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Chapter 3

THE IMPLICATIONS OF SUPPLY-SIDE UNCERTAINTIES FOR ECONOMIC POLICY

Introduction

Supply-side uncertainties have increased the risk of policy errors…

The increases in real energy and capital costs caused by the oil price shock and financial turmoil are likely to reduce the productive potential of OECD economies. The extent and the speed of these effects are very difficult to estimate and will depend on how permanent the shocks prove to be. At the same time, past and ongoing structural reforms are boosting potential output, but with long and unknown lags. The net effect has been to increase the uncertainty that surrounds measures of economic slack, such as the "output gap", the unpredictability of which is a recurrent difficulty for macroeconomic policy setting at the best of times. At the current juncture, heightened uncertainties about supply-side developments combine with weakening activity and concerns about inflation to compound the risk of policy errors.

… both inflationary and deflationary

Policy errors could occur in both directions. The experience of stagflation in the 1970s and early 1980s showed that, while real-time measures of economic slack provided apparently legitimate grounds for easing policy, *ex post* it appeared that capacity conditions were actually tighter than such estimates suggested and that policy easing had fuelled inflation (Orphanides *et al.*, 2000). On the other hand, overly tight policy based on an underestimate of potential output could imply a risk of creating unnecessary slack.[1]

The current study finds that…

To address the current issues, the chapter starts by looking at simple ways of estimating the possible impact of recent increases in real energy and capital costs on potential growth. After discussing the size of the growth-enhancing effects of economic reform, the chapter looks at the overall impact of these different forces on potential growth in coming years. The chapter then turns to the problems inherent to measuring the business cycle. Implications for monetary and fiscal policy are drawn in the final section. The main findings are as follows.

… recent shocks may reduce potential growth…

- While the effects are subject to uncertainty, the lingering influence of recent financial turmoil and higher oil prices could reduce potential growth significantly, possibly on the order of 0.3 percentage point in the United States and the euro area.

1. Some authors argue that the unwarranted and eventually deflationary tightening of US monetary policy in 1928-29 was largely related to an excessively pessimistic assessment of potential output at the time (Orphanides, 2003).

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... while other forces may be supporting growth...

- At the same time, economic reforms may continue to boost potential growth across the OECD area. In particular, structural unemployment has been falling in major OECD economies, in part as a result of past and ongoing economic reforms. Maintaining the pace of improvement will, however, take considerable reform effort.

... compounding the uncertainty due to actual GDP revisions

- In the current circumstances, the uncertainty created by unusual supply-side developments compounds the possible errors attaching to estimates of actual GDP which have been the main drivers of output gap uncertainty over recent decades.

With respect to monetary and fiscal policy settings, the following implications may be drawn:

Uncertainty calls for reliance on a wide array of inflation indicators

- The likely decrease in potential growth, together with observed longer lags in the response of inflation to output, increases the possibility of monetary policy errors at the current juncture, reinforcing the case for central banks to continue relying on a wide array of indicators of inflationary pressure.

Output gap uncertainty can distort real-time fiscal indicators

- Errors in the cyclically-adjusted fiscal balance arising from erroneous business cycle indicators appear in most cases to be relatively small. In certain situations, however, revisions to output and unemployment gaps can be large enough that estimates of steady-state debt-to-GDP ratios could be seriously distorted by output gap uncertainty.

Supply shocks require different policy responses

- The appropriate response of fiscal policy to output gap uncertainty depends on whether such errors are caused by demand- or supply-side developments. Usually, errors in output gap estimations reflect unforeseen demand fluctuations, in which case automatic stabilisers have a useful role to play. In contrast, a situation where output gap uncertainty arises from a negative supply shock may call for partially offsetting automatic stabilisers, especially if the shock works to depress the sustainable employment level.

Impact of recent developments on potential output

Higher real energy prices reduce equilibrium output...

Because energy is an important input to the production process in OECD countries, a sustained hike in real energy prices must entail lower equilibrium output. At a basic level, a higher relative price of energy means greater intensity in the use of other inputs (labour and capital) which are available only in inelastic or limited elasticity supply, implying a fall in productive potential. At an assumed level of $120 per barrel in the projection, the cost of crude oil relative to that of output is 240% above its 20-year average in the United States and 170% above in the euro area.[2] As

2. The local currency price of Brent and the GDP deflator are used to measure the prices of crude oil and output. Consistent with this choice, the oil share in output is calculated on input-output tables at basic prices, which exclude value added tax, excise duties and retail margins.

an illustration, when using a very simple partial equilibrium framework to account for potential growth (Appendix 3.A1), such a massive move in the real cost of oil will cut about 4% off steady-state potential output in the United States and 2% in the euro area in the long run. The difference arises for two reasons. First, the share of oil and natural gas in production is about 50% larger in the United States than in the euro area. Second, the oil shock has been larger in the United States because of the falling dollar.

... and the potential growth rate...

The impact of the oil shock on annual potential growth depends on how quickly supply converges to its equilibrium value. Since neither current nor long-term potential output can be observed directly, reckoning how fast one converges to the other is fraught with difficulties. Nonetheless, the rate at which new equipment and building replace the existing capital stock may provide an indication of the speed at which current potential output converges to its long-term path. When this rate is estimated conservatively (Appendix 3.A1), the oil shock is reckoned to dent potential growth by 0.2 percentage point a year in the United States and 0.1 percentage point in the euro area in the first years of adjustment. Alternative ways of estimating the speed at which existing capital is replaced, which give greater weight to shorter-lived capital items, suggest that the near-term impact might possibly be higher (Appendix 3.A1). Moreover, it could be even larger to the extent higher oil prices lead to advance scrapping of existing capital equipment.

... but are also the flipside of growth enhancing forces

The rise in energy prices should be seen in the context of globalisation and the re-emergence of China and other developing countries in the world economy. Energy demand from fast-growing developing economies, and the associated increases in oil prices, are the flipside of the contribution these countries make to the growth of global supply, especially in manufacturing. In other words, globalisation increases the productive capacity of the world economy, reduces the prices of manufactured goods (and some tradeable services), and puts upward pressure on commodity prices. Because all effects do not occur at the same time, and in particular the fall in manufactured goods prices appears to have largely occurred before the increases in energy prices, globalisation can now seem to reduce potential output in OECD countries even though its overall contribution is positive. Furthermore, it should be noted that globalisation can hardly be seen as the sole driver of the oil price shock.

Financial turmoil has led to higher real interest rates...

As for energy, a permanently higher cost of capital relative to output implies lower equilibrium output.[3] The financial market turmoil that started in August 2007 has increased the cost of borrowing, and therefore

3. Such a contraction in potential growth is not necessarily negative for economic welfare if the previous boost was the result of a credit bubble driving real interest rates to levels that were artificially low and ultimately destabilising. See for instance Ahrend *et al.* (2008).

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the cost of capital, for home buyers and most firms, with the exception of the best-rated corporations. In the second half of 2007, real borrowing costs for firms and home buyers rose by around ½ percentage point in both the United States and the euro area.[4] While the shock was initially larger in the United States, it has been partially offset by cuts in the Federal funds rate and a (partly resulting) decrease in longer-term rates (Table 3.1).[5] Hence, the shock to capital costs that is being applied to the simple partial equilibrium framework is considerably smaller than the shock to risk spreads that has been observed so far during the turmoil. Moreover, no attempt has been made to take into account the negative impact stemming from non-price rationing, which is likely to be substantial in the near term, especially in the United States where lenders have tightened credit standards considerably since mid-2007.

Table 3.1. **Illustrative impact estimates of recent supply shocks**

	United States	Euro Area
	Per cent	
Oil price shock		
Oil and gas share	3.2	2.1
Real oil price increase relative to the previous 20 years	240	170
Impact on steady-state output	-4.1	-2.1
	Percentage points	
Medium-term impact on potential growth	-0.2	-0.1
Shock to real interest rates from the 2007 turmoil		
Change in real mortgage rates	0.5	0.4
Change in real rates charged to businesses	0.4	0.6
Medium-term impact on potential growth	-0.1	-0.2
Medium-term impact of both shocks on potential growth	-0.3	-0.3

Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/367308622753

... with possibly significant effects on potential growth

Evaluating the impact of higher capital costs on potential output is challenging for several reasons. *First*, capital intensity adjusts slowly and therefore the pre-turmoil capital intensity may have been below what would have been implied by the pre-turmoil interest rate. *Second*, instead of deciding to expand their stock of physical capital, investors may have considered the pre-turmoil low interest rates as artificial and looked through them. In the five years to mid-2007, real interest rates charged to businesses were 1.8 percentage points below their average over the

4. Business borrowing rates are measured using the yield on BBB corporate bonds. BBB rates provide a good measure of corporate borrowing costs because 70% of corporate borrowing from capital markets is rated BBB or immediately above or below at issuance (Standard and Poor's, 2007). Mortgage rates are averaged across categories of borrowers. Real rates are derived from nominal rates using a five-year moving average of the GDP deflator.
5. For US home buyers, the moderate average development masks the fact that, while rates remained broadly stable for conventional mortgages eligible for purchase by government agencies in the course of 2007, they increased substantially for other categories of borrowers.

previous ten years in the United States (0.4 percentage point in the euro area). *Third*, and alternatively, the increase in interest rates charged to private borrowers that has taken place in the context of the financial turmoil may be partly transitory and could therefore be reversed to some extent. Notwithstanding these important caveats, the shock to real capital costs is calculated to reduce annual potential growth by 0.1 percentage point in the United States and 0.2 percentage point in the euro area in the first years of adjustment towards new capital costs.

The role of structural reforms in increasing potential growth

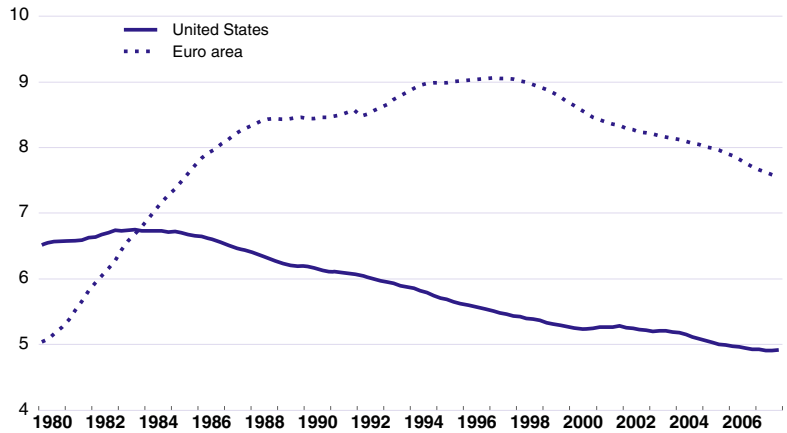
Successful reform raises potential output

Policy reforms which serve to raise labour productivity or employment play an important role in improving the productive potential of economies. As regards employment, there are two categories of measures by which the employment rate could be sustainably increased: the first aims at expanding the labour force (*via* increases in the retirement age, for example), the second at achieving a permanent reduction in unemployment.

Equilibrium unemployment is on a falling trend…

The OECD routinely produces estimates of the structural unemployment rate, defined as the rate of unemployment consistent with stable inflation (the so-called NAIRU, or non-accelerating inflation rate of unemployment).[6] The latest updating exercise confirms the continuation of the decline in the structural unemployment rate for most OECD economies over the most recent period, to the end of 2007 (Gianella *et al.*, 2008). This is illustrated in Figure 3.1 which shows the evolution of

Figure 3.1. **The estimated NAIRU in the United States and the euro area**



Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/367418222426

6. The general background to and details of previous OECD work estimating time-varying NAIRUs within the Phillips curve framework are given by Richardson *et al.* (2000). The time-varying NAIRU is obtained *via* the estimation of a reduced form Phillips curve equation using a Kalman filter procedure.

the estimated NAIRU for the United States and the euro area over the past two decades. Overall, the cumulative decrease in the NAIRU over the past decade has been substantial, in particular for the euro area.

... with non-negligible implications for potential growth

During this period, the decline in the NAIRU raised the rate of potential output by approximately 0.1 percentage points *per annum* in the euro area and by about half that in the United States. This means that, all other things being equal, a similar fall in the structural unemployment is needed in the future to maintain potential growth at its recent rate.

Reforms contributed significantly to this improvement

OECD studies indicate that changes in labour and product market policy settings can explain much of the non-cyclical movements of the unemployment rate (Box 3.1). On the basis of the most recent estimates, Table 3.2 reports the respective contributions of different structural reforms conducted over the period 1995-2003 to the evolution of the estimated NAIRU for, respectively, the United States and the euro area. However, the possibility that omitted variables could also play a substantial role in driving the NAIRU cannot be excluded. For example, recent large immigration flows may in some cases have helped to improve labour market performance but this factor is unlikely to continue to reduce structural unemployment.

Box 3.1. **Explaining the dynamics of structural unemployment**

A large body of empirical research has studied the impact of structural features on aggregate unemployment, stressing the need for fundamental labour market reforms to deal with high and persistent unemployment. An analysis of the determinants of structural unemployment conducted for the *OECD Jobs Strategy* (Bassanini and Duval, 2006) showed that the level of unemployment benefits, the tax wedge and stringent product market regulation are robustly associated with unemployment rates (and also with participation). Changes in policies explain almost two-thirds of non-cyclical unemployment changes in the long run, on average, in OECD countries. Moreover, the precise impact of a given policy reform depends on the institutional context, tending to be larger when implemented in an overall more employment-friendly environment.

More recent OECD work has investigated the impact of a similar selection of structural variables directly on NAIRUs rather than on unemployment rates in order to better correct for the cycle (Gianella *et al.*, 2008). More precisely, the change in the estimated NAIRU is regressed on the current and lagged changes in a selection of institutional variables for a sample of 19 OECD economies over the period 1978 to 2003. The study confirms that, among the standard indicators of labour and product market rigidities, the level of the tax wedge, the replacement rate and the level of product market regulation have a strong influence on the structural unemployment rate.[1] For some countries union density is also found to play a role in explaining the dynamics of the NAIRU. Overall, the elasticities with respect to the main policy variables considered are of a similar order of magnitude as those found by Bassanini and Duval, albeit slightly lower: on average, it is estimated that a 10-percentage point reduction in the tax wedge, a 10% reduction in unemployment benefits and a decline in product market regulation by two standard deviations would be associated with a drop in the NAIRU by respectively 1.7, 0.3 and 0.6 percentage points. For countries where it is significant, a 10-percentage point reduction in union density would imply a decrease of 0.35 percentage point of the NAIRU.

1. Data on minimum wage regulations, for the countries where they exist, are unfortunately not available over a sufficiently long time period. A proxy for the user cost of capital is also added to the equation, but not considered here given the focus on structural reforms.

Table 3.2. **Contributions of product and labour market reforms to changes in the structural unemployment**

	Contributions of 1995-2003 reforms					ΔNAIRU	ΔNAIRU
	Tax wedge	Replacement rate	PMR	Union density	Total	1995-2003	1995-2005
United States	0.1	0	-0.2	-0.1	-0.2	-0.5	-0.6
Euro area	-0.2	0.1	-0.7	-0.1	-0.9	-1	-1.2

Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/367357633706

Structural reforms could continue to boost potential output…

A sustained pace of policy reform will be required to achieve a similar decline in the structural unemployment rate in future years. Nonetheless, the level of the structural unemployment suggests that there is significant room for further decreases in the NAIRU, especially in the euro area. If the pace of policy reforms were sustained, their positive contribution to potential growth would be of the order of 0.1 percentage point *per annum* in the euro area and 0.02 percentage point in the United States.

… also via increased labour force participation and productivity…

The effects of structural reforms on potential growth may extend beyond lower structural unemployment. For example, by encouraging more working-age people to look for jobs they could increase the participation rate of older workers. The effective retirement age has, however, already been raised quite substantially in many countries and it will take considerable reform efforts just to have the same contribution from this factor to potential growth in the future as in the recent past. The same probably applies to product market reforms which have increased competitive pressures in network and distribution industries in particular, but where the available evidence suggests that the pace of progress has been relatively stable. Finally, the downward trend in hours worked has already shown signs of inflection in many countries.

… provided the pace of reform is maintained

Summing up, sustaining the contribution from structural reform to potential growth into the future will require a determined effort. Even if this effort can be made, however, the energy and credit shocks are likely to imply a slowdown in growth, possibly on the order of 0.3 percentage point *per annum* in the euro area and the United States. To the extent that the contribution from structural reform falls, it will accentuate the effects of adverse shocks on potential growth.

Problems in assessing the cyclical situation

Business cycle indicators are often subject to significant revisions

Ideally, estimates of an economy's position in the business cycle should be available on a timely basis and subject to minimal revision so that early outturn estimates already provide a reliable picture of the "true" state of the economy. In practice, real-time estimates of output and unemployment gaps depend not only on estimates of potential output or the NAIRU, but equally on, respectively, current data on GDP growth or unemployment levels. Early vintages of these series are frequently and

sometimes substantially revised over time, implying that output or unemployment gap estimates based on early data releases can be misleading, and sometimes quite significantly so.

Uncertainty over actual GDP is the main source of gap revisions

Annual revisions to gap estimates exceeding half a percentage point are not unusual, even several years after the initial estimate is published, though the magnitude tends to decline gradually over time. Historically, in two-thirds of the OECD countries examined, and all of the G10 economies except Italy and Sweden, revisions to data for actual GDP appear to have been a more important source of gap revisions than revisions to potential GDP over the past one or two decades (Table 3.3).

Table 3.3. **Mean absolute revision between different vintages of data**

	Output gap[1]	Actual real GDP[1]	Potential real GDP[1]
United States	0.46	0.61	0.43
Japan	1.09	0.82	0.35
Euro Area	0.26	0.20	0.14
Germany	0.41	0.43	0.35
France	0.36	0.35	0.15
Italy	0.35	0.22	0.34
United Kingdom	0.38	0.42	0.22
Canada	0.37	0.50	0.26

Note: The sample period is 1994 to 2003 for all countries but the euro area where it is 1997 to 2003. Concretely, revision between vintage published in year t+1 and t+4 in the spring issue of the *OECD Economic Outlook*.
1. Expressed as the log difference.
Source: Pain and Koske (2008).

StatLink http://dx.doi.org/10.1787/367358511873

Forecasts of business cycle indicators are even more uncertain

The accuracy with which a business cycle indicator can be projected is an important criterion for its usefulness in policy setting,[7] as changes in the stance of macroeconomic policy affect the aggregate economy only with a certain time lag. Recent OECD research (Pain and Koske, 2008) shows that the uncertainty attached to estimates of the cyclical position is significantly magnified when turning to forecasts, even those at relatively short-term horizons: while the quality of current year projections of business cycle measures – though not unproblematic – is generally acceptable, this contrasts with year-ahead projections of often questionable information content (Box 3.2).

Box 3.2. **General business cycle measurements problems**

Work undertaken recently by the OECD (Pain and Koske, 2008) looks at forecasts, "now-casts", and first-vintage-data based calculations of business cycle measures, comparing them with the "true" underlying business situation as calculated from later vintages of data.

7. In this respect, estimation methods that also directly provide information about the precision, and hence the uncertainty, attached to estimates are useful.

Box 3.2. **General business cycle measurements problems** *(cont.)*

The precision of gap estimates based on real-time data

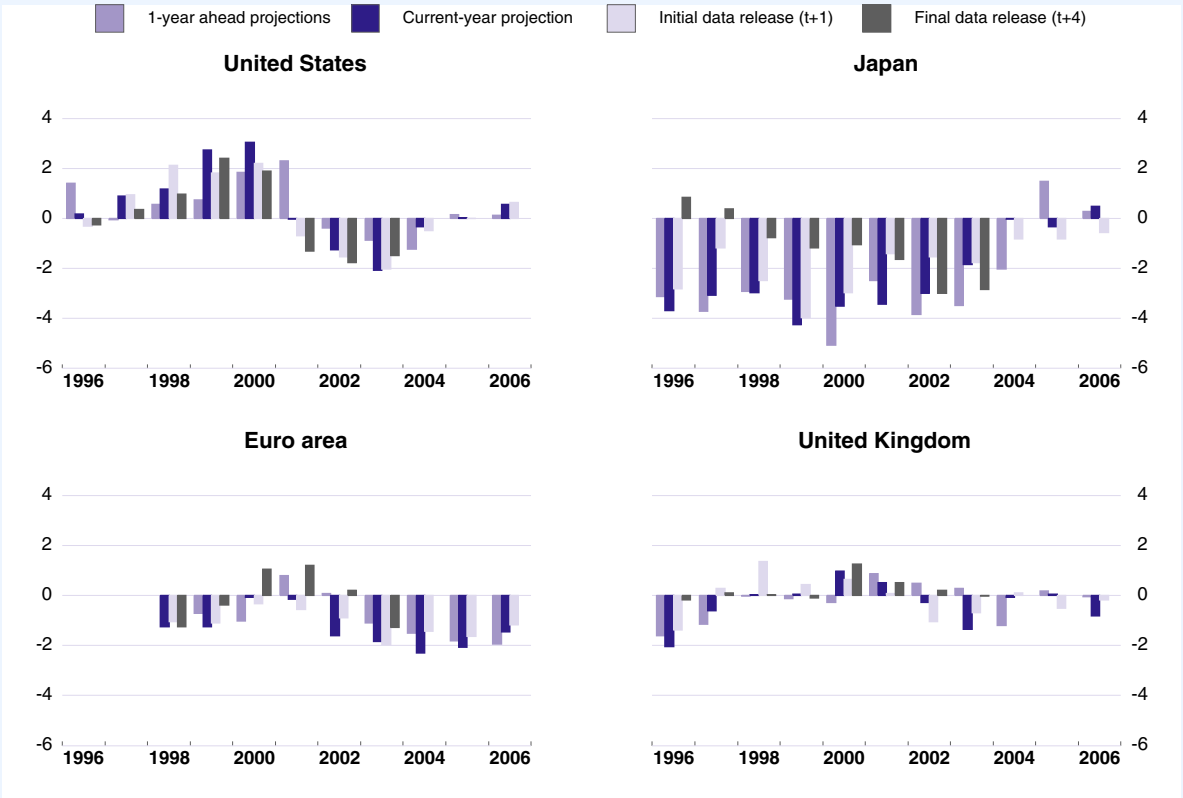
As discussed in the main text, given frequent and sometimes substantial revisions of data over time, estimates of the cycle based on early vintages of data provide only imperfect information about the underlying state of the economy. However, while the initial outturn estimates of the output and unemployment gap are imprecise, initial estimates in a particular year are generally highly correlated with subsequent estimates for that year. Initial estimates are also good predictors of the sign of the gap: for 80% of the available observations, the sign of the initial outturn estimate of the output gap in a particular year is the same as that of the revised estimate made three years later.

The accuracy of current-year and one-year-ahead projections of the output and unemployment gaps

Making use of projections from successive spring issues of the *OECD Economic Outlook*, the OECD work also examines the quality of current year and one-year-ahead projections of different gap measurements. The current-year projections of gap measures (projections for year *t* made in year *t*) appear to be reasonably good predictors of the initial (projections for year *t* made in year *t+1*) and final outturn (projections for year *t* made in year *t+4*) estimates (figure below). The projections are generally highly correlated with the outturn estimates and the sign of the gap, as well as its direction of change. Nonetheless, the current-year projections of the different gap measures are statistically biased for most countries.

In contrast to the current year projections, the one-year-ahead projections (for year t made in year t-1) appear to be rather bad predictors of the initial and final outturn estimates (see figure). The correlations between the projections and the outturn estimates are often very low and not significantly different from zero. Moreover, both the sign and the direction of change of the gap are wrongly predicted in many cases.

Output gaps: different vintages of data and projections



Source: Pain and Koske (2008).

StatLink http://dx.doi.org/10.1787/367507610328

Business cycle indicators play a key policy role

Indicators of the current and projected cyclical position of the economy play an important role in monetary and fiscal analysis and surveillance. In the current situation, and as discussed above, potential growth may fall in response to energy and finance related shocks, which have added to the usual uncertainty about the cyclical position.

Overestimating potential growth may mean understating price pressures…

As business cycle indicators are often an important input in inflation projections, uncertainty with respect to these variables results in greater uncertainty around inflation forecasts (Box 3.3), complicating monetary policy setting. Even though monetary policy decisions may be based on an extensive array of potential indicators of inflationary pressures,[8] reductions in growth potential would need to be incorporated into the central bank policy response function. To the degree that falls in potential remain unnoticed, they may lead to an underestimation of current and future inflationary pressure, with the attendant risk of monetary policy becoming inappropriately accommodating.

… and an upward shift in inflation expectations would be costly to correct

Given the evidence that the responsiveness of inflation to domestic demand pressures has decreased,[9] a reduction in potential may only become visible in rising inflation with significant lags. With a lowered response of inflation to supply-demand imbalances, an inflation overshoot will be more costly to correct through monetary policy. If undesirably high inflation outcomes were accompanied by an upward shift in inflation expectations, central banks could even find themselves in the unenviable position of having to increase interest rates in an attempt to stop the upward drift of inflation expectations (and inflation) in conditions of weak economic activity and increasing unemployment.

Output gap measures still have a useful role to play…

While greater uncertainty about potential would tend to reduce the policy weight given to output gap measures,[10] if underlying price pressures showed up in actual inflation data with an increasing lag, this would also imply a reduction in the information content of current inflation indicators (and potentially inflation projections to the degree that forecasting accuracy would be affected). Greater uncertainty about potential output thus need not imply giving more weight to indicators of current (and possibly projected) inflation relative to output gap measures when setting monetary policy.

… but uncertainty affects monetary policy choices

Greater uncertainty may affect the strength of monetary policy reactions to new information, depending on whether the costs of policy

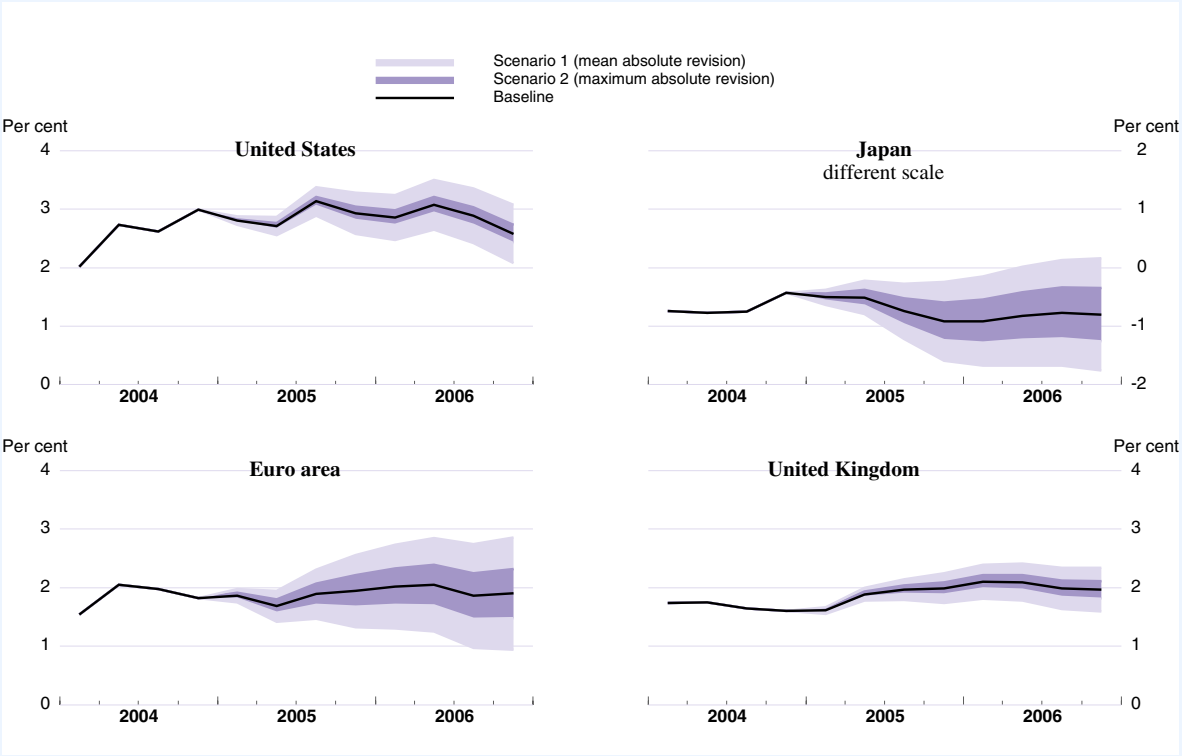
8. Central banks differ in the weight they ascribe to these other indicators, but they would normally include a range of different statistical and exclusion-based measures of underlying (or "core") inflation; commodity and import prices; capacity utilisation, as well as credit and possibly monetary aggregates.
9. This is probably at least partially driven by an increasing importance of the global business cycle, as well as possibly connected to an enlarged role for prices of commodities and manufacturing imports (see OECD, 2007).
10. Furthermore, a lower short-run trade-off between inflation and activity has the side-effect of complicating the measurement of output gaps.

Box 3.3. **The impact of uncertainty about business cycle indicators on inflation projections**

Uncertainty about output gaps has consequences for the reliability of inflation projections that use estimates of the short-run trade-off between inflation and activity. The figure below shows an estimate of the hypothetical error in inflation projections (starting from the first quarter of 2005) which would have been caused had output diverged constantly (and to the same side) from its true potential level by an amount corresponding to the observed mean absolute (respectively maximum absolute) revision for a given country's output gap.[1] The degree of such inflation forecast uncertainty varies considerably across countries, reflecting both different coefficient estimates of gaps in the country models of inflation, as well as different degrees of output gap uncertainty. For the United Kingdom and the United States the uncertainty around the inflation forecast created by output gap uncertainty is relatively low. It is notably higher for Japan and the euro area.[2] A high degree of uncertainty around the constructed euro area inflation projection reflects the high uncertainty around the projections for Germany and Italy, in part offset by the comparatively low uncertainty around the French forecast.[3]

The impact of output gap uncertainty on inflation forecasting

Percentage points



Source: Pain and Koske (2008).

StatLink http://dx.doi.org/10.1787/367561261835

1. The baseline scenario estimates consumer price inflation with a Phillips-curve model until the end of 2004, a dynamic forecast of inflation being generated to the end of 2006 employing actual values of all the exogenous variables. Two alternative scenarios are then estimated for inflation. In the first, the level of the gap for each of the economies was altered by the mean absolute revision observed during the period 1995 to 2006 between the current-year projection and the final outturn estimate at time *t*+4. In the second, the gap was altered by the maximum absolute revision observed over this period. This provides an estimate of the upper bound of the possible degree of uncertainty.
2. The euro area forecasts are obtained as a weighted average of the forecasts for Germany, France and Italy, employing 2005 consumption weights.
3. Low uncertainty around the French forecast results from a combination of low output gap uncertainty and a small output gap elasticity of inflation.

errors are symmetric or not. Asymmetric risks, such as those potentially resulting from either significant deflation risk or a danger of asset price bubble build-ups, could be seen as arguing for stronger monetary policy responses when greater uncertainty increases the likelihood of the more undesirable outcomes. This reasoning may, however, not hold in situations where policy errors in *both* directions carry significant risk of resulting in particularly bad outcomes (*e.g.* if the risk of deflation is mirrored by that of stagflation). When risks are of comparable magnitude on both sides, the presence of uncertainty ceases to require that monetary policy should necessarily respond more aggressively to a downturn.

Cyclically-adjusted fiscal indicators remain reliable…

Given the direct link from potential and unemployment gaps to measures of the structural budget balance, the uncertainties discussed above have direct relevance to the assessment of the fiscal position and stance.[11] In practice, however, errors in the cyclically-adjusted balance arising from erroneous business cycle indicators appear in most cases to be relatively moderate. Over the period 1995-2003, on average across 21 OECD economies, revisions to the level of the output gap accounted for revisions of around 0.4 percentage point of GDP in the cyclically-adjusted primary balance. Hence, gap revisions can explain some, but by no means the major part, of the *ex post* revisions made to structural budget estimates. A fiscal position that would be considered sound (or unsound) would generally be regarded as such under reasonable alternative scenarios (Figure 3.2).[12] As regards *changes* in the fiscal balance, both "now-casts", and first-vintage-data based calculations of the fiscal stance are fairly good predictors of the "true" fiscal stance.

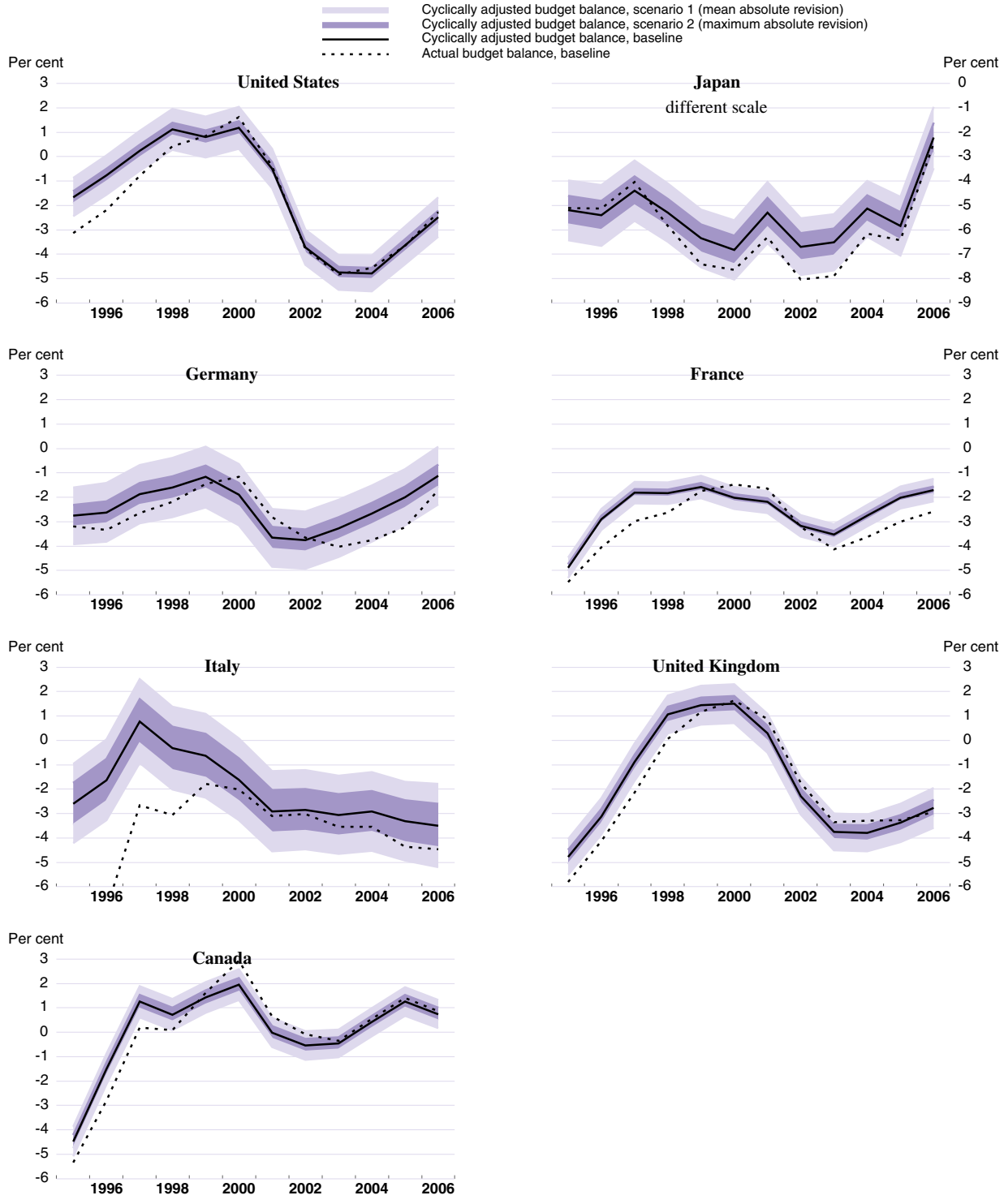
… with exceptions…

Nevertheless, in some countries, revisions to the output and unemployment gap can at times be so large as to induce revisions to the cyclically-adjusted primary balance of more than 1% of GDP. In these cases, estimates of steady-state debt-to-GDP ratios could be seriously distorted by output gap uncertainties, which would also matter if a country is close to meeting or missing a relevant policy target.

11. In addition to revisions of gap estimates, revisions to the cyclically-adjusted balance as a proportion of GDP can result from revisions to actual revenues and disbursements, as well as revisions to GDP. Quantitatively, GDP revisions play, however, only a minor role in driving revisions to the GDP shares of the cyclically-adjusted balance and of its components.
12. Alternative scenarios for the cyclically-adjusted fiscal balance (as a share of GDP) are derived by varying the size of the change in the output and unemployment gaps. The baseline scenario is one that uses the change in the output and unemployment gaps published in the spring 2007 issue of the *OECD Economic Outlook*. Two alternative scenarios are obtained by varying the change in the output and unemployment gaps by the mean absolute revision (respectively, the maximum absolute revision) observed during the 1995-2003 period. Mean and maximum absolute revisions are determined based on the differences between the projected current-year change in the gaps and the revised estimate of that change made four years later.

Figure 3.2. **Gap uncertainty and the level of the cyclically adjusted budget balance**

Per cent of GDP



Note: Excludes receipts from sales of mobile phone licenses.

Source: Pain and Koske (2008).

StatLink http://dx.doi.org/10.1787/367450772873

... but policy errors could occur from negative supply shocks

More generally, the response of fiscal policy to output gap uncertainty would also depend on whether such errors are caused by demand or supply-side developments. Where errors in the output gap reflect unforeseen demand fluctuations, automatic stabilisers will have a useful role to play. In contrast, a negative supply shock will ultimately require a recalibration of fiscal policy settings. The shape of the necessary adjustment will depend on the nature of the supply shock.[13]

13. Negative productivity shocks, by lowering real wages and profits, would be expected to lower government tax revenue, but also the government wage bill and social transfers, with any net effect on the fiscal balance likely to be small. In contrast, an increase in the equilibrium unemployment rate would worsen the fiscal position both through decreasing tax revenue and an increased need for transfers (*e.g.* unemployment benefits), implying a need for some off-setting of automatic stabilisers through fiscal tightening.

APPENDIX 3.A1

Deriving illustrative estimates of the impact of changes in factor prices on supply

A simple framework is used to gauge the impact of recent supply shocks

Recent developments in energy and capital markets have led to increases in the prices of production factors relative to output. A production function framework has been used to provide illustrative estimates of the impact of these changes on supply. The framework is simple because it looks at the implications of changes in factor prices on steady-state output without taking account of general-equilibrium feedbacks. This choice has been made because it enables the shocks to be calibrated directly on the basis of observed price changes. Nevertheless, the framework used here has the limitation that the real wage is assumed to remain steady in the face of shocks to real energy and capital costs. Related to this, any effects of a wider wedge between firms' real labour costs and workers' real wages on equilibrium unemployment are not taken into account.

The model is based on a well-established specification…

In the vein of a wide body of empirical research following the seminal work by Rasche and Tatom (1977) and Darby (1982) and recently illustrated by Duval and Vogel (2008), and as in the FRB/US model used by the US Federal Reserve (Brayton and Tinsley, 1996), the present framework uses a standard multi-factor Cobb-Douglas production function

$$Y = \prod_{i=1}^{n} F_i^{\alpha_i} \qquad [1]$$

where the factor shares α_i sum to one. If p_i denotes the price of factor i relative to output, profit maximisation implies that the elasticity of factor i to a change in its relative price is given by:

$$\frac{\Delta Fi/Fi}{\Delta Pi/Pi} = \frac{\partial F_i/\partial p_i}{F_i/p_i} = -\frac{1}{1-\alpha_i} \qquad [2]$$

As a result, steady-state output responds to a change in the relative factor price p_i with the elasticity:

$$\frac{\Delta Y/Y}{\Delta Pi/Pi} = \frac{\partial Y/\partial p_i}{Y/p_i} = -\frac{\alpha_i}{1-\alpha_i} \qquad [3]$$

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The impacts of movements in relative factor prices on steady-state output are estimated by integrating the ordinary differential equation (3).

… using four production factors

Four factors (n = 4) enter the production function: labour, non-residential business capital, dwellings and oil (including natural gas because its price is closely tied to that of oil). The model includes residential buildings in the capital stock because they produce housing services, in the form of market and imputed rents, which are part of GDP. Government capital is not included because the national accounts do not measure its contribution to output. The price of capital p_i which determines production choices is the real user cost of capital, which combines the real interest rate paid by the borrower and depreciation. The average depreciation rate of business capital depends critically on whether different categories of capital are weighted according to value following the conventional "capital stock" approach or to their efficiency profiles following the "capital services" approach (Schreyer, 2003).[14] Because both approaches have legitimate foundations and have been applied in empirical analysis (Beffy *et al.*, 2006; Schreyer and Webb, 2006), both are used here. For oil, the relative factor price is simply the local currency price of Brent as a ratio to the GDP deflator.[15] In the case of an oil shock, the present approach, which assumes constant factor shares, may involve some overestimation of the long-term reduction in the level of potential output. The reason is that, because new capital will be more energy-efficient, the oil and gas share is likely to trend down over time after an oil shock, gradually limiting the impact.

Included for consistency, housing capital does not drive the annual results

Because the scrapping rate of residential buildings is very low, this category of capital – which has been retained in the analysis to be consistent with national account data – has very little impact on the reported results. In all the reported simulations (in both the main text and the appendix), resetting the assumed change in mortgage rates to zero never changes the estimated impact on potential growth by more than 0.1 percentage points. At the same time, precisely because houses depreciate slowly, their cost of capital is very sensitive to the interest rate,

14. While the scrapping rate of capital does not appear explicitly in the services approach as it does in the stock approach, its level can be derived by relating the change in the volume of capital services to the level of investment. See for instance Beffy *et al.* (2006), footnote 15.
15. International Energy Agency (IEA) indices of real energy prices for end users might be considered as a potential alternative. The local currency price of Brent relative to the GDP deflator has been preferred for three reasons. First, the IEA indices do not cover services. In a framework based on an economy-wide production function, services, which make up significantly more than half of OECD output, have to be taken into account. Second, the economy-wide approach requires considering the price of oil when it enters the economy rather than when it reaches end users because value added in the transport and processing of oil is part of GDP. Third, price indices for end users include excise duties, retail margins and non-deductible value-added tax, three items which are not reckoned in the basic prices at which the oil shares are calculated. As such, price indices for end users are not well suited to the present study.

implying that shocks to mortgage rates can have large effects on the steady-state level of the housing stock. Because these steady-state effects phase in only very slowly, they are probably negligible in practice compared with other long-term trends affecting housing supply including demography and urban planning.

Estimated steady-state impacts are translated into annual effects

Steady-state effects are converted into annual impacts using the average scrapping rate of the stock of capital. This approach may be thought (but is not guaranteed) to provide a lower bound on the speed of adjustment, especially when the shock is large, because the renewal rate of capital is likely to accelerate in response to a large shift in factor prices. Part of the output adjustment in response to an oil shock also does not require the renewal of capital and can therefore occur faster. Furthermore, the structure of the model, where potential adjusts smoothly to its new long-term equilibrium path, by definition ignores the possibility that supply may contract by more in the near term.[16] On the other hand, energy-intensive capital often has service lives that are well above average. Because it depends on the renewal rate of capital, the estimated speed of convergence will differ between the capital stock and services approaches.

Calibrated on recent data…

The data are taken from various sources. Shares for business and housing capital are calculated on 2004 data (the most recent vintage that is unlikely to be revised) using the OECD National Accounts database. Nominal interest rates are taken from Datastream, the German Bundesbank and the Bank of France. Real interest rates are calculated as nominal rates minus a five-year moving average of the inflation rate of the GDP deflator. The yield on BBB-rated corporate bonds serves as proxy for the average interest rate charged to businesses for non-residential capital. Scrapping rates of the capital stock are taken from the *OECD Economic Outlook 78 and 82 databases* for the capital stock and services approaches, respectively. Housing capital is assumed to depreciate by 3% a year in the United States as estimated by Harding *et al.* (2007) and by 1.2% in the euro area as derived from the US rate and the information in the *OECD Economic Outlook 78 medium-term database*. The oil and gas share in production (which can equivalently be seen as the intensity of oil and gas usage in production) is taken from Blanchard and Galí (2007) for the United States and calculated using the *OECD Input-Output Tables* for the euro area. Brent prices are from Datastream and the GDP deflator from the *OECD Economic Outlook 83 database*.

… the main model suggests significant oil shock effects…

When the scrapping rate of existing capital is estimated using the conventional stock approach, the oil shock is reckoned to dent potential growth by 0.21 percentage point a year in the United States and 0.06 percentage point in the euro area in the first years of adjustment (Table 3.4). The capital stock approach can be considered as providing a

16. A model with vintage capital would capture this effect.

Table 3.4. **Detailed illustrative estimates of the impact of real energy and capital cost increases**

	Capital stock approach		Capital services approach	
	United States	Euro area	United States	Euro area
Oil price shock	*Per cent*			
Oil and gas share	3.2	2.1	3.2	2.1
Real oil price increase relative to the previous 20 years	240	170	240	170
Impact on steady-state output	-4.1	-2.1	-4.1	-2.1
	Percentage points			
Medium-term impact on potential growth	-0.21	-0.06	-0.51	-0.20
Shock to real interest rates from the 2007 turmoil	*Per cent*			
Capital share	39	49	39	49
of which: housing	10	9	10	9
non-residential business capital	30	40	30	40
User cost of homes	8	4	8	4
User cost of business capital	12	8	21	17
	Percentage points			
Change in real mortgage rates	0.5	0.4	0.5	0.4
Change in real rates charged to businesses	0.4	0.6	0.4	0.6
	Per cent			
Resulting change in business capital cost	3	7	21	17
Resulting change in residential capital cost	7	10	7	10
Impact on steady-state output	-2.1	-5.9	-1.5	-3.3
	Percentage points			
Medium-term impact on potential growth	-0.1	-0.2	-0.1	-0.3
Medium-term impact of both shocks on potential growth	-0.3	-0.3	-0.7	-0.5

Source: OECD calculations.

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central estimate of the relevant scrapping rate. On the one hand, energy-intensive capital typically has longer service lives than other types of non-residential capital and is therefore likely to have a scrapping rate below the average for the stock approach. On the other hand, in the wake of a large shift in real oil prices, energy-intensive capital could well be upgraded and replaced more rapidly than past average scrapping rates would indicate.

… while capital stock adjustment could be even faster

As a (possibly extreme) alternative, if the scrapping rate is estimated using the capital services approach, which gives more weight to short-lived equipment such as information and communication technology, convergence will be estimated to be much faster. In the capital services framework, the illustrative steady-state estimates of the oil shock translate into initial annual reductions of potential growth of 0.51 percentage point in the United States and 0.20 percentage points in the euro area. However, even following a large oil shock, energy-intensive facilities (for instance refineries, power plants, cement works and buildings) are unlikely to be replaced at the very high rates of 13-16%

per annum that are implied by the capital services approach.[17] The renewal rate of capital taken from the capital services framework is therefore most likely to lead to overestimating the speed at which installed equipment adjusts to the shift in the real price of oil.[18]

The estimated effects of financial turmoil are also significant

The effects of the 2007 rise in real interest rates are also significant, reducing potential growth by an estimated 0.1 percentage point in the United States and 0.2-0.3 percentage point in the euro area. The impact is larger in the euro area because businesses have been confronted with a greater rise in real interest rates and the capital share in value added is higher. In practice, however, businesses may finance themselves in international markets and the cost of capital relevant for the decision on capital intensity may not correspond to the real interest rate on firms' domestic financial markets. The implication would be that the effects of the shock would be similar across the OECD area.

17. The scrapping rate is very high in the capital services framework because this approach puts a strong weight on capital that is replaced quickly such as information technology equipment and software.
18. Some models incorporate much faster adjustment speeds because the response to an oil shock can happen in part by cutting energy consumption before updating capital. For instance, potential output absorbs two-thirds of an oil shock within two years in the FRB/US model used by the Federal Reserve (Brayton *et al.*, 1997). In the framework used here, such a rapid adjustment speed would reduce potential growth by 2.3 percentage points in 2008 and 1.1 percentage points in 2009. On the other hand, as newly installed capital is more energy-efficient than what it replaces, a partial rebound in potential output is likely to follow the initial contraction.

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TABLE OF CONTENTS

Boxes

Tables

Figures

Conventional signs

$	US dollar	.	Decimal point
¥	Japanese yen	I, II	Calendar half-years
£	Pound sterling	Q1, Q4	Calendar quarters
€	Euro	Billion	Thousand million
mb/d	Million barrels per day	Trillion	Thousand billion
. .	Data not available	s.a.a.r.	Seasonally adjusted at annual rates
0	Nil or negligible	n.s.a.	Not seasonally adjusted
–	Irrelevant		

Summary of projections

	2007	2008	2009	2007 Q4	2008 Q1	2009 Q2	2009 Q3	2009 Q4	2009 Q1	2009 Q2	2009 Q3	2009 Q4	Fourth quarter 2007	Fourth quarter 2008	Fourth quarter 2009
	Per cent														
Real GDP growth															
United States	2.2	1.2	1.1	0.6	1.0	-0.5	0.7	0.2	1.0	1.4	2.2	3.0	2.5	0.3	1.9
Japan	2.1	1.7	1.5	2.6	3.3	1.1	1.0	1.3	1.6	1.6	1.7	1.7	1.5	1.7	1.6
Euro area	2.6	1.7	1.4	1.2	3.1	0.2	1.1	1.2	1.4	1.7	1.8	1.9	2.1	1.4	1.7
Total OECD	2.7	1.8	1.7	1.7	2.1	0.5	1.2	1.2	1.7	2.0	2.4	2.7	2.6	1.3	2.2
Inflation[1]															
United States	2.5	3.2	2.0	3.9	3.5	3.6	2.4	2.0	1.8	1.7	1.6	1.6	3.4	2.9	1.6
Japan	0.1	0.9	0.4	1.6	1.2	0.6	0.3	0.3	0.3	0.4	0.5	0.6	0.5	0.6	0.5
Euro area	2.1	3.4	2.4	4.8	4.2	3.3	2.6	2.4	2.3	2.2	2.1	2.0	2.9	3.1	2.1
Total OECD	2.2	3.0	2.1	3.5	3.4	3.2	2.5	2.3	2.0	1.9	1.8	1.8	2.8	2.8	1.9
Unemployment rate[2]															
United States	4.6	5.4	6.1	4.8	4.9	5.2	5.5	5.8	6.0	6.2	6.2	6.1	4.8	5.8	6.1
Japan	3.9	3.8	3.8	3.9	3.8	3.8	3.8	3.9	3.9	3.8	3.7	3.7	3.9	3.9	3.7
Euro area	7.4	7.2	7.4	7.1	7.1	7.2	7.2	7.3	7.4	7.4	7.5	7.5	7.1	7.3	7.5
Total OECD	5.6	5.7	6.0	5.5	5.6	5.7	5.7	5.9	6.0	6.0	6.0	6.0	5.5	5.9	6.0
World trade growth	7.1	6.3	6.6	4.8	6.5	6.1	6.1	6.3	6.6	6.9	7.0	7.1	7.2	6.2	6.9
Current account balance[3]															
United States	-5.3	-5.0	-4.4												
Japan	4.8	4.4	4.4												
Euro area	0.2	0.1	0.0												
Total OECD	-1.4	-1.3	-1.1												
Cyclically-adjusted fiscal balance[4]															
United States	-3.2	-5.2	-4.4												
Japan	-2.6	-1.6	-2.5												
Euro area	-0.7	-1.0	-0.8												
Total OECD	-2.0	-2.8	-2.5												
Short-term interest rate															
United States	5.3	2.7	3.1	5.0	3.2	2.6	2.6	2.5	2.3	2.6	3.4	4.0			
Japan	0.7	0.8	0.7	0.8	0.8	0.9	0.9	0.8	0.7	0.7	0.8	0.8			
Euro area	4.3	4.5	4.1	4.7	4.5	4.5	4.5	4.4	4.2	4.1	4.1	4.1			

Note: Real GDP growth, inflation (measured by the increase in the consumer price index or private consumption deflator for total OECD) and world trade growth (the arithmetic average of world merchandise import and export volumes) are seasonally and working-day-adjusted annual rates. The "fourth quarter" columns are expressed in year-on-year growth rates where appropriate and in levels otherwise. Interest rates are for the United States: 3-month eurodollar deposit; Japan: 3-month certificate of deposits; euro area: 3-month interbank rate.

Assumptions underlying the projections include:

- no change in actual and announced fiscal policies;
- unchanged exchange rates as from 13 May 2008; in particular 1$ = 104.44 yen and 0.64 ;

The cut-off date for other information used in the compilation of the projections is 23 May 2008.

1. USA; price index for personal consumption expenditure, Japan; consumer price index and the euro area; harmonised index of consumer prices.
2. Per cent of the labour force.
3. Per cent of GDP.
4. Per cent of potential GDP.

Source: OECD Economic Outlook 83 database.

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