box 1.2.) For example, in an extreme situation in which the structural

### Box 1.2. The impact of public finances on gilt yields

Most economists recognise that the state of public finances affects borrowing costs for governments. But quantifying the impact is difficult. Indeed, it is hard finding a consensus even regarding what functional form to assume. For example, it could be the case that in extreme circumstances – such as when a country has an extremely high level of public debt, or when a crisis is brewing – the relationship between long-term government bond yields and budget deficits and debt may be non-linear.<sup>a</sup>

To illustrate the problem, consider first a simple regression of the slope of the yield curve (*YCSLOPE*, defined as the difference between 10-year gilt yields and short-term (LIBOR) interest rates) against inflation expectations (*INFEXP*, proxied using a trend estimate of actual inflation), a gauge of the business cycle (*CYCLE*, based on actual GDP growth), the budget deficit to GDP ratio (*DEFICIT*) and the government debt to GDP ratio (*DEBT*), using data since the early 1970s. The results we obtain are:

$$YCSLOPE = -5.97 + 0.04 \times INFEXP + 0.45 \times CYCLE + 0.33 \times DEFICIT + 0.08 \times DEBT$$

(–7.2) (1.6) (3.4) (6.3) (4.8)

where t-values are shown in parentheses.

On the face of it, this model does a fairly reasonable job, with only the inflation expectations term failing to pass a test for statistical significance with flying colours, and being rather less powerful than one might expect. The public finance terms are worryingly large. A sustained 5 percentage point rise in the budget deficit, for example, would add more than 1.5 percentage points (150bp) to the 10-year gilt yield. A rise in the debt-to-GDP ratio from 55% of GDP to 75% would have a similar impact, implying an overall hit of more than 3 percentage points (300bp) to yields from the sort of deterioration that is currently taking place in the UK's public finances.

Checking whether the debt and deficit terms interact, we find it is not difficult to come up with a non-linear specification where coefficients have the expected signs. One such model takes the form:

$$YCSLOPE = -0.05 + 0.03 \times INFEXP + 0.49 \times CYCLE + 0.32 \times DEFICIT + 0.07 \times DEBT + 0.34 \times DD$$

(–5.0) (0.8) (2.8) (1.6) (3.1) (1.5)

where t-values are again shown in parentheses and *DD* is the deficit to GDP ratio *times* debt to GDP. Here the simulation properties of the model are even scarier than the previous ones. For the same rise in the deficit and debt ratios, the equation suggests that 10-year gilt yields ought to rise more than 4 percentage points (400bp).

a. See, for example, R. Faini, 'Fiscal policy and interest rates in Europe', *Economic Policy*, 21, 443–489, 2006.

<sup>22</sup> Note that it starts out the projection at about 7%, i.e. well above what the OECD assumes it to be.

deficit stays in double digits all this year and in both 2011 and 2012, and (net) public debt soars to around 85% of GDP by end-2011, the model suggests that (nominal) 10-year gilt yields could easily reach double digits by the end of this period – a rate last seen in the early 1990s. Such an outlook would presumably also raise long-term inflation expectations somewhat. Nevertheless, the real (expected) long-term interest rate would still rise appreciably – perhaps to 6% or 7%.

In this sort of scenario, our UK NAWRU model suggests that the natural rate of unemployment would rise somewhat more aggressively than in our central scenario, adding about 1 percentage point to the structural unemployment rate each year, i.e. rising about twice as fast as in our central-case scenario. Under these circumstances, the gradual turnaround in the contributions that labour variables are projected to make to trend GDP growth over the next few years, shown in Table 1.2, might never materialise. Or, to put it another way, were a lack of fiscal effort to lead to a major sell-off in the bond market, the deterioration in potential GDP growth stemming from a rising NAWRU might well be quite a bit more painful than in our central scenario.

### **The contribution of capital inputs and TFP**

Next we consider the contributions of capital and TFP to potential GDP growth, shown in Table 1.3. Here we have modestly trimmed the estimates in last year's Green Budget. There are two reasons why. First, we needed to lower the estimates to take into account recent data. In particular, GDP declined much more sharply than expected in late 2008 and 2009, while employment and the capital stock did not. (Indeed, employment has held up much better than expected, even after taking into account what has happened to demand and to unit labour costs. Or, to put it another way, firms appear to have hoarded labour rather more than usual in such circumstances, with the result that productivity performance has been dire.<sup>23</sup>) Looking ahead, there may well be some payback for this surprisingly poor productivity performance, in the form of unusually weak employment demand, for a given level of product demand and a given level of wages. But some – probably a minority – of the 'surprise', represented by the residuals on our employment model, may well feed into the trend estimates of TFP, and thus into future potential GDP growth.

The second reason for trimming the potential GDP growth projections reflects the likelihood that the greater-than-expected decline in GDP will lead not only to temporarily higher-than-previously-assumed rates of scrapping of physical capital but also to a reassessment of its marginal product. In other words, more of the capital stock will need to be written off – now that it is clear not only that increments to it failed to deliver the sort of rate of return (or profits) that investors expected when they made the investment, but that, in many cases, investors ended up incurring losses.<sup>24</sup> And the willingness to invest, for a given level of demand and cost of capital, may well have fallen permanently too, to reflect the (now perhaps more realistic) assessment of the likely future rate of return on such an investment. Of course, on top of that, if the credit supply curve has permanently shifted to the right – which it probably has thanks to the financial sector recognising that its 'old' business model was optimistic concerning the rate of return it

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<sup>23</sup> For further details, see Chapter 4.

<sup>24</sup> Of course, some of the physical capital will still retain some market value, but probably rather less than assumed by the ONS's statisticians. (They generally assume straight-line depreciation in the value of 'old' capital, with the rate of depreciation assumed depending only on the normal life of the asset.)

Table 1.3. 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 1.2)	Overall potential GDP growth from sum of filtered contributions	Actual or forecast GDP growth
1972–2008	0.9	1.3	0.1	2.2	2.2
1996–2008	1.0	1.2	0.3	2.5	2.2
2001–2008	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	0.3	2.6	2.1
2003	0.9	1.2	0.3	2.4	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	0.2	1.9	2.9
2007	0.9	0.8	0.1	1.8	2.6
2008	0.5	0.7	–0.1	1.1	0.5
<i>Forecasts</i>					
2009	–0.2	0.7	–0.3	0.1	–4.7
2010	–0.3	0.8	–0.5	0.0	1.8
2011	0.1	0.8	–0.2	0.7	2.3
2012	0.3	0.9	–0.1	1.2	1.4
2013	0.5	1.0	0.0	1.5	1.5
2014	0.6	1.0	0.0	1.7	1.7
2015	0.7	1.0	0.1	1.8	1.8

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.

would achieve – then this too would act to curb the rate of investment for non-financial companies.

Quantifying such an analysis, and especially quantifying what might be temporary as opposed to permanent effects, is very difficult. Hence, we have relied, as formerly, on trend-fitting, in which the filters use statistical rules as opposed to behavioural or theoretical parameters to achieve such a partition. As a result, our numbers are fairly similar to those used previously, but subject to a wide margin of error. As a check on our TFP estimates, it is interesting to note that the 1.0% per annum rate of increase in total factor productivity that we pencil in from 2013 onwards is spot on the UK's long-term average, as gauged over the period 1890 to 2006.<sup>25</sup>

Taking all the contributions to potential GDP growth into account, it looks likely that the sustainable growth rate of the UK economy will eventually stabilise at around 1¾% per

<sup>25</sup> For details, see table 2 of G. Clette, Y. Kocoglu and J. Mairesse, 'Productivity growth and levels in France, Japan, the United Kingdom and the United States in the twentieth century', NBER Working Paper 15577, December 2009.

annum – very similar to what both the OECD and IMF estimate.<sup>26</sup> In the absence of the crisis, we might have expected a rate of 2¼%.<sup>27</sup> So, our estimate of the likely growth rate of potential GDP is significantly lower than the 2¾% expected by the Treasury and the 2½% rate that it assumes in its public finance forecasts.

By 2015, we estimate that potential output will be 9% of GDP (£132 billion in today's money) lower than it would have been in the absence of the crisis (see Figure 1.11). This is 8% of GDP (£119 billion) below what the Treasury expects and 13% of GDP

Figure 1.11. Barclays versus Treasury estimates of the level of potential GDP, pre- and post-crisis

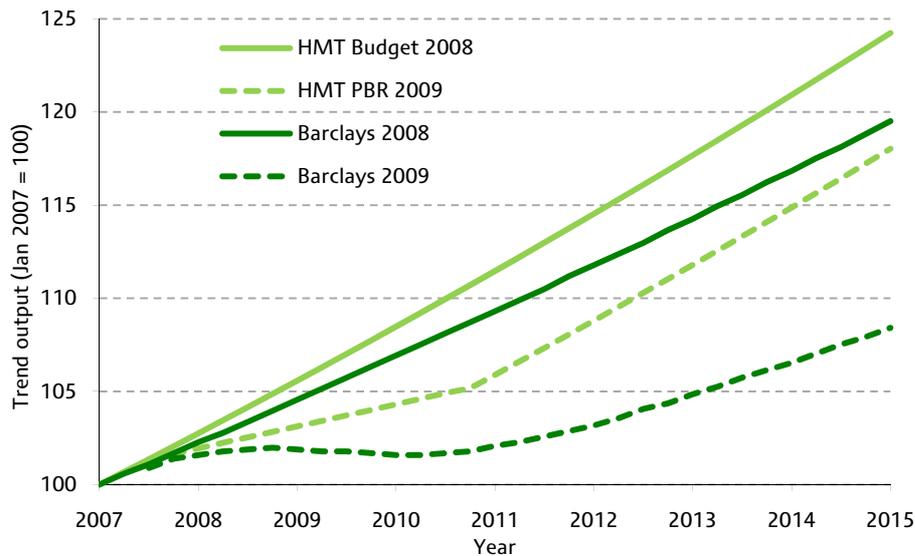
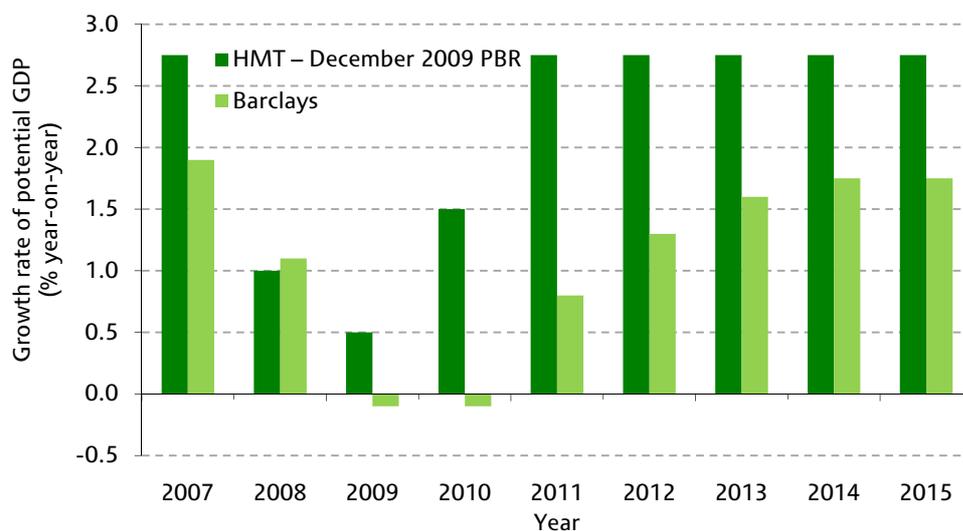


Figure 1.12. Barclays versus Treasury estimates of the growth rate of potential GDP



<sup>26</sup> For details of the former, see OECD, *Economic Outlook*, no. 86, November 2009. For details of the latter, see annex 4 of the UK's 2009 Article IV Consultation, *IMF Country Report*, no. 09/212, July 2009.

<sup>27</sup> Interestingly, a pre-crisis estimate from the OECD was very close to this figure, at 2.4% over the period 2009 to 2013, gauged in 2007. For details, see OECD, *Economic Outlook*, no. 81, June 2007.

(£184 billion) lower than the Treasury was projecting prior to the crisis. The difference between our and the Treasury's estimates of potential GDP growth imply that the gap will grow by around 1% of GDP (£14 billion) a year. Figure 1.12 shows our latest estimates of the growth in productive potential for each year from 2007 to 2015 alongside the growth in potential implicit in the December 2009 PBR forecast.

As for the output gap, we gauge it to be around 3½% of GDP currently, or about 3 percentage points smaller than the Treasury estimated it to be in the PBR.

## 1.4 Conclusion

Historical and international experience suggests that the current financial crisis is likely to reduce significantly the *level* of productive potential of the economy over the next few years – with an impact typically in the 5–10% range. We suspect that the effect will turn out to be around the mid-point of this range, whereas the December 2009 PBR goes with an estimate at the optimistic end of it.

History suggests that severe financial crises may also sometimes affect the long-term *growth rate* of potential output. We project, over and above the deterioration in the level of aggregate supply, an additional lasting reduction in the long-term growth rate of potential output, of around half a percentage point per annum, even though past experience suggests that this is by no means an inevitable outcome. Accordingly, we are much more circumspect concerning this estimate.

The Treasury's most recent forecasts assume that the crisis will reduce the level of potential output by 5% over three years (compared with the levels expected in the absence of a crisis), but that the long-term trend growth rate of potential GDP will remain unaffected at 2¾% (with 2½% assumed for the purposes of its public finance forecasts). Our best estimate is more pessimistic, being that the level of potential GDP will be reduced by 7½% over three years and that thereafter it will grow by only 1¾% per year. The latter estimate is very close to the OECD's estimate of the UK's rate of potential GDP growth.