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Implications of Output Gap Uncertainty in Times of Crisis

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IMPLICATIONS OF OUTPUT GAP UNCERTAINTY IN TIMES OF CRISIS

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ABSTRACT/RÉSUMÉ

Implications of output gap uncertainty in times of crisis

This paper analyses the monetary and fiscal policy implications of output gap estimates in times of crisis. The widening of output gaps observed in major OECD economies in the wake of the recent crisis has been mainly due to total factor productivity gaps, except in the United States where it essentially resulted from a large increase in the unemployment gap. As indicated by "positive" Taylor rules, output gaps influence policy-controlled interest rates and are in principle important indicators to guide monetary policy decisions. However, these gaps are estimated with a large margin of uncertainty, especially when composed mainly of TFP gaps. Given the high uncertainty of output gap estimates at present, monetary policy should put more weight on alternative indicators of inflation pressure such as wage settlements, trends in unit labour costs and a wide range of indicators of inflation expectations. The recent fall in margins observed in some countries may, for instance, translate into a combination of wage moderation and upward price pressure as firms try to rebuild their margins. In the United States, the large unemployment gap could also keep wage inflation under pressure despite a flattening Phillips curve. These downward pressures should not, however, trigger a deflationary spiral as long as inflation expectations stay anchored. As regards fiscal policy, output gaps remain necessary inputs to assess the fiscal stance adjusted for the cycle, such measures of underlying fiscal balances being reasonably robust to output gap uncertainty.

JEL classification codes: E23; E24; E31; E52; E62.
Keywords: Monetary policy, inflation, output gap, unemployment gap, fiscal policy.

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Implications de l'incertitude des écarts de production en temps de crise

Cet article étudie les implications pour les politiques monétaire et budgétaire des écarts de production en période de crise. L'élargissement des écarts de production observé dans les principales économies de l'OCDE dans le sillage de la crise récente a été principalement le résultat d'écarts de productivité totale des facteurs, excepté aux États-Unis où il a principalement résulté d'une augmentation significative de l'écart de chômage. Comme indiqué par des règles de Taylor estimées, les écart de production influencent les taux d'intérêt contrôlés par les banques centrales, et constituent en principe des indicateurs importants pour guider les décisions de politique monétaire. Toutefois, ces écarts sont estimés avec une grande marge d'incertitude, en particulier lorsque composés principalement d'écarts de PTF. Étant donné la forte incertitude entourant les estimations d'écarts de production à ce jour, la politique monétaire devrait accorder plus de poids à des indicateurs alternatifs des pressions inflationnistes comme la fixation des salaires, les tendances des coûts unitaires du travail et un large éventail d'indicateurs d'anticipations d'inflation. La chute récente des marges observée dans certains pays pourrait, par exemple, se traduire par une modération salariale et par des pressions à la hausse des prix lorsque les entreprises tentent de rétablir leurs marges. Aux États-Unis, l'important écart de chômage pourrait également garder l'inflation salariale sous pression en dépit de l'aplatissement de la courbe de Phillips, dans la mesure où l'ajustement des salaires a jusqu'à présent été limité. Ces pressions à la baisse ne devraient toutefois pas entraîner de spirale déflationniste tant que les anticipations d'inflation restent ancrées. Concernant la politique budgétaire, les écarts de production demeurent des éléments utiles pour évaluer la position budgétaire ajustée du cycle, les mesures des soldes structurels étant relativement robustes à l'incertitude des écarts de production.

Codes JEL : E23; E24; E31; E52; E62.
Mots clé : Politique monétaire, inflation, écart de production, écart de chômage, politique budgétaire.

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IMPLICATIONS OF OUTPUT GAP UNCERTAINTY IN TIMES OF CRISIS

By Romain Bouis, Boris Cournède and Ane Kathrine Christensen[1]

1. Introduction

1. Supply-demand imbalances matter considerably to macroeconomic policy. Output gaps aim to measure by how much actual output deviates from the economy's productive potential and should in theory give monetary policy makers indications about the scope and need for easing or tightening of monetary policy. The output gap should also help fiscal authorities to assess by how much current levels of revenue and expenditure reflect cyclical factors as opposed to fundamentals. Besides being an input to projecting output gaps, prospects for potential growth are also of use in themselves for monetary and fiscal policy making. In particular, the assessment of fiscal consolidation needs is strongly influenced by prospective potential growth.

2. With negative or very weak near-term growth and high unemployment, inflation is likely to be under downward pressure for some time in most OECD countries. Concerns about deflation risks have re-emerged, so that prospects for economic slack represent an important issue for monetary policy given its role in shaping inflation trends alongside inflation expectations. This paper looks at what developments through the crisis, especially in the labour market but also as regards the quantity of capital and total factor productivity (TFP), imply for potential output, economic slack in the future, and the conduct of monetary policy.

3. The crisis has a number of structural effects which can strongly influence supply-demand imbalances:

- In the labour market, in particular, higher unemployment may become entrenched, *i.e.* "structural", as a result of duration dependence, occupational and geographical mismatches and other structural policy settings. Labour-force participation may decline permanently if the long-term unemployed become discouraged or find pathways to inactivity, including via disability benefit schemes.
- Because of its impact on the cost of capital, the financial crisis may have affected the equilibrium stock of capital and has raised a question about the possibility of a permanent effect on the efficiency of its use.

4. The paper argues that, overall, the crisis appears to have put the productive potential of OECD economies on a lower path than before, but without reducing the growth rate of trend TFP. Although the sources of this downward shift vary across countries, the main sources can be roughly ascribed to some crisis-induced unemployment becoming entrenched, some workers leaving the labour force for good and the capital stock moving to a lower path as part of boom-time investment is not replaced. Altogether, potential output is estimated in the database of the *OECD Economic Outlook of November 2011* to be

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1. The authors are members of the OECD Economics Department. They are grateful to Sveinbjörn Blöndal, Henrik Braconier, Jørgen Elmeskov, Stéphanie Guichard, Vincent Koen, Jean-Luc Schneider and David Turner for helpful comments. The authors nevertheless remain solely responsible for any errors. They would also like to thank Isabelle Fakih for excellent technical preparation. The opinions expressed in this paper are the authors' and are not necessarily shared by the OECD or its member countries. Corresponding author: romain.bouis@oecd.org.

about 4% below its pre-crisis trend in Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States (G10) s a whole.[2]

5. Although potential output has shifted to a lower trend level, actual output has shifted down much more during the crisis, leaving most major OECD economies with ample economic slack. The OECD measure of the output gap for end-2011 is around 4% in the United States, Japan, France and the United Kingdom. In these countries, the main reason behind the large output gaps is that TFP is well below its trend, with the important exception of the United States where economic slack is primarily the result of unemployment above its estimated structural rate.

6. Estimates of output gaps are, however, highly uncertain, especially when driven by TFP gaps, defined as the differences between two unobservable variables. Consequently, monetary policy setting should not put too much weight on output gaps and focus more on other forward-looking measures of future inflation such as wage settlements, trends in unit labour costs and a wide range of indicators of inflation expectations. The falls in margins observed in countries with labour input rigidities may, for instance, imply a combination of wage moderation and upward price pressure as firms try to rebuild their margins. In the United States, the large unemployment gap could also be expected to exert downward pressure on wage inflation in coming years, in spite of a flatten Phillips curve, as only a limited part of the wage adjustment has been observed in the wake of the crisis. Despite this downward pressure, a deflationary spiral remains, however, unlikely as long as inflation expectations stay anchored.

7. As regards the fiscal policy, output gaps remain necessary inputs to assess the fiscal stance adjusted for the cycle as such measures are reasonably robust to output gap uncertainty. The higher levels of debt have besides made potential growth even more crucial to assess fiscal sustainability, particularly for individual countries in the euro area.

8. The rest of the paper develops the points made above by describing the current and prospective supply-demand imbalances (Section 2), by discussing the role of potential output and output gap estimates for monetary policy and drawing the consequences for future inflation (Section 3) before considering the implication of output gap uncertainty for fiscal policy (Section 4).

2. Current and prospective supply-demand imbalances

2.1 Overall imbalances

9. OECD measures of output gaps indicate that, while almost all G10 economies quickly slumped to situations of large slack in the 2008-09 downturn, the subsequent rebound was uneven (Figure 1). On OECD estimates, in 2011, some countries still had output gaps greater than 3% of potential output in absolute terms (the United States, Japan, the United Kingdom and France) while others saw the gap narrow to less than 1% of potential output (Germany, the Netherlands, Switzerland). In the "muddling-through" scenario of the *OECD Economic Outlook* of end-November 2011, renewed economic weakness results in output gaps widening in 2012 before they narrow somewhat in the course 2013 when in most cases growth is projected to recover to slightly above trend.

10. Output gaps can be estimated using a variety of approaches (Beffy *et al.*, 2006; Mishkin, 2007; ECB, 2011). Estimation can be based on purely statistical measures from historical data, on a theoretical approach, or on a combination of the two. Taylor (1993) uses *e.g.* the deviation of real quarterly output from a linear trend while OECD, IMF and EC estimates of potential GDP rely on a production function approach

2. For the sake of practicality and for historical reasons, this set of countries will be referred to as G10 in the remainder of the paper.

with filtered variables as inputs (see Box 1). Other methods include using cyclical indicators directly as is currently done by the Office for Budget Responsibility in the United Kingdom (Office for Budget Responsibility, 2011). Differences in estimates can be significant (Figure 2) and sometimes lead to very different policy conclusions. For instance, the output gap estimated for the first quarter of 2009 by the Congressional Budget Office (CBO) suggested that the US economy was operating below capacity, calling for an accommodative monetary policy but at the same time, the gap derived from the model of the Board of Governors of the Federal Reserve, suggested the opposite, with an estimated output still above potential (Lubik and Slivinski, 2010).

11. At present, different estimates of output gaps in the main OECD areas tend to have the same sign, but in the cases of the United States and the United Kingdom the extent of slack varies considerably across different estimates (Figure 2). Analyses carried out for the United States (Orphanides and van Norden, 2002) and the euro area (Massimiliano and Musso, 2011) show indeed that *ex post* revisions of the estimated output gaps are of the same order of magnitude as the estimated gaps themselves, with the uncertainty mostly due to parameter instability, model uncertainty, or unreliable end-of-sample estimates of the trends in output, although data revisions also play a role. Analysis across a range of OECD countries confirms the role of data revisions for output gap uncertainty and emphasises that *ex post* revisions of output gap estimates are larger around turning points (Koske and Pain, 2008). This uncertainty is confirmed for different vintages of OECD estimates of output gaps (Figure 3) with revisions of 1 to 1.5 percentage points to output gaps being relatively common. This uncertainty limits the usefulness of output gap estimates for policy making.

Box 1. The decomposition of output gap estimates

The OECD approach for estimating potential output has moved progressively over time from using simple statistical measures (*e.g.* peak-to-peak analysis of GDP trend growth and filtering methods) to more structural economic methods based on production functions and estimated inflation relationships (see Beffy *et al.*, 2006 for details). One major reason for this evolution is that statistical measures are sensitive to the choice of arbitrary non-economic assumptions whereas the production function/growth accounting approach, although also using statistical filtering methods, offers an economically meaningful decomposition of growth potential into supply-side factors and is based on more transparent assumptions in economic terms.

The production technology is assumed to be a constant return to scale Cobb-Douglas production function with Harrod neutral labour augmenting technical progress:

$$Y_t = \left(A_t L_t H_t\right)^{\alpha} \left(K_t\right)^{1-\alpha}, \qquad \text{[B1-1]}$$

where Y_t denotes real GDP, A_t is the multi-factor productivity (or labour efficiency), L_t represents total employed persons, H_t is the annual amount of hours worked per employee, and K_t is the capital stock. Finally, α is the relative contribution of labour to output, typically measured as the average wage share over the sample period.

This production function can be decomposed by rewriting total employment as the product of the participation rate (PR_t), the working age population (POP_t) and one minus the unemployment rate UNR_t:

$$Y_t = \left(A_t POP_t PR_t (1 - UNR_t) H_t\right)^{\alpha} \left(K_t\right)^{1-\alpha}. \qquad \text{[B1-2]}$$

The computation of the potential output proceeds as follows. A_t is obtained by solving [B1-1]. A Hodrick-Prescott filter is then applied to A_t, to the annual amount of hours worked per employee and to the participation rate. The calculation of the structural rate of unemployment ($NAIRU_t$) uses a multivariate unobserved components model that treats the NAIRU as an unobservable variable within a (price-inflation-based) Phillips curve. The parameters of the Phillips curve equation as well as the time series of the NAIRU are then estimated on the basis of a Kalman filter technique. Using these new variables in [B1-2] yields the following expression of potential output:

$$Y_t^* = \left(A_t^* POP_t PR_t^* (1 - NAIRU_t) H_t^*\right)^{\alpha} \left(K_t\right)^{1-\alpha}, \qquad \text{[B1-3]}$$

Box 1. The decomposition of output gap estimates (cont.)

where A_t^*, PR_t^*, and H_t^* are respectively the trend counterparts of A_t, PR_t, and H_t. Taking natural logarithms and computing the difference between actual and potential GDP allows decomposing the output gap in terms of a productivity gap, a participation gap, an unemployment gap, and an hours worked gap (Equation [B1-4]). There is no trend capital stock gap (in other words $K = K^*$) in the current OECD method of calculating productive potential.

$$y_t - y_t^* = \alpha\left(a_t - a_t^*\right) + \alpha\left(pr_t - pr_t^*\right) - \alpha\left(\ln\left(1 - NAIRU_t\right) - \ln\left(1 - UNR_t\right)\right) + \alpha\left(h_t - h_t^*\right), \quad \text{[B1-4]}$$

where lower case letters denote the logarithm of capital case counterparts. Noting that $\ln(1-x) \approx -x$ when x is small, this can be re-written to show the relationship between output and unemployment gaps:

$$y_t - y_t^* = \alpha\left(a_t - a_t^*\right) + \alpha\left(pr_t - pr_t^*\right) + \alpha\left(h_t - h_t^*\right) + \alpha\left(NAIRU_t - UNR_t\right). \quad \text{[B1-5]}$$

This multi-pronged calculation of output gaps underscores possible deviations from Okun's law. As originally formulated, Okun's law (1962) states that a one-percentage-point increase in the unemployment rate (or in the absolute value of the unemployment gap) is associated to a three per cent decrease in output (or in the absolute value of the output gap).[1] The expression [B1-5] should not be interpreted strictly as an Okun relationship as it would imply an Okun coefficient of only α (see *e.g.* Prachowny, 1993). However, [B1-5] can be reconciled with the traditional Okun coefficient if it is assumed that the change in the unemployment rate is accompanied by a change in the other factors reported in [B1-5]. In particular, if a one-percentage-point reduction in the unemployment rate goes with a 3% increase in hours worked, the overall effect of a one-percentage-point decrease in the unemployment rate is in the order of 2-3% increase in output. Employment changes and hours worked do not, however, always move together in this assumed 1:3 ratio, while other variables (labour efficiency and participation) may also respond differently to unemployment changes, depending on periods and countries. This implies that the Okun's coefficient tends to show a large cross-country variation and to be unstable over time as pointed out by several analyses that stress the emergence of two major changes: (i) a gradual change over time of the coefficients of the relationship (see *e.g.* Lee, 2000); and (ii) some discrete changes of the relationship towards the end of the 2000s (Jin and Pain, 2012 forthcoming).

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1. The Okun's coefficient has been substantially revised over time and may today be close to two rather than three.

12. A particularly important source of uncertainty about current and prospective output gaps stems from the impact of the crisis on productive potential (Bini Smaghi, 2011). As discussed below, this impact can come from hysteresis effects in labour markets, a possible permanent impact on capital intensity, as well as any effects on total factor productivity. The OECD assessment (see in particular in OECD, 2011a) is that the crisis has not reduced potential GDP growth permanently. The crisis, however, is estimated to have shifted down the path of potential output significantly by around 4% in the G10 area as a whole, with relatively small declines in Germany and comparatively large reductions in Italy and the United Kingdom

(see Figure 4 and Box 2). Independently, though, potential GDP growth is projected to come down over the medium to long term in OECD countries, primarily as a result of demographic change and slower increases in participation rates on the assumption of no further reforms to encourage participation. These effects are incorporated in OECD medium and long-term projections, with potential growth in the G10 countries averaging 1.9% in the pre-crisis period, falling to low rates in the 2008-2012 period as the downward level shift in potential was phased in and then recovering in the 2013-2018 period (Figure 5) before slowing down to 1.7% in 2019-2026.[3]

Box 2. Potential output after the crisis

Potential output after the crisis is likely to be influenced by consequences of the crisis for the stock of capital, sustainable labour input and total factor productivity:

- The impairment of financial intermediation has exacerbated the sharp contraction in investment that is typical of recessions. As a result, in the *OECD Economic Outlook* of November 2011, the stock of capital in 2013 (measured on the basis of available capital services) is projected to be well below pre-crisis projections for the same year, especially in Japan (-16%) and Italy (-14%). In the OECD approach, the fall in the capital stock translates immediately into lower potential output. From the point of view of fiscal analysis, an important question is how much of this fall is likely to be permanent, as opposed to a cyclical undershooting of investment that will be reversed in the upturn. One way of answering this question is to consider that the crisis will durably reverse the contraction of real corporate borrowing costs observed during the 2003-07 credit booms, during which they went 1½ percentage points below their average over the previous business cycle in the United States. In a simple partial-equilibrium production-function model with no offset from monetary policy, a 1½ percentage point increase in the real interest rate faced by firms reduces the capital stock of the US business sector by 6½ per cent (OECD, 2009b; Cournède, 2010). Assuming that this estimated order of magnitude also obtains for the aggregate economy would suggest that the downward shift in the path of the capital stock is unlikely to be reversed in most countries with the exception of Italy and Japan where it appears to have involved a lot of overshooting.

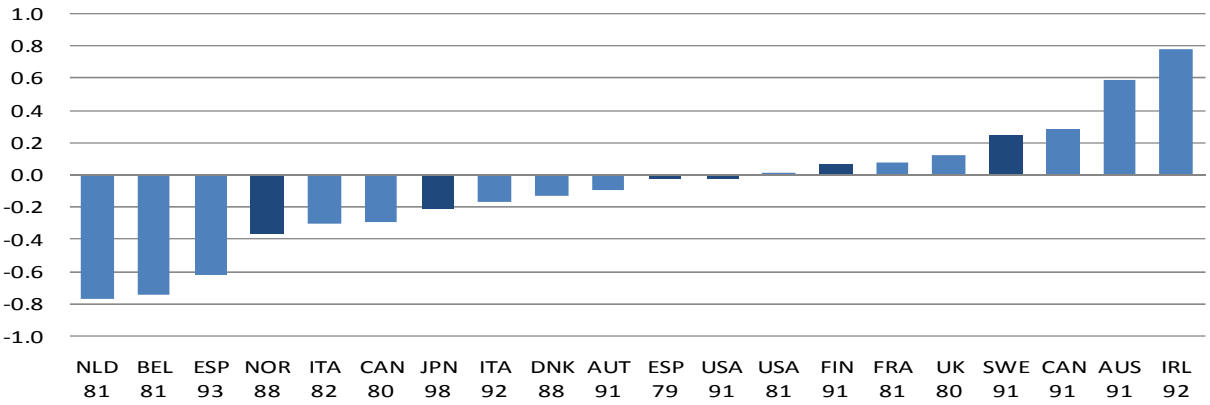
- Another key determinant of future potential output is whether trend total factor productivity (TFP), which remains well below its pre-crisis trends especially in European countries, will be durably affected by the crisis. The elusive nature of potential TFP – the trend of a residual – calls for extreme caution about judgments regarding its level. However, the question of whether TFP growth will be affected by the crisis or not cannot be avoided given the central role of this factor in driving the long-term evolution of living standards. The crisis can affect trend TFP growth in either direction. On the one hand, the crisis can result in permanently higher risk aversion or in capital remaining locked into "zombie firms," especially if interest rates remain very low and banks are allowed to keep rolling over bad loans. Such effects can permanently reduce capital flowing to firms engaged in research and development (R&D) activities with strong growth potential, resulting in less innovation and lower trend TFP growth ("scarring" effects). On the other hand, if the crisis speeds up the reallocation of capital from lower to higher marginal-productivity activities and the financial sector is more efficient following its restructuring and reform, the crisis could improve the funding of growth-enhancing R&D activities and accelerate future trend TFP growth ("cleansing effects"). The experience of OECD countries following severe downturns shows that TFP growth increased in almost as many cases as it declined (Box Figure 1).

- The crisis and continuing economic weakness are also likely to affect potential growth via the labour market. Protracted periods of high unemployment, and especially of high long-term unemployment, are likely to increase the structural rate of unemployment, and in the absence of reform, it would mechanically take a long time for a period of cyclically low unemployment to reduce NAIRUs again. The crisis could also in theory have some permanent effects on trend participation and hours worked, but these effects are likely to be limited in practice.

3. Demographic change will also have consequences for long-term growth in emerging-market countries, with the average annual GDP growth rate in Brazil, Russia, India and China projected to ease from 8.0% in 2001-07 to 6.7% in 2016-2026 in the long-term projections presented in OECD (2011).

Box 2. Potential output after the crisis (cont.)

Box Figure 1. Change in TFP growth following severe downturns



Note: Change in the average annual growth rate comparing the five years following the start of the downturn with the five years preceding it. The darker bars denote downturns that are associated with banking crises, see Haugh *et al.,* (2009).

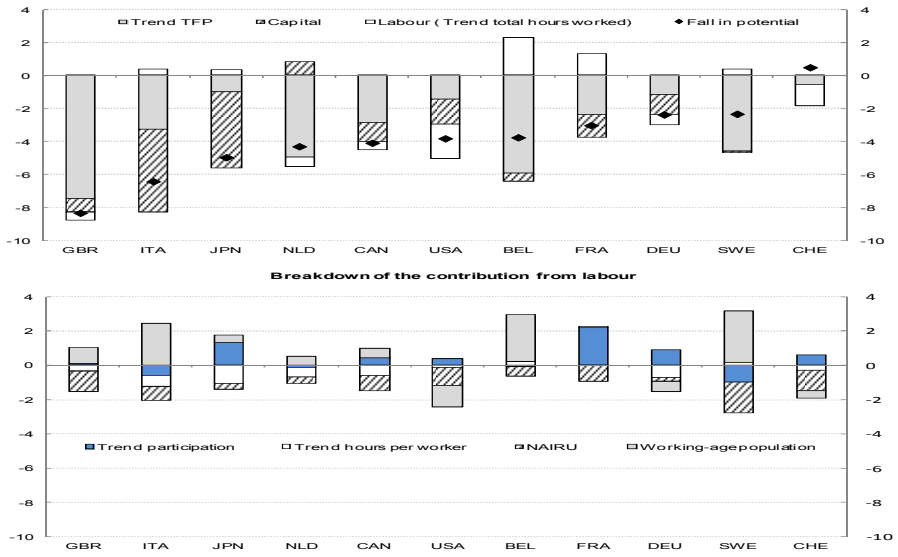
Source: OECD.

Among these effects, the most powerful ones appear in most G10 countries to stem from the fall in the capital stock and the fall in trend TFP relative to their pre-crisis trends (Box Figure 2). The considerable uncertainty about the level of trend TFP argues against putting too much weight on its contribution to the fall in potential output, a contribution which is large in the Belgium, Canada, France, Italy, the Netherlands, Sweden and the United Kingdom.

The increase in the NAIRU is contributing significantly to the fall of potential output in Sweden and the United Kingdom. An increase in trend participation appears to be limiting the fall in potential output in France, Germany, and Japan. A larger than anticipated working-age population, related to migration, supports potential output significantly in Belgium, Italy and Sweden, and to a lesser extent in the United Kingdom.

Box Figure 2. Sources of the fall in the level of potential output in 2013 relative to pre-crisis estimates

Percentage points (except Potential which is in per cent of December 2007 projections for 2013)



Note: The chart shows how each component of potential output contributes to the difference between December 2007 and November 2011 projections for 2013. A residual arises because the non-linearity of the production function and methodological evolutions imply that the change in potential output does not necessarily correspond to the aggregate of changes in its components.

Source: OECD Economic Outlook No. 82 and No. 90 databases and OECD calculations.

2.2 Decomposition of output gap developments since the onset of the crisis

13. The OECD method of estimating potential output makes it possible to assess the contributions from different sources to aggregate economic slack by decomposing the output gap into a labour-market gap, summarising trend deviations in unemployment, labour force participation and hours worked per employee, and a gap in total factor productivity (TFP). Previously, the OECD output gap also incorporated a capital-stock gap comparing the current and trend levels of capital services (Beffy *et al.*, 2006). Because of the uncertainty surrounding the long-term impact of the crisis on the capital stock, the OECD method of calculating potential output in 2009 switched to actual capital services rather than a smoothed version of this series (OECD, 2009b), thereby eliminating the capital-stock gap. This new approach corresponds to a short or medium-term orientation of the output gap which is well suited to monetary policy analysis (as inflationary pressures are more directly influenced by the intensity in the utilisation of current rather than equilibrium capital) while the previous long-term orientation may be more directly relevant to fiscal policy assessment (which typically concerns horizons over which the capital stock can be expected to adjust, see below).

14. In the recent crisis, changes in output gaps of major OECD economies have had unemployment and total factor productivity gaps as their most important counterparts, albeit in contrasting ways across countries (Figure 6). In the United States, the spectacular opening of the output gap has resulted from a dramatic increase in the unemployment gap, in line with the hypothesis that most of the rise in the unemployment observed since the onset of the crisis is cyclical rather than structural (see *e.g.* Levine, 2011). In contrast, in other G10 countries, the total factor productivity (TFP) gap has been the main contributor to the increase in slack in the wake of the crisis and, with the exception of the Netherlands, remains today the most important component of output gaps. This section discusses trends in and drivers behind the labour-market gaps before turning to the role of capital and total factor productivity in shaping supply-demand imbalances.

2.2.1 The role of labour markets in shaping prospects for supply-demand imbalances

15. International experience suggests that downturns following financial crises are more prolonged than other recessions and tend to be associated with a slower return to high employment (Reinhart and Rogoff, 2009). Financial crises indeed tend to damp investment for a longer period due to an increase in the cost of borrowing, tighter lending standards and greater uncertainty on investment returns, leading to an increase in the level and duration of unemployment, and a reduction in hours worked by employees (CBO, 2011).[4]

Unemployment gap

16. With an unemployment rate at two percentage points or more above its pre-crisis level in 12 OECD countries (Figure 7), unemployment gaps (the differences between the NAIRU and the current unemployment rate) remain negative in a number of countries, although not as large in absolute terms as what has been observed in previous recessions, except in the United States (Figure 8).[5] The counterpart to

4. OECD analysis suggests that financial crises can lead to a persistent decline in potential output lying on average between 1.5 and 2.4%, with a much more pronounced effect observed for deep and severe crises of roughly 4% (Furceri and Mourougane, 2009a). Crises are also found to significantly raise the level of structural unemployment with an impact reaching almost 1.5 percentage points after five years in the case of very deep economic downturns (Furceri and Mourougane, 2009b).

5. The NAIRU estimated by the OECD does not incorporate the effects of temporary measures such as short-time working schemes or the temporary extension of unemployment benefits and can therefore be considered as a medium or long-term NAIRU. In contrast, the so-called short-term natural rate of

the muted rise in unemployment outside the United States were the comparatively small employment losses relative to output declines in the downturn, reflecting both apparent labour hoarding and, in the early stages of the crisis, reduction in average hours worked. By contrast, in the United States, employment responded strongly to the fall in output.

17. An important feature of the unemployment developments since 2008 is the high incidence of long-term unemployment. In many countries (*e.g.* Canada, the United Kingdom and the United States) the share of long-term unemployment has risen significantly during the crisis, albeit in some cases from a very low level (Figure 9). In other countries (*e.g.* Italy and France), the share of long-term unemployment was already high before the crisis, exposing them also to the risk of a persistent increase in unemployment into the recovery (OECD, 2011a). This is however not universal: the share of long-term unemployment has, for instance, receded in Germany, Belgium and the Netherlands.

18. As high long-term unemployment in the past has typically been associated with an increase in structural unemployment due to hysteresis effects, most OECD countries are estimated to have experienced a rise in their NAIRU since 2008 (Figure 10). Indeed, OECD analysis suggests that an increase in long-term unemployment of one percentage point may be associated with an increase in the structural rate of 1/3 to 2/3 of a percentage point depending on the stance of labour market policy (Guichard and Rusticelli, 2010). On this basis, the crisis may have induced an increase in the structural unemployment rate of 1 percentage point in Italy, ¾ percentage point in the United Kingdom and the United States, and of less than ½ percentage point in Canada, France and Japan.[6] On the other hand, structural unemployment is estimated to have fallen in Germany, thanks to earlier labour market reforms.

19. As the number of workers becoming unemployed during a given period has fallen back to its pre-crisis levels in many countries (as a share of the labour force), the key factor behind the risk of unemployment persistence is the lack of a rebound in hiring. The outflow rate from unemployment – defined as the probability that worker exits unemployment within the following month – has indeed remained depressed, in some cases at very low levels by historical standards, not least in the United States (Figure 11). Although such decreases may be only temporary, reflecting the cyclicality of outflow rates, they still call for a structural policy response given their likely long-lasting effects on employment as observed in the aftermath of earlier crises. Vacancy rates (calculated as the ratio of unfilled vacancies to the sum of unfilled vacancies and total employment) also remain well below their pre-crisis levels in a number of countries (Figure 12).

20. Potential sources of this lack in hiring and possible policy remedies include:

- High labour costs as a barrier for hiring. This could be addressed, in principle, by cutting payroll taxes targeted at new hires (so-called gross hiring subsidies). Such targeted cuts should be preferred to across-the-board payroll tax cuts as they are less expensive, which is particularly important in the current context of fiscal consolidation, and involve a smaller deadweight loss. Targeting new hires involving a net increase in jobs (so-called marginal job subsidies) would be, in principle, an even more effective policy but is also more complex and lengthy to set up while

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unemployment as calculated by the CBO, incorporates structural factors which have temporarily boosted the natural rate in the recent crisis.

6. The short-term NAIRU may, however, be significantly higher than the long-term NAIRU in some countries and the unemployment gap correspondingly narrower, as a result of crisis-related measures and temporary mismatch. For example, the short-term NAIRU in the United States could be 1 to 2 percentage points higher than the long-term one (Dudley, 2011, Valeta and Kuang, 2010 or CBO, 2011). If that is the case, the unemployment gap would be relatively narrow compared with previous recessions with correspondingly smaller pressures for wage adjustment (see below).

the speed at which measures can stimulate labour demand is an important criterion in the context of return to work strategies. Reforms of wage bargaining institutions, reduced use of administrative extension of collective contracts and greater scope for opting out of industry-wide agreements would also help to contain high labour costs, facilitating hiring.

- The apparent reduced attractiveness of long-term unemployed workers for employers (so-called "duration dependence" or hysteresis effects), an issue exacerbated in Canada and the United States by the extension of unemployment benefits during the crisis (Dantan and Murtin, 2011). Estimates of the impact of such extensions on the short-term NAIRU vary, ranging from one-tenth to 1½ percentage points.[7] Such extensions can be maintained until labour market prospects improve sufficiently, but they should in the meantime be coupled with activation measures and be conditional on job search. The extensions of unemployment benefits introduced during the crisis will have to be scaled back in a timely manner to avoid them increasing structural unemployment.

- Increased mismatch in general or along occupational and regional lines:

  – There is only scattered evidence of a general deterioration in the efficiency of matching job openings and unemployed workers as a result of the crisis. The recession has led to a large movement along the Beveridge curve – with a lower vacancy rate and a higher unemployment rate – in the United Kingdom and the United States, without any significant shift of the curve itself related to structural changes (see *e.g.* Yellen, 2011 for the United States).[8] Countries like Germany, Japan and the Netherlands have even experienced an improvement in job matching in the five years preceding the crisis, corresponding to a leftward shift of the curve. Among G10 countries, only Switzerland, and to a lesser extent, Sweden have seen a worsening of job matching during the crisis, continuing a trend that started in the early-2000s (OECD, 2010a).

  – Increased regional mismatches do not seem to have played any big role. Even if the dispersion of regional unemployment rates has increased in absolute terms during the crisis, for instance in the United Kingdom, the United States or Spain (Figure 13), this rise vanishes once looking at the coefficients of variation that divide this dispersion by the level of unemployment, indicating little evidence of any increase in regional mismatch. This should

7. Valeta and Kuang (2010) estimate that the extension of unemployment benefits in the United States may explain about 0.4 to 0.8 percentage point of the 1¼ percentage point increase in the NAIRU, the remainder being explained by the need for unemployed construction workers to find a job in other sectors. Aaronson *et al.* (2010) suggest that the combined federal-state extension of benefit from 26 weeks to 99 weeks (or 90 weeks on a national average) in response to the crisis could, if maintained, raise the average length of the unemployment spell by between 1½ to 3 weeks, corresponding to an increase in the unemployment rate of about ½ to 1 percentage points. Rothstein (2011) finds a weaker impact with unemployment and insurance extensions estimated to have raised the unemployment rate in early 2011 by only 0.1-0.5 percentage point, with at least half of this effect attributable to reduced labour force exit among the unemployed while another recent estimate (Nakajima, 2011) indicates a much larger effect, implying a 1.4 percentage point increase in the NAIRU.

8. Shifts in the Beveridge curve can partly reflect cyclical influences. Vacancies tend for instance to adjust more quickly than unemployment to changes in labour demand, leading to anticlockwise movements around the unemployment-vacancy curve, as observed in most previous recessions.

also reduce concerns that labour mobility may have decreased during the crisis due to the strong prevalence of negative home equity, in particular in the United States.[9]

– However, the mismatch between vacancies and jobseekers across different occupations may have increased. Downturns usually hit specific industries and a number of countries have recorded particularly strong losses in sectors like construction, wholesale and retail trade and financial intermediation during the recent crisis (Table 1). Although manufacturing has since then largely rebounded, construction has remained depressed in most countries where it enjoyed a boom before the crisis. And the countries where the construction sector has been hardest hit (*e.g.* the United Kingdom and the United States[10]) are also the ones where the incidence of long-term unemployment has risen most. The financial sector may also weigh on labour market prospects in countries with major financial centres (notably the United Kingdom). The matching of workers and jobs could be improved by facilitating occupational mobility, in particular through intensified public employment services and training programmes. Implementing such support may however be challenging in countries that do not have the sufficient infrastructures in place, as *e.g.* the United States (although a number of states have such programmes).

Participation gap

21. Unlike in previous recessions, there has been so far little evidence of a widespread withdrawal from the labour force (Figure 14, panel A), so that participation gaps (Figure 15) are unusually small in absolute terms. A notable exception to this pattern is the United States, where there has been an unusually large cyclical decline in labour force participation. Even though they are smaller than in previous recessions, there are also significant negative participation gaps in Japan and Italy.

22. Trends in participation, however, vary for different population groups:

- Youth and low-skilled are the population groups for which labour force withdrawals have been the most pronounced (Figure 14 panels C and D). In the case of youth this may partly reflect longer time spent in formal education, as is usually observed in recessions which will increase potential output in the long term. However, for those who do not stay longer in education and who face difficulties to enter the labour market, the current context may weigh on their long-term career prospects, with implications for the economy over many years through the so-called "scarring" effects of youth unemployment (see *e.g.* Scarpetta *et al*., 2010). Promoting more extensively apprenticeship contracts for low-skilled youth (through reduced labour costs in exchange for a training commitment) may have the double advantage of securing the transition towards employment while reducing the scarring effect in the medium term.

9. Schulhofer-Wohl (2011) finds that homeowners in the United States with negative home equity positions have in fact been moving slightly more than other homeowners. This may, however, reflect a specificity of US mortgage bankruptcy rules (in design or enforcement costs depending on states) coupled with particularly negative home equity positions, raising the incentive to default. By contrast, a recent study (Ferreira *et al.*, 2011) documents that negative equity does reduce household mobility in the United States and attributes Schulhofer-Wohl's finding to some measurement errors.

10. The unemployment rate for construction workers in the United States has for instance been almost three times higher in the recent crisis than in normal times, representing about 1.25 million more unemployed construction workers in the current recovery (*i.e.* almost 1% of the labour force) than during the preceding expansion (Valeta and Kuang, 2010).

- Employment rates of older workers have shown remarkable resilience and have even increased during the crisis (Figure 14, panel B). In contrast to recession episodes of the 1980s and 1990s, governments have not encouraged premature exit of older workers via the early retirement route and some, in the context of pension reform, took measures to encourage longer working lives. At the same time, the loss of wealth associated with the crisis may have induced older workers to extend their active life.

23. Looking ahead, high levels of unemployment nevertheless raise the risk that unemployed workers drift out of the labour market, at least for some categories of workers, due to loss of human capital and discouragement effects. Importantly, empirical analysis (see Duval *et al.*, 2011) suggests that economic downturns have in the past affected labour force participation with a considerable delay. As a consequence, prospects for trend participation and gaps remain surrounded by wide margins of uncertainty, even if such gaps have in the past been subject to comparatively small revisions in most countries (Figure 16), and depend in part on future policies that influence labour-market exit.

24. A particular concern in countries with high and persistent unemployment is that labour force withdrawal may take the form of an increased take-up of long-term sickness and disability benefits, which generally implies a permanent exit from the labour market and hence a reduction of the participation gap in the "wrong" way. In the past, inflows into disability schemes have tended to increase in the wake of recessions and have typically been very difficult to reverse (OECD, 2010b). In countries where this pattern has been observed (Netherlands, Sweden, Switzerland, United Kingdom and United States, among others), spikes in disability rates have often followed unemployment peaks with a lag of more than two years, with tighter access to other benefit programmes (*e.g.* unemployment insurance, social assistance, financial incentives to early retirement) amplifying the effects of recessions on disability rates. In the current context, two factors may however mitigate this tendency. First, older workers – the population group the most likely to rely on disability enrolment to prematurely exit the labour market – have not been as severely affected in the last recession as compared with earlier downturns. Second, many of the countries facing fast-rising disability rates following past recessions (the United States and, to a lesser extent, the United Kingdom) have taken measures to stem the "excess" flow of recipients and also, in some cases, to help existing recipients with work capacity to rejoin or enter the labour market. Nonetheless, it will be a challenge to ensure that disability and long-term sickness systems not be used as *de facto* early retirement systems in coming years.

Hours gap

25. The decline in total hours worked in the recession has been absorbed differently across countries, with a few countries, including Belgium and Germany, reducing total hours almost entirely through adjustments in average hours per worker (Figure 17). This created in some cases (especially in Germany and Japan) a considerable negative hours gap. However, slack in average hours worked has diminished during the recovery, due to a combination of an increase in average hours worked and a small reduction in estimated trend hours worked. As a result, hours gaps at present are estimated to be relatively small in the larger European economies, with the exception of Italy, and the United States, and large slack in working hours intensity would appear to be confined to Japan and Canada (Figure 18). This suggests that these two latter countries could absorb a pick-up in activity through more hours worked. These observations should, however, be considered with caution as revisions to hours gaps can be significant (Figure 19).

26. Policy measures introduced before (working time accounts) and during (short-time working schemes) the crisis have indeed permitted or encouraged a drop in hours worked. Although the adjustment in average hours worked has been a recurrent feature of past recessions in several countries (such as Belgium or Germany), short-time work arrangements have been used on an unprecedentedly large scale in the recent crisis.

27. One question is whether part of this drop will become permanent. As suggested by the experiences of Germany and Switzerland, there is little evidence of any sign of persistence in low hours following the recent crisis. Spontaneous reductions permitted by working-hours accounts are likely to adjust automatically as the activity picks up so that the hours gap currently observed in some countries should vanish without any policy intervention. In some countries, notably Germany, short-time working schemes contained incentives for employers to stop using such schemes when demand firmed.

Are there population gaps?

28. Migration flows have reacted differently to the crisis in Europe and the United States (Figure 20). Despite large adjustments in intra-EU movements and some restrictive measures with respect to labour migration adopted by some countries, external migration flows were quite resilient in Europe during the crisis, partly reflecting the persistence of labour demand in some sectors like social services but also limited return migration (notably for non-European migrants, who may face difficulties to come back later if they returned to their country of origin). In contrast, migration has been much more sensitive to the economic downturn in the United States and the foreign-born working-age population decreased in absolute terms in 2008/09, in particular because of a reduction in temporary labour migration and of a strong decline in irregular migration of foreign workers as well as to increasing return migration, notably to Mexico (OECD, 2011b). To the extent that immigrant workers may return if economic prospects normalise, this would suggest that some destination countries, notably the United States might be experiencing "negative population gaps" (actual minus trend working-age population) while some home countries could have positive population gaps.

2.2.2 The role of other factors

29. The level of the capital stock, the intensity of its use, and total factor productivity developments also influence overall supply conditions and output gaps. Disentangling the separate effects of the three factors is not straightforward in practice. Since the advent of the crisis, capital-stock gaps are assumed to be zero in the OECD calculation of output gaps (see OECD, 2009a). Furthermore, intensity of the use of capital (*i.e.* its utilisation rate) is not directly controlled for so that its movements are incorporated in TFP gaps.

Capital stock

30. If the experience of the crisis damps the appetite for risk, the real interest rates in OECD countries will rise, reducing the equilibrium level of the capital stock in OECD countries (Cournède, 2010). The OECD has incorporated this effect in its estimates of potential output by assuming that the real interest rates faced by the corporate sector would revert to more normal levels from the unusually low levels experiences during the credit boom in the mid-2000s. The associated rise in the cost of capital was seen as equivalent to an increase in real interest rates of up to 150 basis points (OECD, 2010c). Such an increase is comparable to the part of the fall in real interest rates during the 2000s that cannot be explained by fundamental variables in Turner and Spinelli's (2011) model. This increase in real interest rates is also consistent with the marked fall in capital accumulation observed during past major OECD banking crises. Such a shock to real interest rates was seen as reducing the capital stock of the business sector by 6.5% in the average OECD country and, correspondingly, potential output of about 2% (OECD, 2010c). The time elapsed since the crisis started means that its effects on investment have had the time to materialise. Therefore, in the current OECD projection of the capital stock for future years, there is no further specific adjustment of its trend level. As a result of lower investment in recent years and of projections for investment until 2013, the capital stock in 2013 is 4.6% below the projection for the same year in *OECD Economic Outlook* of December 2007.

31. This adjustment to the level of the capital stock and potential output is in line with other estimates. For example, estimates by the European Commission are of the same order of magnitude with a fall in potential output consecutive to the crisis-related reduction of the capital stock expected to be of 1.8% (European Commission, 2009). IMF analysis carried out for Italy and Canada (Morsy and Sgherri, 2010; Estevão and Tsounta, 2010) also points to a long-lasting effect of the crisis on the level of the capital stock in these countries. Likewise, for the United States, about one half of the estimated 2% decrease in potential output could be attributable to slower capital accumulation, according to the Congressional Budget Office (2011).

32. In coming years, the high levels of public debt reached by most OECD countries in the wake of the recent crisis may weigh on capital stocks and future economic growth. A small but growing literature indeed documents a non-linear relationship between initial debt and subsequent growth (Reinhart and Rogoff, 2010; Cecchetti *et al.*, 2011, among others). Although debt generally boosts economic growth by fostering capital deepening and allocative efficiency, excessive public debt – defined as a debt-to-GDP ratio in a range of 85% or more (Cecchetti *et al.*, 2011) – puts a drag on growth by raising interest rates.[11] Growth-damaging effects of debt are found to be even greater at higher levels of indebtedness as the difference between short-term and long-term interest rates has been a non-linear function of public debt in G7 countries (excluding Japan) in recent years (Égert, 2010). To preserve potential growth, countries therefore need to reduce their public debt over the medium and long term, a priority particularly challenging in a context of population ageing with associated rising health and pension spending pressures.

Trend total factor productivity

33. OECD estimates of potential GDP are based on the assumption that, after the crisis, TFP growth reverts to its pre-crisis trend. Other institutions have built projections of potential growth incorporating the possibility that the impact of the crisis on the cost of capital and on the quality of capital allocation may reduce TFP growth permanently, or for an extended period of time, through adverse effects on innovative activities (IMF, 2009; European Commission, 2009; Office of Budget Responsibility, 2011).

34. Long-term prospects for trend TFP (based on hourly productivity) are subject to a high degree of uncertainty. At least two factors may influence trend TFP after the crisis: the degree of product market competition and the state of banks and other financial institutions.

35. On theoretical grounds, the direction of the effect of financial crises on total factor productivity is *a priori* ambiguous: spending on innovation and R&D is likely to be significantly reduced, lowering total factor productivity, but firms may also have stronger incentives to restructure and improve their x-efficiency to limit their losses (Furceri and Mourougane, 2009a). The relative strength of these different forces is difficult to quantify but there is some evidence from previous recessions that TFP growth is more likely to rise when competitive forces are stronger (Figure 21). In the context of the recent crisis, the potential cleansing effects may have been somewhat impeded in countries where policies prevented adjustment. Direct and indirect subsidies to particular sectors – some of which were already in place before the crisis – have been frequent, with one third of OECD countries offering some type of financial support for their automotive industries, and many countries engaging in activist interventions to forestall plant closure through managed bankruptcies and government-sanctioned mergers (OECD, 2010e). Short-time working schemes may also lead to a sub-optimal allocation of capital and workers in the economy if they help preserve jobs that are not viable in the long run. However, given that most of these measures have been removed, they are not expected to have any permanent distortive effects.

11 . With the exception of the United Kingdom, the Netherlands, Sweden and Switzerland, all G10 countries exhibit public debt-to-GDP ratios greater than 85% according to the most recent figures.

36. Historical experience suggests that the long-run impact of financial crises on TFP depends in general on policy measures concerning the banking sector. For instance, while Sweden, Finland and Japan all experienced a severe financial crisis in the recent past, Japan was the only country for which lower trend labour productivity growth was observed ten years after the banking crisis downturn. A candidate explanation is that the resolution of the banking crisis in Japan took a long time with many "zombie" banks and companies kept alive through regulatory forbearance, resulting in impairment of the financial system and a misallocation of capital with harmful consequences for trend productivity growth (Haugh *et al*. 2009). Conversely, Finland and Sweden experienced relatively short-lived recessions in the first half of the 1990s without damaging effects on potential output growth thanks to a prompt resolution of banking problems which was probably instrumental in permitting a significant restructuring of the economies linked to innovation although favourable exchange-rate movements also helped (European Commission, 2009; OECD, 2009b and 2011d).

37. More generally, financial constraints or high risk aversion tend to reduce R&D investment with scarring effects on productivity. Evidence indicates that the crisis has already affected business R&D expenditure which is mainly financed from retained earnings and moves in parallel with GDP (Figure 22). Business R&D tends also to be re-oriented towards short-term, low-risk innovations during downturns while longer-term, high-risk innovation projects are being cut first (Guellec and Wunsch-Vincent, 2009). At the same time, as banks, markets and investors have become more risk averse, firms face more difficulties in funding their investments in R&D through external sources. In particular, small innovative firms are hard hit in times of heightened stock market volatility and depressed IPO markets as their investment depends critically on equity financing (Carpenter and Petersen, 2002). The depressed market for initial public offerings combined with a growing aversion to risk has also put a drag on venture capital activity. Both disbursement and funds raised by US venture capital investors collapsed at the turn of 2009. Investment somewhat rebounded in 2010, but the total amount of venture capital fundraising, whose evolution tends to lead the amount of funds invested by the sector, is still declining (Figure 23).

TFP gaps

38. Estimates indicate a marked decrease in actual measured TFP levels in the aftermath of the crisis, with an average decline across countries of roughly 5% from 2007 to 2009. Following these dramatic drops, TFP levels have sharply rebounded but still remain below their pre-crisis levels at the end of 2011, except in the United States (Figure 24). As a result, TFP gaps have reached their lowest levels over the past 40 years in several countries (Figure 25), in part reflecting a capacity utilisation gap, as evidenced by the spectacular drop in capacity utilisation rates over 2008-09 (Figure 26).[12] Indeed, taken at face value, the estimated TFP gaps account for the bulk of economic slack in most countries at present, the United States being a notable exception.

39. However, as the TFP gap is a "double residual" (TFP and *a fortiori* its potential are unobservable variables), such estimates are necessarily very imprecise and must be interpreted with great caution. For instance, the maximum absolute revision to TFP gaps for the first quarter of 2004 averages 2.4 percentage points across G10 countries (Figure 27). The large successive revisions of TFP gaps imply corresponding changes in overall output gaps over time.

12 . The evolution of the capacity utilisation rate is indeed an aspect omitted in the definition of the OECD estimates of potential production so that a fall of this rate results in a widening of the TFP gap. It must however be noted that capacity utilisation rates have significantly rebounded since their lows of 2009 so that this argument cannot account for the still large TFP gaps observed in a number of countries.

2.2.3 Conclusion

40. The reliability of output gap estimates may depend on their composition. A large negative output gap is likely to provide a robust signal when it incorporates a large negative unemployment gap, as is currently the case in the United States (Figure 1). The reasons are that unemployment rates are usually not revised much, and that NAIRUs are surrounded by relatively narrow error bands (Figure 28), although because of the crisis current uncertainty about the NAIRU is probably larger than captured in these statistical error bands. Nevertheless, the US output gap can be seen as giving a clear indication of large economic slack. Output gaps appear more uncertain when they are largely composed of TFP gaps, as is the case in Europe, as such gaps tend to be fragile and subject to large revisions. Particular caution about the presence of slack is required when the overall gap is negative while the unemployment gap is positive, as is currently the case in Germany.

41. Structural reforms can add to the uncertainty in output gap estimates. Improvements in structural policy settings boost potential output, but the time profile of the supply expansion is difficult to anticipate. Similarly, structural reforms also affect demand, again with effects that are difficult to forecast in size and timing (Bouis *et al.*, 2012).

42. The large degree of uncertainty surrounding output and unemployment gap estimates may call for relying on other indicators to assess the degree of slack in the economy. Survey measures of capacity utilisation, wage growth, unit labour costs, and actual and expected inflation may therefore prove more useful in the current situation than estimates of the output and unemployment gaps.

3. The role of potential gap estimates for monetary policy and consequences for future inflation

3.1 The role of potential output and output gap estimates in monetary policy setting

43. Output gap estimates are, in principle, important indicators to guide monetary policy decisions as they help to predict future inflation but also because growth and employment objectives supplement inflation objectives in some central banks' mandates. Estimated monetary policy reaction functions indeed confirm the importance of output gaps in explaining policy-controlled interest rates, as indicated for instance by "positive" Taylor rules (Box 3).

44. At current output gaps, as estimated by the OECD, actual interest rates would however seem to be very low when compared with "normative" OECD-calculated Taylor rates (Figure 29). This is particularly true for Canada, the United Kingdom and the United States where interest rates are between 2 and 4 percentage points below what would be optimal according to the OECD-calculated Taylor rates. Thus, taken at face value, the OECD estimates would suggest that many central banks are behind the curve and that inflationary pressures are building up. However, in addition to being influenced by the state of financial markets,[13] asymmetric risk structure at low underlying inflation, and fiscal consolidation or a limited room left for fiscal policy, the discrepancy between actual and Taylor interest rates may reflect difficulties in estimating output gaps after the Great Recession and uncertainty about the reliability of such estimates. This should diminish the weight given to them in the conduct of monetary policy (see *e.g.* Smets, 2002).

13 . Policy rates have, for example, been persistently and significantly below Taylor rules in the wake of financial market turmoil, such as the Russia and LTCM crises and the bursting of the dot-com bubble. Empirical evidence (Orphanides and Wieland, 2000) indicates that when inflation is close to zero, monetary policy is too accommodative compared to what would be optimal in the absence of the zero bound. There are indications that such deviations may often be associated with the build-up of subsequent financial imbalances, although this remains controversial (Borio, 2006 and Ahrend *et al.*, 2008).

Box 3. Taylor rule specifications and estimates

Taylor rules relate the policy rate to its neutral level and deviations of inflation from target and output from potential according to the following formula:

$$i = r^* + \pi + \lambda_1(\pi - \pi^*) + \lambda_2(y - y^*),$$

where i is the Taylor policy rate, r^* the natural real interest rate – also called the neutral rate – π and y are respectively current inflation and current output, and π^* and y^* refer to the inflation target and the potential output. The coefficients λ_1 and λ_2 denote the weights assigned respectively to inflation and output gaps.

In addition to providing information about future inflation, a number of reasons can explain why central banks care about output gaps in the conduct of the monetary policy:

- Some central banks specifically target labour-market objectives, either in a dual-mandate – by pursuing price stability and low unemployment without any order of preference – or in a hierarchical mandate under which other economic policy objectives can be targeted so long as they do not interfere with price stability. The US Federal Reserve, for example, pursues maximum employment along with stable prices and moderate long-term interest rates (dual-mandate) while the ECB aims at supporting high levels of employment and economic growth as long as it does not endanger price stability (hierarchical mandate). Monetary policy mandates may also include labour-market objectives more generally as in the case of the Bank of Canada's aim to promote economic and financial well-being while maintaining low and stable inflation.

- Some recent theoretical advances (*e.g.* Blanchard and Gali, 2007 and 2010) also suggest that a welfare-maximising central bank should include unemployment in policy rules in presence of real wage rigidities. In the absence of such rigidities, the unemployment rate is independent of productivity (wages respond one-for-one to productivity shocks because of offsetting income and substitution effects) and stabilisation of inflation coincides with the welfare-relevant output gap taking a value of zero, a property referred to as the "divine coincidence". Under a more realistic framework of sluggish adjustment of real wages to negative productivity shocks (for instance, ill-conceived and new product market regulation), the "divine coincidence" no longer holds and strict inflation targeting leads to a larger decrease in output than what is optimal.

The rate resulting from a Taylor rule depends on the definitions of the different variables and of the weights assigned to inflation and output gaps. The inflation rate used by Taylor (1993) is, for example, the year-on-year rate of change of the GDP deflator while the US Federal Reserve usually employs the price deflator of core Personal Consumption Expenditures (PCE) as its key inflation measure. The ECB and central banks in several countries (Canada, Japan, Sweden, Switzerland, United Kingdom, among others) target the core or headline Consumer Price Index (CPI). The weights assigned to output and inflation gaps also influence the Taylor rate. Although these weights can be empirically estimated – yielding "positive" Taylor rules (see below) – they can also be set at some specific values (leading to "normative" Taylor rates), in general at 0.5 as in the original formulation of Taylor.

In practice, output gaps play a significant role in estimated Taylor rules. The table below reports estimates of Taylor coefficients for Canada, the euro area, Japan, Sweden, Switzerland, the United Kingdom and the United States based on quarterly data over 1985Q1-2011Q2 (except for Sweden and the euro area for which estimation periods are respectively 1988Q1-2011Q2 and 1999Q1-2011Q2).[1] Results indicate that monetary policy significantly reacts to output gaps in the euro area, Switzerland, and the United States, but not in Canada, Japan, the United Kingdom, or Sweden.[2] The result of a non-significant coefficient on the output gap in these countries is, however, sensitive to the period of estimation, as the coefficient becomes significant over some country-specific subperiods (1985Q1-1995Q4 for Canada, 1989Q1-2007Q4 for Japan, 1986Q1-2011Q2 for the United Kingdom, and 1988Q1-2007Q2 for Sweden, although with a negative sign in Sweden).

Box 3. Taylor rule specifications and estimates (cont.)

Taylor rule estimates

(period of estimation 1985Q1-2011Q2, except otherwise indicated)

	Estimated Nominal Neutral Rate	Inflation Stabilisation Coefficient	Output Stabilisation Coefficient
Canada	4.80***	2.05***	0.19
	(0.4)	(0.5)	(0.2)
Japan	2.78***	1.68***	0.05
	(0.3)	(0.2)	(0.1)
Sweden[1]	4.53***	1.18***	-0.002
	(0.5)	(0.1)	(0.2)
Switzerland	3.39***	1.10***	0.46***
	(0.1)	(0.1)	(0.1)
United Kingdom	5.71***	1.12***	0.38
	(0.4)	(0.1)	(0.2)
United States	3.85***	1.62***	0.46***
	(0.4)	(0.2)	(0.1)
Euro area[2]	3.08***	0.32	0.57***
	(0.2)	(0.3)	(0.1)

1. Estimation period: 1988Q1-2011Q2.

2. Estimation period: 1999Q1-2011Q2.

The estimated equation is $i = i^* + \lambda_1(\pi - \pi^*) + \lambda_2(y - y^*) + \varepsilon$, where i is the three-month interest rate, i^* the nominal neutral rate, $(\pi - \pi^*)$ and $(y - y^*)$ are respectively the inflation and output gaps.

***, **, and * indicate significance at the 1%, 5%, 10% levels, respectively. Newey-West heteroskedasticity- and auto-correlation-consistent (HAC) standard errors appear in parentheses.

1. The interest rates refer to three-month interest rates. Inflation rates are measured using harmonised core CPI for the euro area, and simple core CPI for other countries, except for the United States for which core PCE is used. The assumed targets for inflation are the same as those considered in Ahrend et al. (2008).

2. For the euro area, the inflation gap coefficient is not statistically different from zero over the 1999Q1-2011Q2 period. It is, however, statistically significant when the latest quarters of the sample (2007Q1 to 2011Q2) are excluded.

3.2 Consequences for future inflation

Wages and labour costs

45. In most countries, hourly wages decelerated moderately but quickly in response to the recession, with the adjustment taking place one or two quarters after the recession began (Figure 30).[14] Arguably, the moderate wage reaction to the severity of the output contraction was helpful to limit the risks of deflation at the trough of the recession. In general, the reaction of wage inflation to output gaps has been very weak while the influence of unemployment gaps has dramatically decreased in the recent crisis, accentuating the flattening of the Phillips curve that had already been observed in the pre-crisis period. Regression analysis of wage inflation, including simultaneously output and unemployment gaps as explanatory variables, indeed confirms that the unemployment gap has recently lost its predictive power for wage inflation in the G10 countries except in Italy, Japan and Sweden (Figure 31). Still, the slowdown in wages in late 2009 and early 2010, combined with a rebound in productivity, was sufficient to bring about a deceleration in unit labour costs (and even a decline in the United States).

14. Hourly wages are measured as the ratio of nominal wages and the self-employment income received by households over the total number of hours worked.

46. Some countries (*e.g.* Germany and Sweden) have also taken measures to reduce the non-wage component of labour costs, notably through targeted cuts in payroll taxes. However, the downward impact on inflation of such measures may have been partly offset in those countries where the payroll tax cuts were financed through higher consumption taxes (*e.g.* Germany).

47. Different forms of labour market slacks presumably have different implications for wage dynamics in the recovery:

- Unemployment gaps influence wages in the short term as evidenced by a number of studies, even if the long-run wage Phillips curve is likely to be vertical (Russell, 2011). However, long-term trends, only partly related to policy, such as globalisation and the decline in union power, may have reduced workers' pricing power, implying a flattening of the Phillips curve. Wages may also have been less responsive to unemployment gaps during the recent crisis than in previous severe downturns because of the better anchoring of inflation expectations. Surprisingly, the output gap appears as a significant determinant of wage inflation in Belgium, Canada, France, Germany and the Netherlands, suggesting that other components of the gap than unemployment may capture relevant information about wage setting (Figure 31).

- Hours gaps probably have small effects on hourly wages and only to the extent that workers on shorter hours actively seek to increase their working time. Where hours gaps are substantial, greater demand can be met partly by increasing hours before creating wage pressures. The corollary is that there will be less self-equilibrating wage adjustment when labour market slack takes the form of hours gap rather than open unemployment.

- Participation gaps probably also have small effects on wages and hence market-based adjustment in wages (see *e.g.* Elmeskov and Pichelmann, 1993).

- Although of a more speculative nature and subject to vast uncertainty, migration-related "population gaps" could in principle have implications for wage setting. If the number of migrant workers in a destination country is below trend (negative population gap), it suggests that emerging labour shortages could be partly addressed by net inward migration, damping wage pressures. In that sense, immigration can "grease the wheels" of the labour market (Borjas, 2001; Bean, 2006). This however comes at the cost of a symmetric effect in the origin country.

48. Overall, even if the US wage Phillips curve appears to be relatively flat, the large unemployment gap in the United States could be expected to keep a lid on wage inflation in the future, especially given that only a limited part of the adjustment appears to have taken place so far. In other major OECD countries with ample economic slack, the lower unemployment gaps would suggest smaller downward pressures on wages in the future.

Margins

49. Developments in margins have been contrasting across economies in the crisis and the recovery, pointing to different prospects and implications for prices over the medium term (Figure 32).[15] However, with the notable exception of the United States, G10 countries have experienced a decline in margins since the beginning of the crisis. These falls go against the usual movements in mark-ups during a downturn

15. There is no consensus on the most appropriate proxy for price-cost margins. For the sake of comparison, margins are here measured as the ratio of gross operating surplus to gross value added in the business sector and as the inverse of the labour income share (*i.e.* the ratio of nominal GDP at factor cost to compensation of employees).

(Woodford, 2003, Gali and Monacelli, 2007). Broader empirical evidence indeed suggests that mark-ups are generally counter-cyclical, supporting the conjecture that downturns result in higher margins as marginal costs fall as demand and production contract before prices adjust and that economic booms put downward pressures on price margins by increasing competition or by decreasing the incentives for collusion (Oliveira Martins and Scarpetta, 1999, 2002).

50. The recent falls in margins observed in many countries can have different sources, with different implications for the outlook for price setting. If lower margins are mainly due to labour hoarding, and if this hoarding is not followed by layoffs, firms will try to rebuild their margins, implying a combination of wage moderation and upward price pressure. If, in contrast, the recent evolutions in margins are the result of a change in product market competition (including more intense foreign competition) and of structural reforms implemented by countries before or during the crisis, they may have some persistent downward effects on inflation for a prolonged period of time. Empirical evidence indeed suggests that a lower mark-up reduces average inflation rates both at the aggregate and the sectoral level (Przybyla and Roma, 2005). However, the stocktaking of reforms undertaken during the crisis (see OECD, 2012) does not indicate any changes in product market regulation consistent with the cross-country evolutions of margins reported in Figure 32. Indeed, margins seem to have decreased the most in countries with the highest downward rigidities on labour input, in line with the labour hoarding hypothesis (Figure 33).[16]

Prices, expectations and monetary policy

51. Despite the considerable uncertainty about the levels of output and unemployment gaps and their components, the data and analysis presented in this paper leave no doubt that economic slack is pervasive in all large OECD economies and will remain so in 2012 and 2013. Although total-factor-productivity-related gaps are highly uncertain, unemployment gaps are clearly negative and set to remain so in 2012 and 2013 beyond margins of estimation error. Large negative unemployment gaps will exert downward pressure on inflation in coming years. Earlier OECD Analysis (Moccero *et al.*, 2011) suggests that, despite this downward pressure, a deflationary spiral remains unlikely as long as inflation expectations stay anchored.

52. Avoiding a fall in inflation expectations is key. Estimates suggest that inflation expectations react only very sluggishly to inflation readings (see OECD, 2011e). These statistical estimates, however, mostly reflect the relationship between expectations and outcomes during the period of stability that preceded the crisis. There is a risk that this relationship could break if, after rising strongly on the back of the past commodity price shock, inflation started to fall rapidly as a result of ample and widening slack. Guarding against this risk possibility calls for keeping monetary policy very accommodative until economic slack starts to recede in earnest and in some cases for expanding accommodation, including through non-conventional measures despite their costs and risks inherent.[17]

16. This latter observation is also consistent with the finding that stringent employment protection legislation on regular contracts mitigates the short-term impact of macroeconomic shocks on employment and labour income (OECD, 2011c).

17. Near-zero interest rates entail a number of risks by reducing incentives for fiscal consolidation and for recognizing and writing off bad loans since the opportunity cost of renewing them is very low. Countries with very low interest rates may therefore well end up with zombie banks, as experienced in Japan, but also encounter problems in the sectors of pension funds and insurance where near-zero interest rates inflate liabilities.

4. Implications for fiscal policy

53. In principle, output gaps should play a central role in fiscal policy formulation by allowing to distinguish cyclical from underlying factors in government revenues and expenditure. Output gaps have arguably become more important for fiscal policy with the increased tendency to specify medium-term objectives in terms of structural or cyclically-adjusted budget balances. Thus, the recently concluded fiscal compact for most EU countries sets a ceiling on permissible cyclically-adjusted deficits, and the same applies in the United Kingdom's Charter for Budget Responsibility; the fiscal rule in Germany, specifying a maximum structural budget deficit, is even enshrined in the Constitution; a debt-brake rule requiring a balanced structural budget at the federal level is effective in Switzerland since 2003 (OECD, 2007b).

54. With a higher level of debt, potential growth has become more important when assessing the current stance of fiscal policy. The exponential nature of debt dynamics means that, at high debt levels, fiscal sustainability is strongly influenced by the shape of the path that potential output is set to follow over the medium to long-term. This is particularly the case for individual euro area countries, where the time path of potential output may not be reflected in the path of interest rates which are set at the level of the area as a whole.

4.1 Output gap indicators for fiscal policy

55. A specific conceptual point arises when considering OECD-estimated output gaps for fiscal policy. The concept of output gap most tightly linked to the needs of fiscal policy compares current demand to the steady-state productive potential of the economy. This definition corresponds to the "long-term" notion of potential output which, on the capital side, is based on the trend rather than the current level of the stock of capital. As mentioned previously, the current OECD methodology to estimate potential output does not include such a notion of trend capital. In countries such as Italy and Japan where capital is well below pre-crisis projections, "long-term" output gaps that included a capital-stock gap could be about two percentage points wider than current OECD estimates for 2012.[18] Notwithstanding this caveat, the OECD estimates only one concept of the gap which is used for both monetary and fiscal analysis.[19]

4.2 Consequences of output gap uncertainty for the reliability of cyclically-adjusted balances

56. The usefulness of output gaps for fiscal-policy making in practice largely hinges on what their uncertainty implies for the reliability of cyclically-adjusted fiscal indicators. Historical evidence for OECD economies suggests that, on average, output and unemployment gap uncertainty has relatively moderate effects on cyclically-adjusted fiscal balances (also because these are more strongly influenced by actual balances than the gap, see below).[20] Uncertainty is, however, greater at cyclical turning points than on average over the cycle as the revisions made to initial estimates of the output gap are markedly larger in those years in which a turning point occurs (Koske and Pain, 2008). Furthermore, the effect of uncertainty varies across countries depending on the typical size of gap revisions and on the tax and revenue

18. This back-of-the-envelope estimate assumes that, out of the 12 and 14% shortfalls in Italy's and Japan's capital stock levels in 2012 *vis-à-vis* pre-crisis projections, 6½ percentage points is structural (see Box 1). This assumption implies capital-stock gaps of 5½ and 7½ per cent, respectively, which contribute around 1.8 and 2.0 percentage points to aggregate "long-term" output gaps in Italy and Japan.

19. OECD calculations of cyclically-adjusted fiscal balances also use the unemployment gap to cyclically correct spending on unemployment benefits (Girouard and André, 2005).

20. Over the period 1995-2003, on average across the G7 countries (and also for a wider sample of 21 OECD economies), revisions to the level of the output and unemployment gaps accounted for revisions of around 0.4 percentage points of GDP in the cyclically-adjusted primary balance (Koske and Pain, 2008).

elasticities with respect to the gap in the country under consideration (Figure 34). The gap-related uncertainty around the cyclically-adjusted budged balance appears to be higher for Japan, Germany and Italy than for other G7 countries. Nevertheless, overall, a fiscal position that would be regarded as sound on contemporaneous estimates of cyclically-adjusted budgetary indicators is unlikely to be seen in a fundamentally different light in subsequent revisions (OECD, 2008; Pain and Röhn, 2011).

57. Output and unemployment gaps are not the only source of uncertainty about cyclically-adjusted budget balances (as a per cent of GDP):

- Cyclically-adjusted balances by definition aim to control for the economy's position in the business cycle but not for the impact of asset-price misalignments, that are often not well correlated with the business cycle. Where asset price shifts have proved temporary, cyclically-adjusted balances have been misleading as a result (Price and Dang, 2011). For example, structural budget balances that are adjusted for asset-price misalignment in addition to the business cycle were more negative than cyclically-adjusted budget balances in nearly all G10 countries in the final period (1998-2000) of the dotcom bubble (Figure 35). In the mid-2000s, asset-price-adjusted structural balances were also below cyclically-adjusted budget balances in countries where house prices were found to overshoot fundamentals, including in the United States, the United Kingdom, France and Canada (Price and Dang, 2011).[21]

- Contingent government liabilities, which have increased massively in the crisis with *de jure* and *de facto* guarantees for systemically important banks, are likely to make government finances more sensitive to supply-demand imbalances. The reason is that the high leverage of banks makes them exposed to cyclical downturns, although efforts to increase capital ratios should mitigate this vulnerability.

4.3 The evaluation of consolidation needs

58. Another important question surrounding the relevance of output gaps for fiscal policy analysis is to which extent the evaluation of consolidation needs depends on the measurement of the gap. Simulations suggest that output gap uncertainty has relatively limited consequences for estimates of consolidation needs (Figure 36). Above-average measurement errors on the output gap, such as 2 percentage points, modify the evaluated consolidation need by close to or less than one per cent of GDP in all G10 countries, given the link between cyclical budget positions and the output gap.

59. There are other important sources of uncertainty about consolidation needs than output gaps:

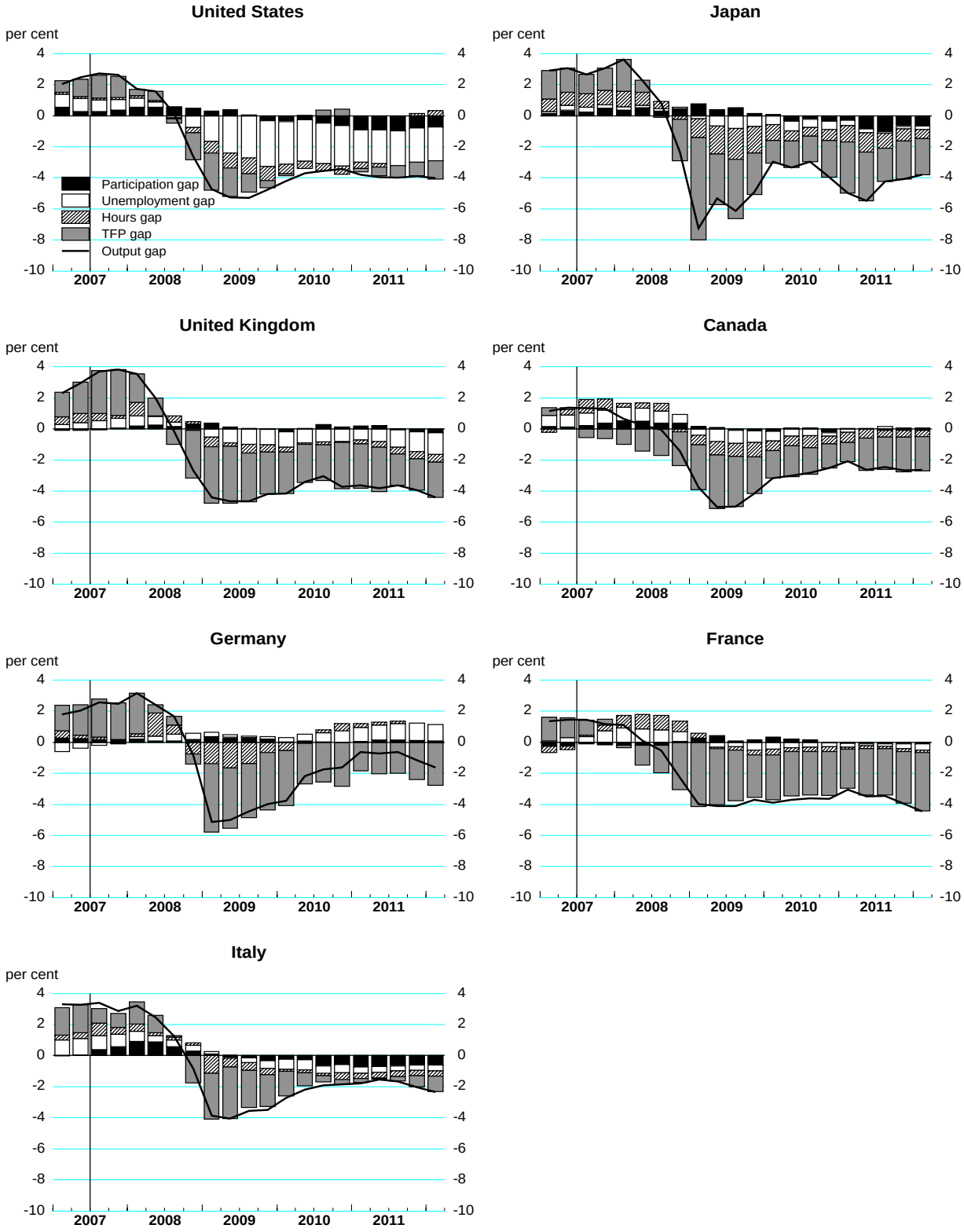
- Consolidation needs are strongly influenced by long-term trends in spending and revenues shaped by demographic change (*e.g.* pensions and health care) and technical progress (*e.g.* health care), although addressing such pressures on budgets needs to take into account inter-generational fairness. These long-term trends have quantitatively large effects on consolidation needs and are subject to considerable uncertainty (Dang *et al.*, 2001; Oliveira-Martins and de la Maisonneuve, 2006). Demographic change can also have consequences for saving and investment behaviour, in turn influencing the differential between the equilibrium real interest rate and the potential growth rate of the economy, which is a key variable for debt sustainability (Turner and Spinelli, 2011).

21. House prices were seen as justified by fundamentals in a different study (André, 2011), underscoring the difficulty of measuring overshooting in asset markets.

- Prospects for potential output are key to assessing consolidation needs but subject to significant uncertainty. In the very long run, fiscal balances generally do not improve permanently as revenue and spending both catch up with productivity growth. The path of potential output nevertheless matters because of debt dynamics in the transition period before this catch-up process finishes. As mentioned above, the OECD assessment in the *OECD Economic Outlooks* of May and November 2011 is that the crisis has had an effect on the level but not on the growth rate of potential output (see Box 2).

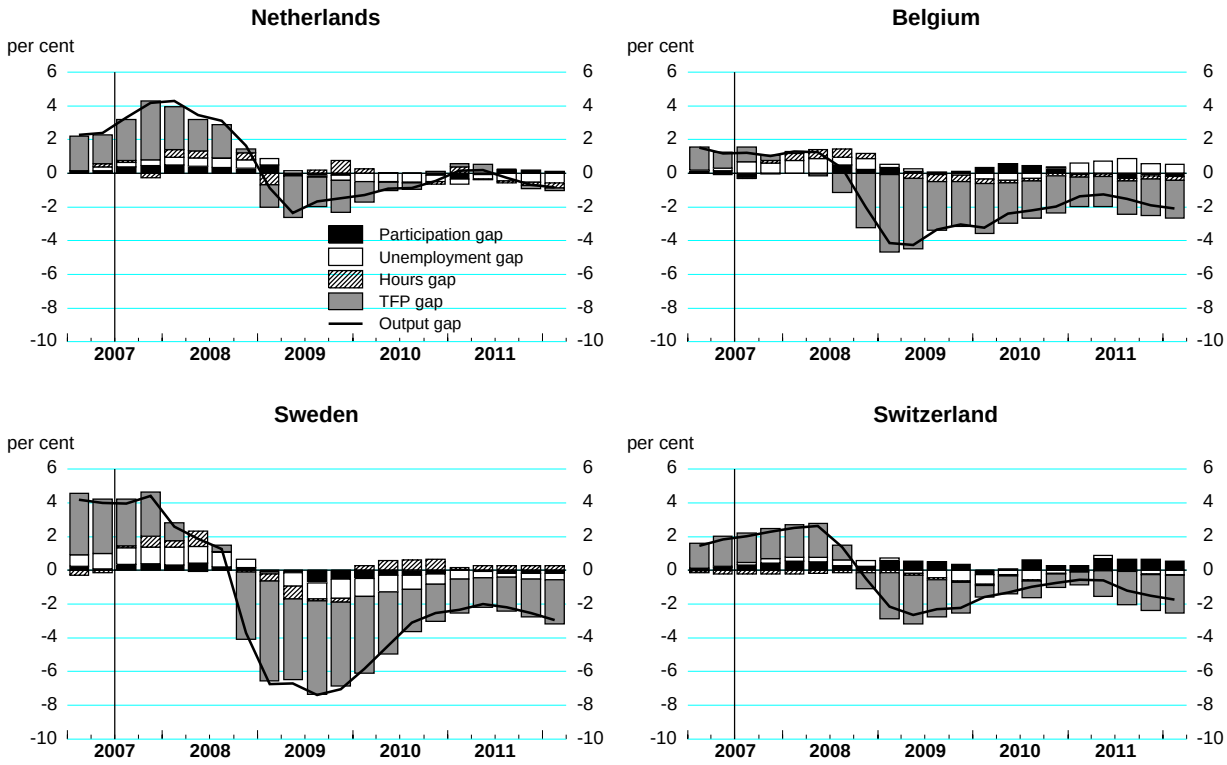
- The nature and sequencing of the shocks hitting economies, which are by nature impossible to forecast, have significant consequences for consolidation needs. Stochastic simulations have been run to gauge the implications for debt dynamics of shocks calibrated on each country's history of changes in debt, such as one-offs and valuation effects that are not explained by budget balances, interest rates, inflation and growth (Merola and Sutherland, 2012). They show that ensuring that long-term debt targets are met for instance 75% of the time instead of just on average can raise consolidation needs by significant amounts in the United States and Japan (Figure 37).

Figure 1. Current OECD estimates point to negative output gaps



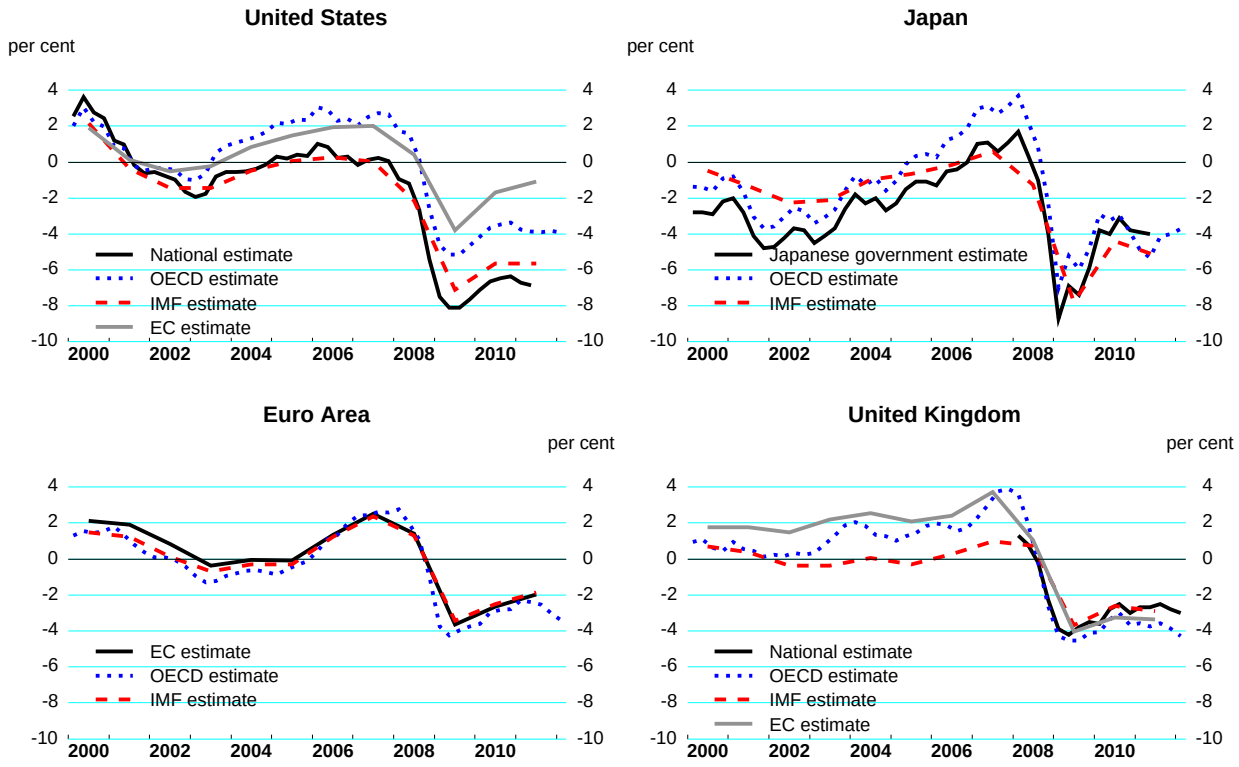
Source: OECD Economic Outlook No. 90 database.

Figure 1. Current OECD estimates point to negative output gaps (cont.)



Source: OECD Economic Outlook No. 90 database.

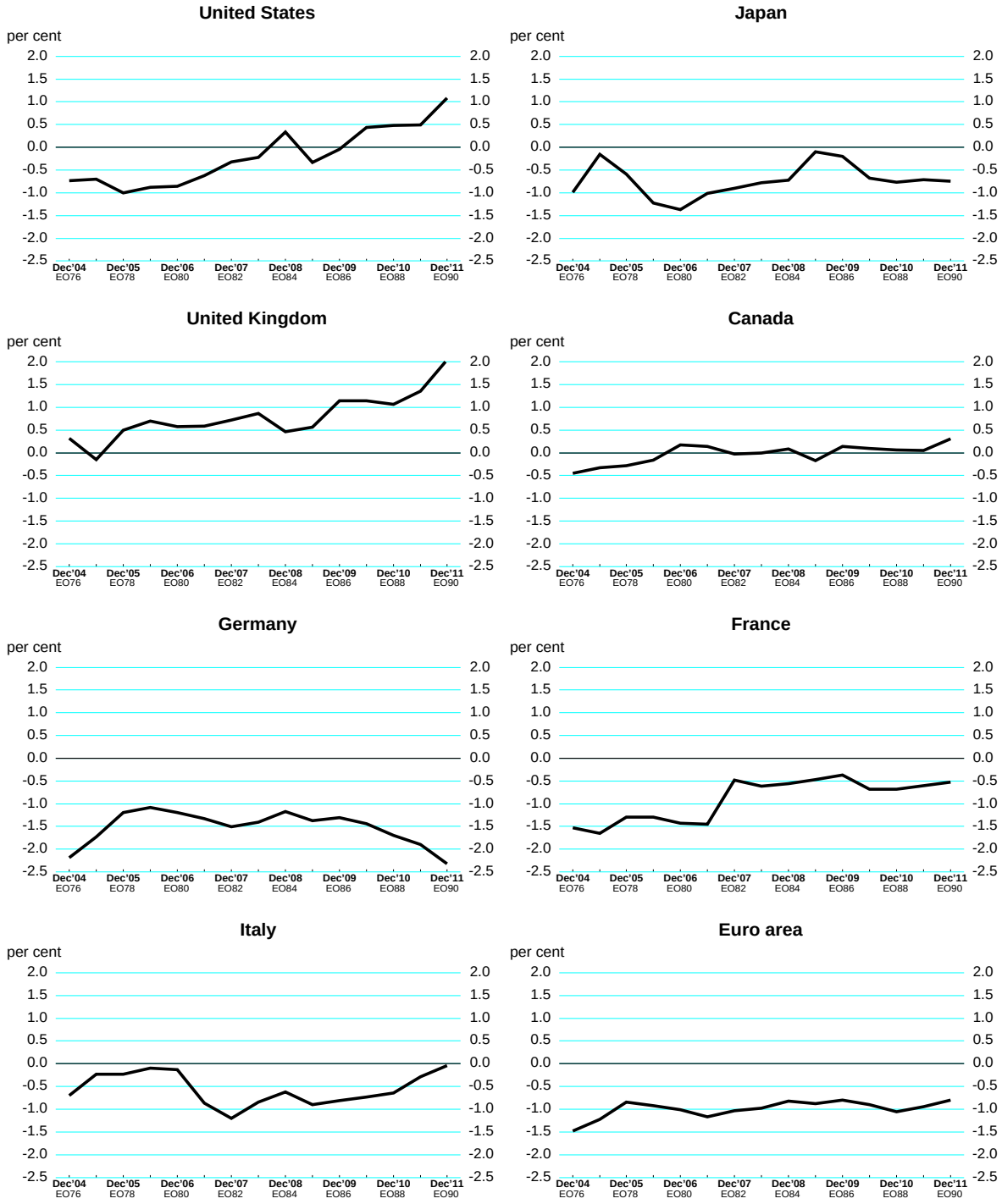
Figure 2. Output gap estimates differ across institutions



Source: Congressional Budget Office, USA; Japanese government; Office for Budget Responsibility, United Kingdom, November 2011; IMF World Economic Outlook, September 2011;European Commission, AMECO, November 2011 and OECD Economic Outlook database.

Figure 3. Successive vintages of output gap estimates for 2004Q1 show significant revisions

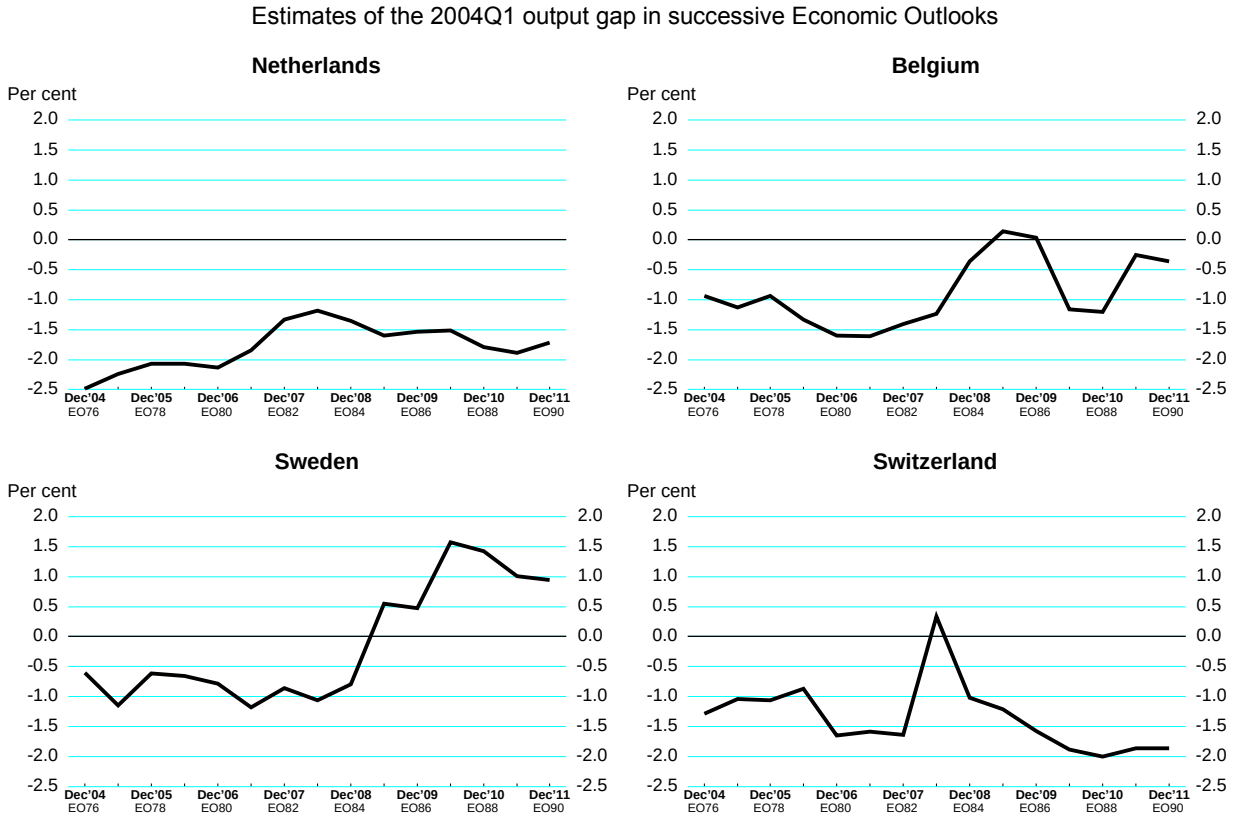
Estimates of the 2004Q1 output gap in successive Economic Outlooks



Note: These figures represent the successive OECD output gap estimates for 2004Q1 from December 2004 (EO 76) to December 2011 (EO 90). The output gap is calculated as the percentage difference between the actual and the potential real GDP.

Source: OECD Economic Outlook databases.

Figure 3. Successive vintages of output gap estimates for 2004Q1 show significant revisions (cont.)

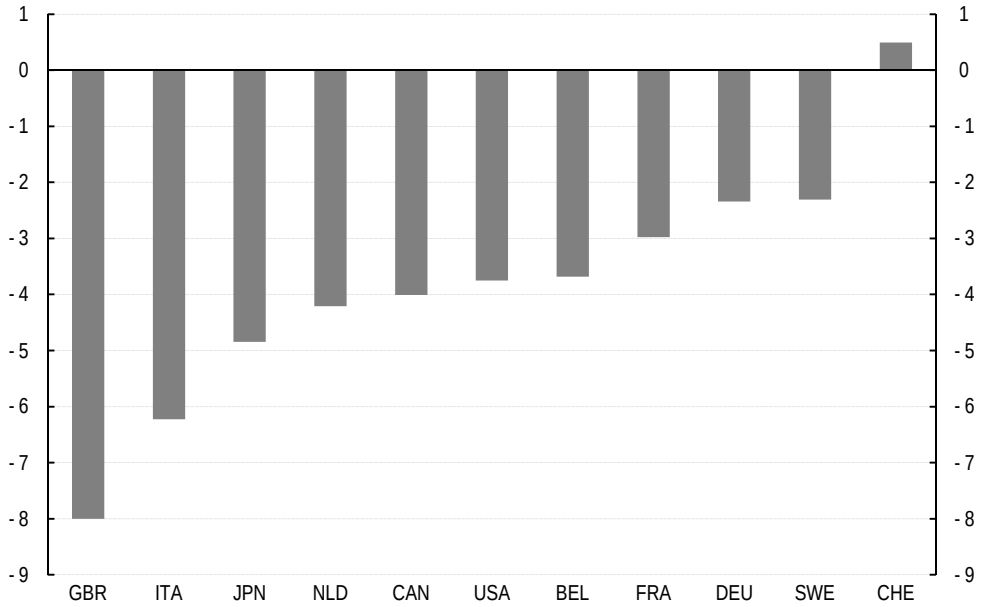


Note: These figures represent the successive OECD output gap estimates for 2004Q1 from December 2004 (EO 76) to December 2011 (EO 90). The output gap is calculated as the percentage difference between the actual and the potential real GDP.

Source: OECD Economic Outlook databases.

Figure 4. Potential output in 2013 has been revised downward in almost all countries

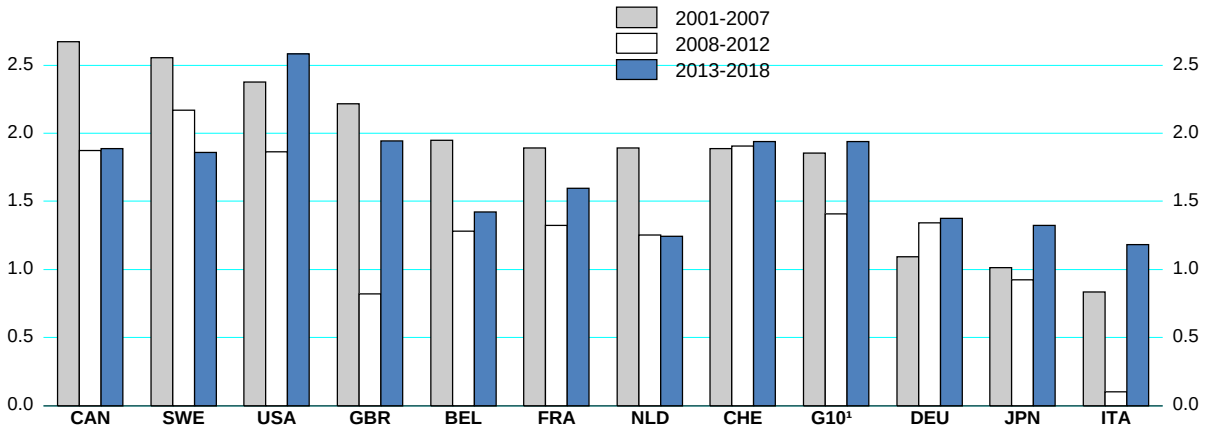
Percentage change between December 2007 and November 2011 OECD projections for 2013



Source: OECD Economic Outlook No. 82 and OECD Economic Outlook No. 90 databases.

Figure 5. Prospective potential growth is projected to rise above crisis-period rates in most countries

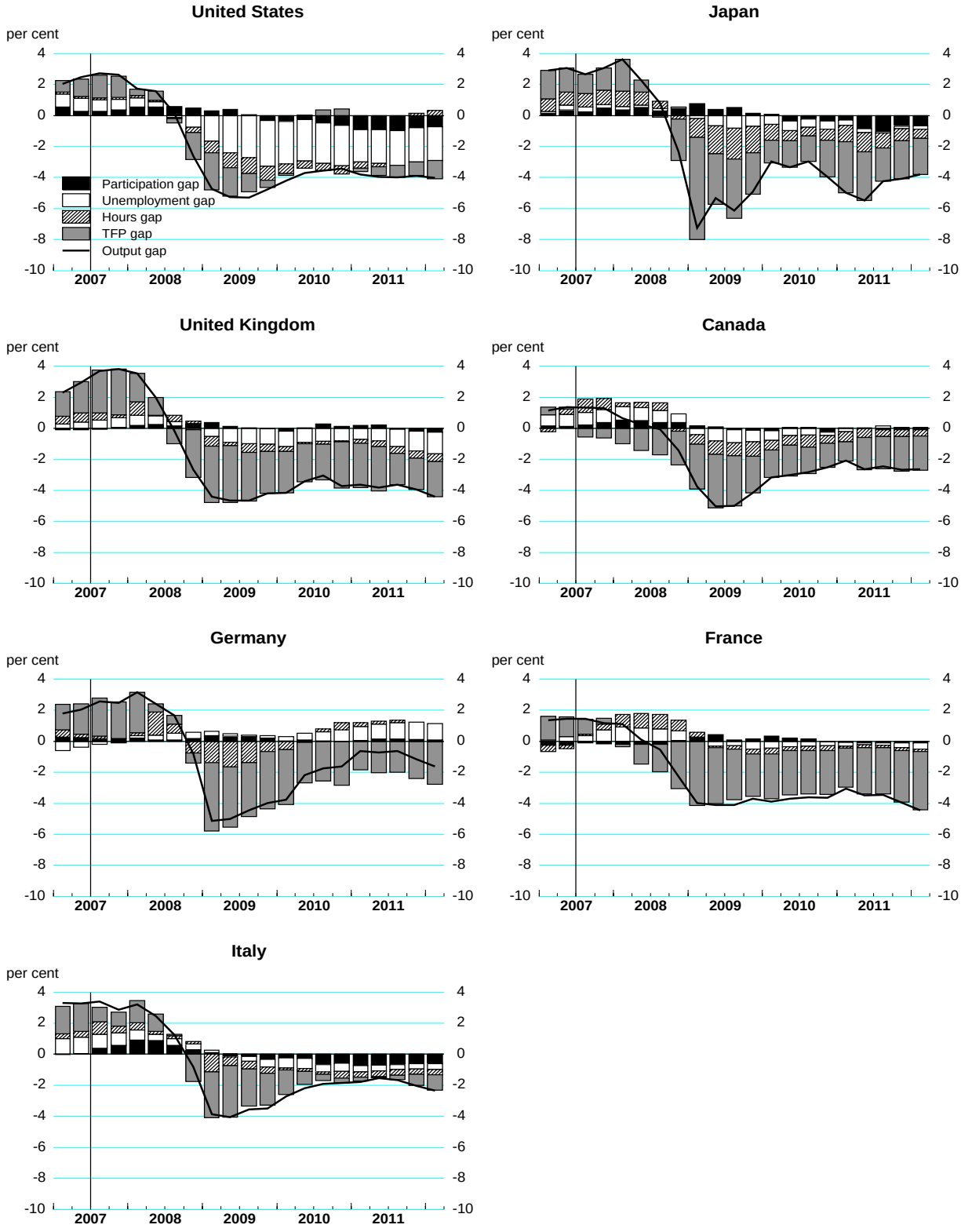
Average annual potential output growth, per cent



1. Weighted average growth rate of the 11 countries. Weight real GDP in USD in 2010.

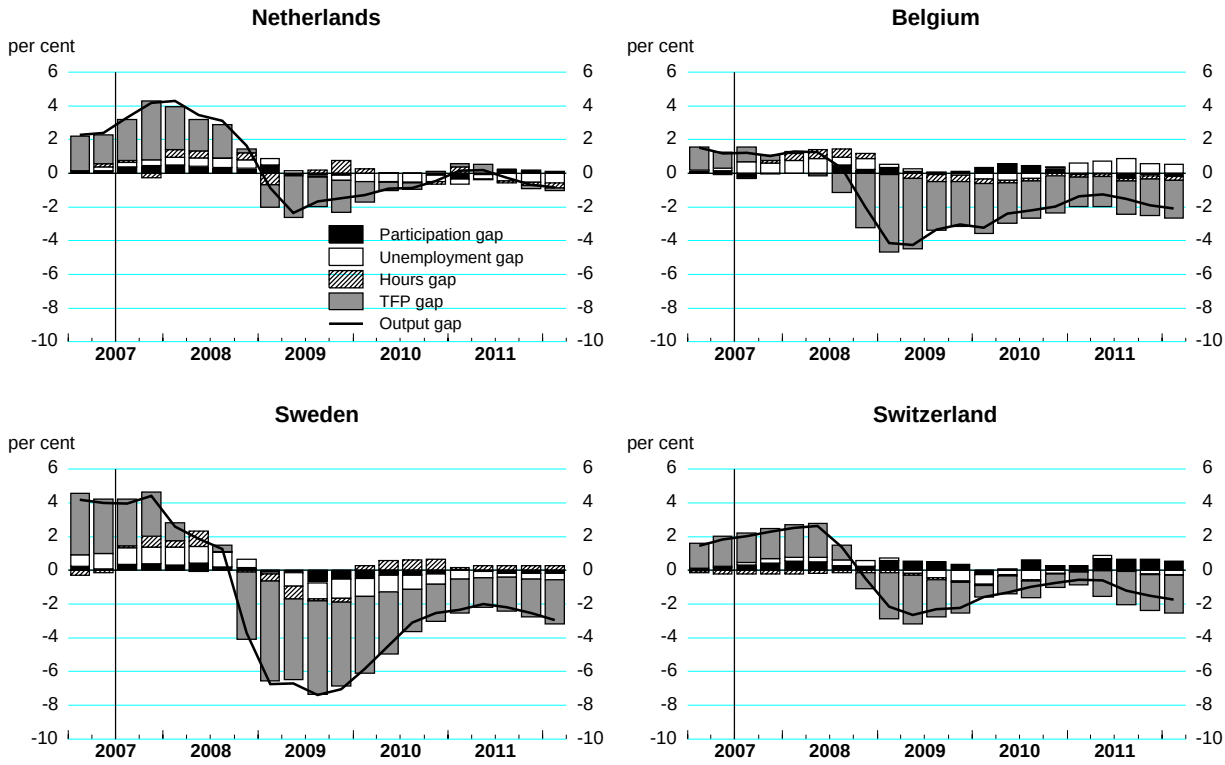
Source: OECD Economic Outlook No. 89 medium and long-term database.

Figure 6. Current OECD estimates point to negative output gaps



Source: OECD Economic Outlook No. 90 database.

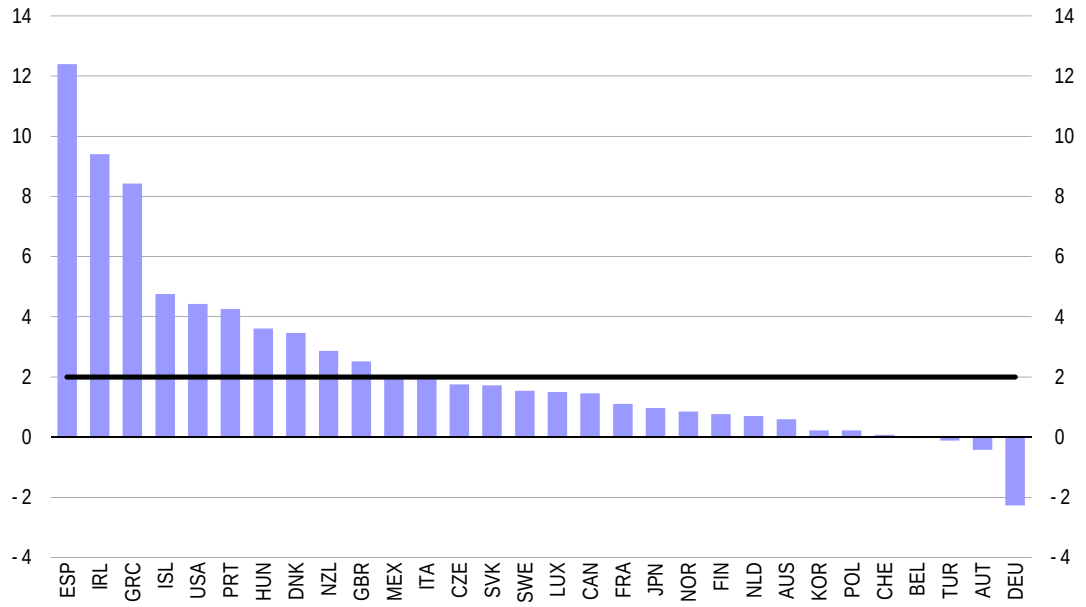
Figure 6. Current OECD estimates point to negative output gaps (cont.)



Source: OECD Economic Outlook No. 90 database.

Figure 7. Unemployment remains well above the pre-crisis level in most countries

2007Q3-2011Q2 change in percentage points[1]

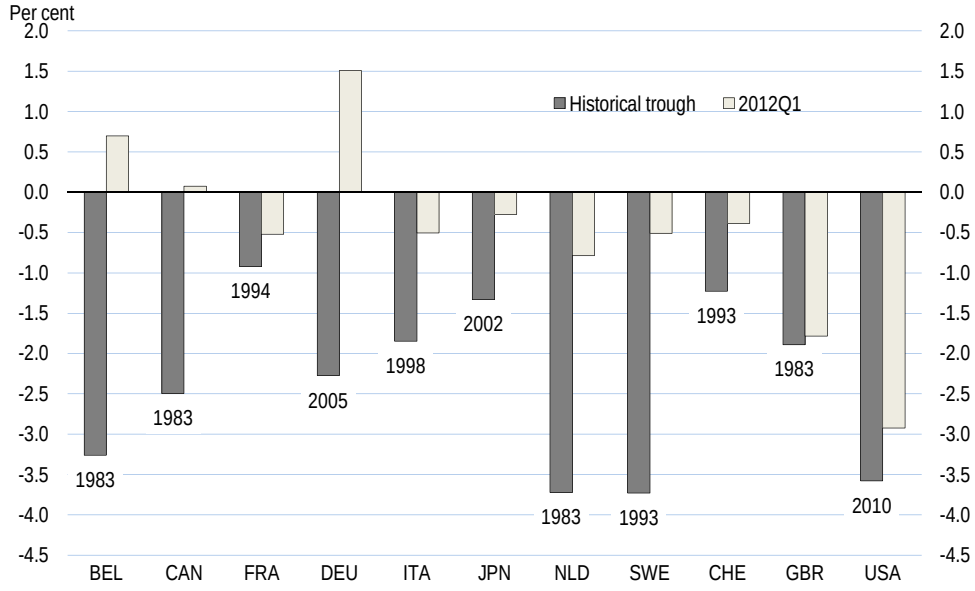


1. Except USA 2007Q3-2011Q3. Data source for Japan and Switzerland 2011Q2 is OECD quarterly Labour Force Statistics.

Source: OECD, Economic Outlook database.

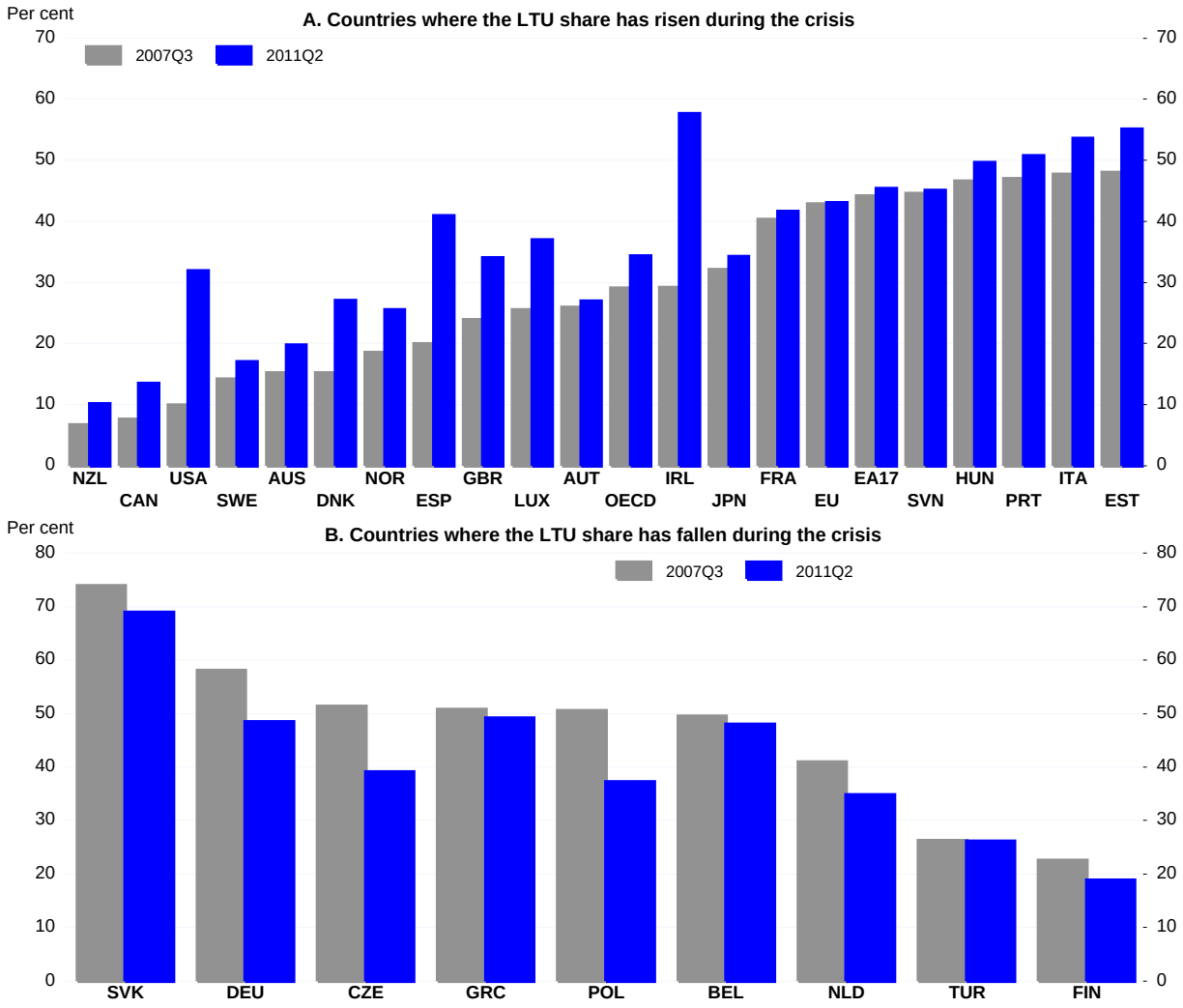
Figure 8. Current unemployment gaps are not as large as in historical troughs

Difference between NAIRU estimate and actual unemployment



Source: OECD Economic Outlook No. 90 Database.

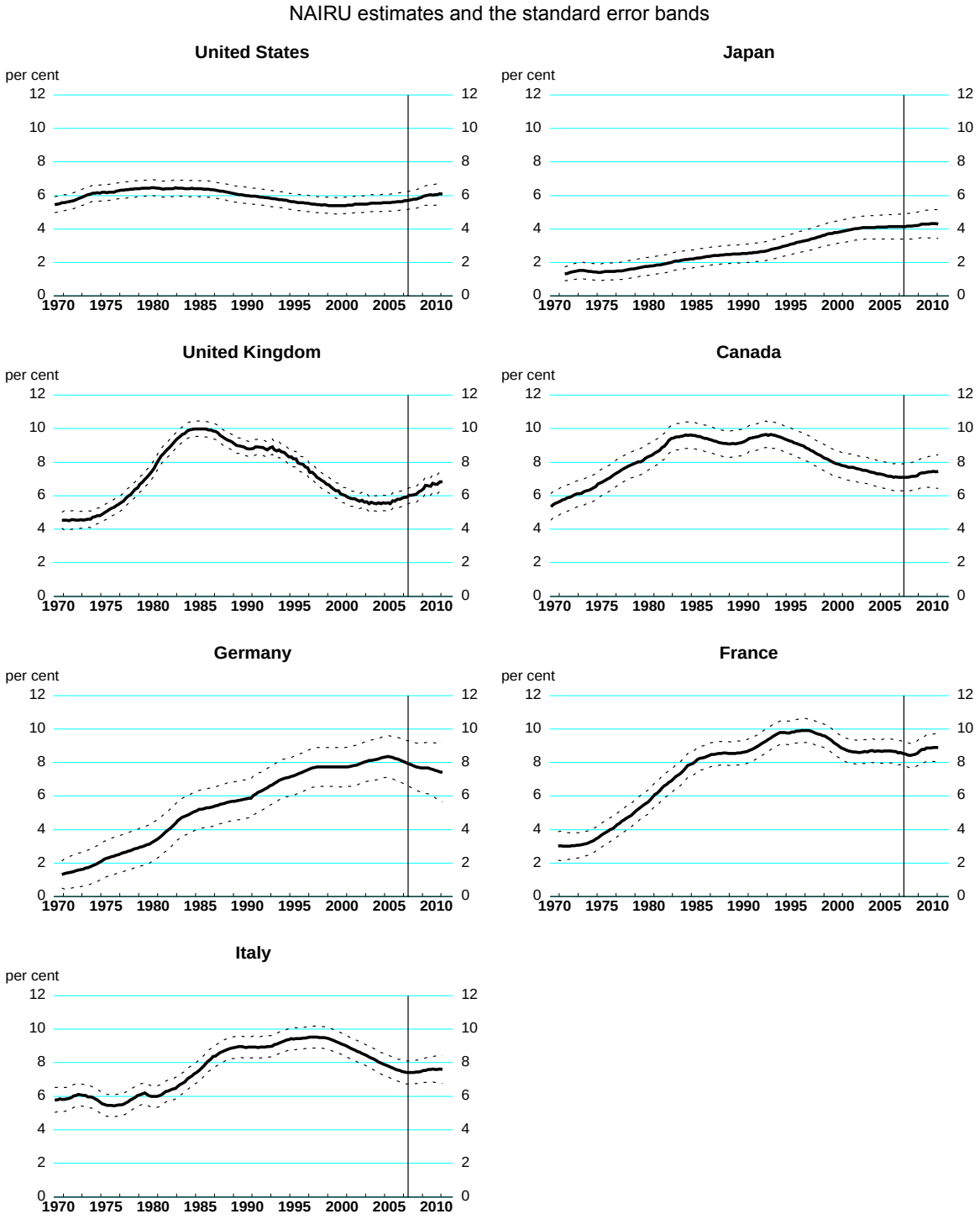
Figure 9. The share of long-term unemployment (LTU) has risen sharply in some countries



1. Series smoothed using a three-quarter centered moving average.

Source: OECD, Quarterly Labour Force Statistics.

Figure 10. The rises in the NAIRU during the crisis are consistent with hysteresis effects in most countries

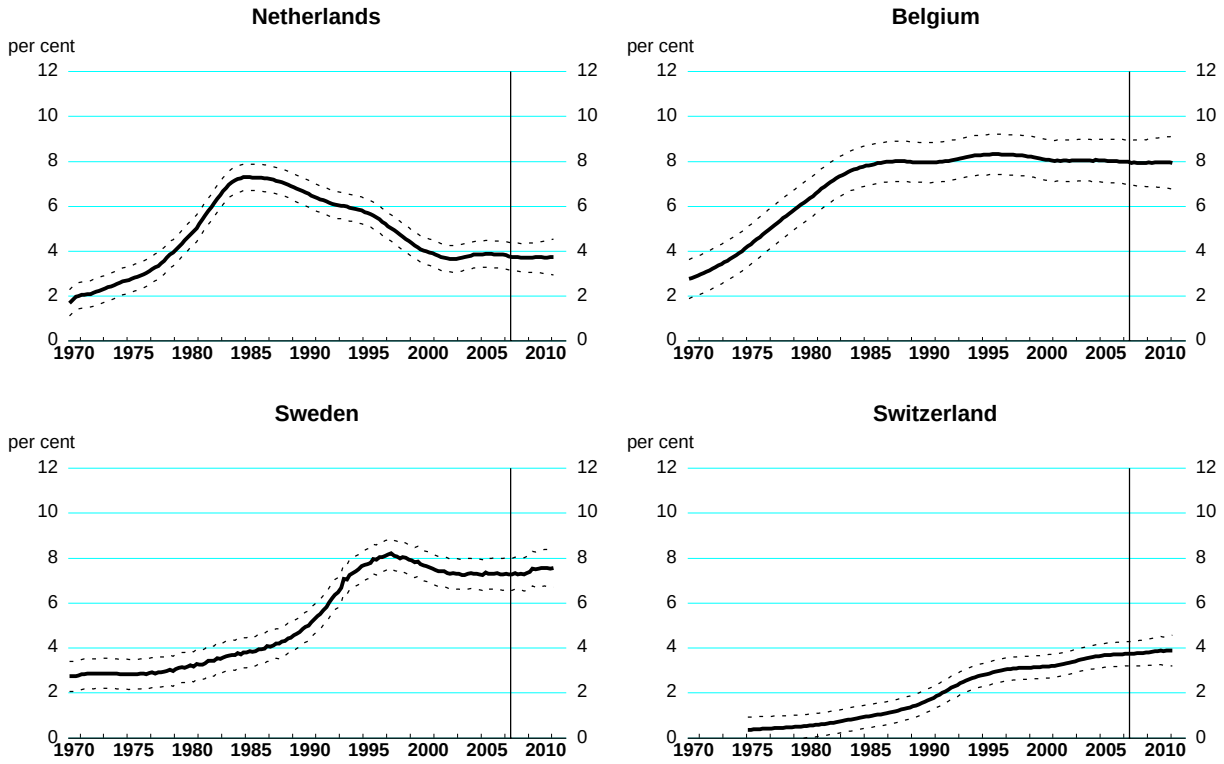


Note: The OECD NAIRU is derived from the information contained in a reduced Phillips curve equation (linking inflation to the unemployment gap) by means of a Kalman filter. Standard errors around the NAIRU are estimated using Monte-Carlo simulation, November 2011. Marking at the beginning of the financial crisis, 2007Q3.

Source: Guichard and Rusticelli (2011).

Figure 10. The rises in the NAIRU during the crisis are consistent with hysteresis effects in most countries (cont.)

NAIRU estimates and the standard error bands

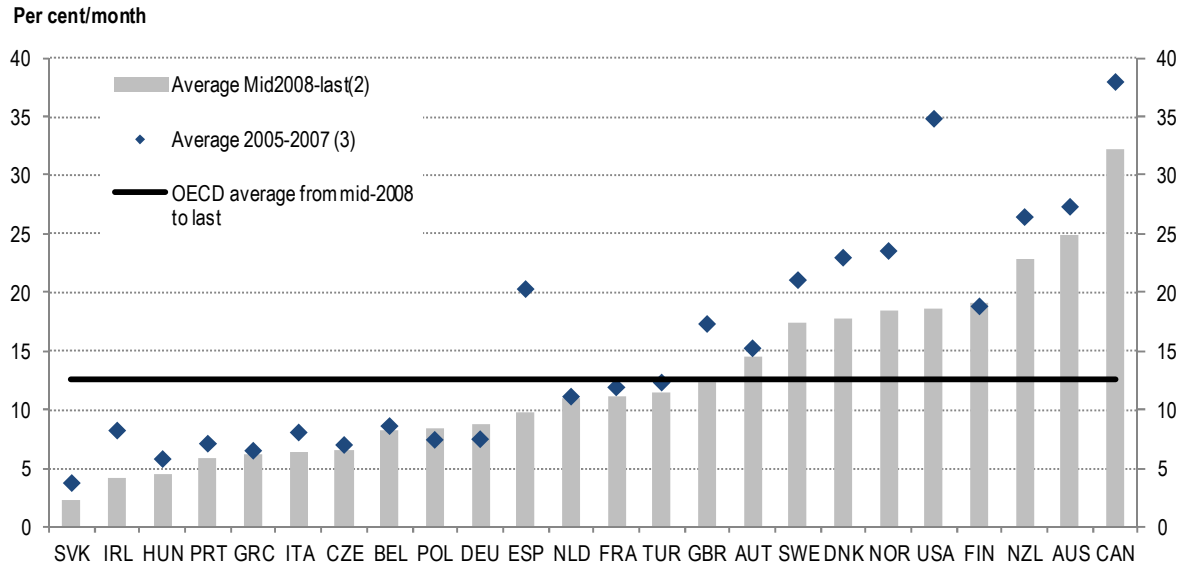


Note: The OECD NAIRU is derived from the information contained in a reduced Phillips curve equation (linking inflation to the unemployment gap) by means of a Kalman filter. Standard errors around the NAIRU are estimated using Monte-Carlo simulation, November 2011. Marking at the beginning of the financial crisis, 2007Q3.

Source: Guichard and Rusticelli (2011).

Figure 11. The probability of leaving unemployment has fallen following the crisis

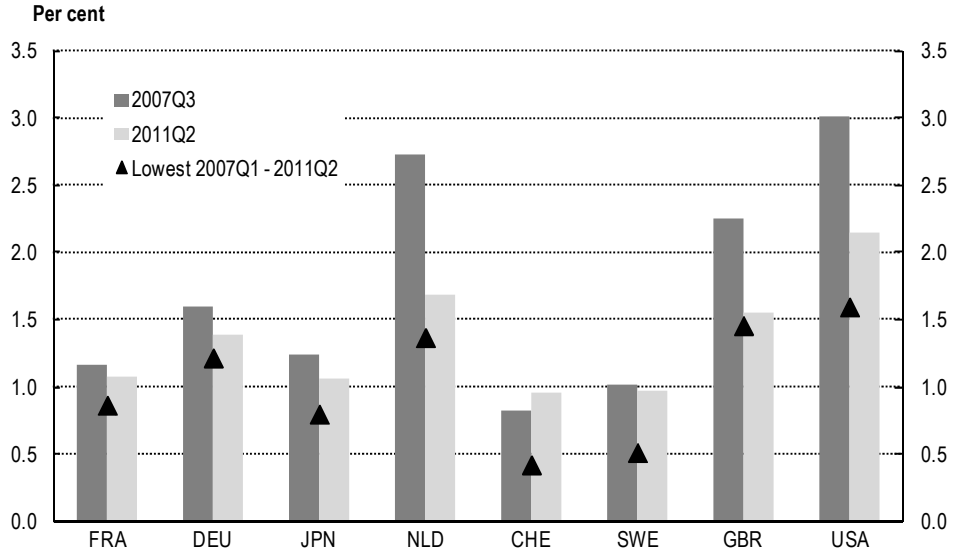
Outflow rates from unemployment[1]



1. Outflow rates are defined as the probabilities that an unemployed worker exits unemployment within the following month. The measured outflow rate includes both outflows to job and to inactivity.
2. Average from mid-2008 to the latest available observation.
3. Except Ireland and Turkey 2006-2007.

Source: OECD calculations based on Eurostat, New Cronos; US Current Population Survey; Australian Bureau of Statistics; Statistics Canada; Labour Force Survey.

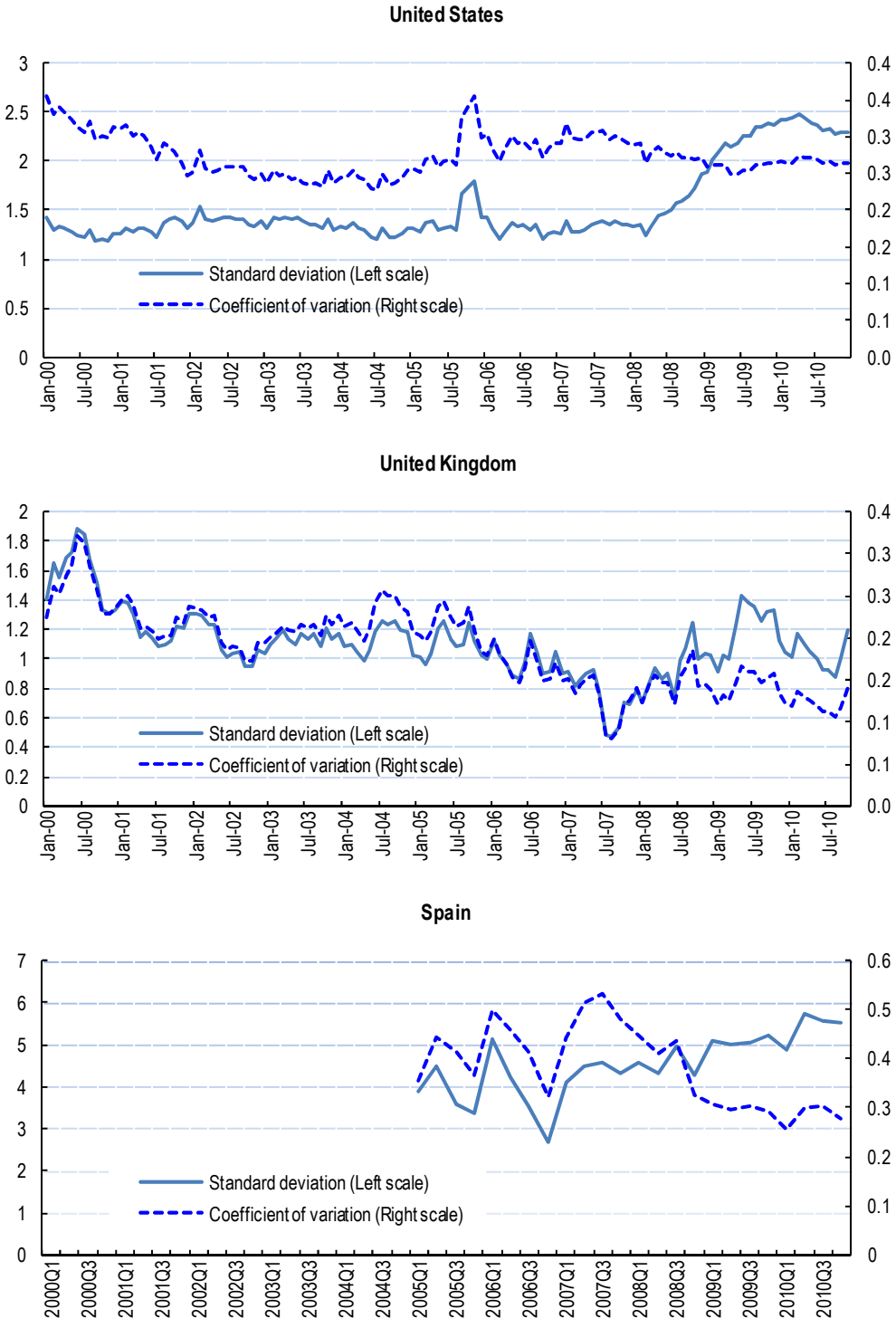
Figure 12. Vacancy rates



Note: Vacancy rate is calculated as the ratio of unfilled vacancies, seasonally adjusted to the sum of unfilled vacancies, seasonally adjusted and total employment. Unfilled vacancy data for Netherlands and Switzerland are from Datastream and are not seasonally adjusted.

Source: Datastream and OECD Monthly Economic Indicators.

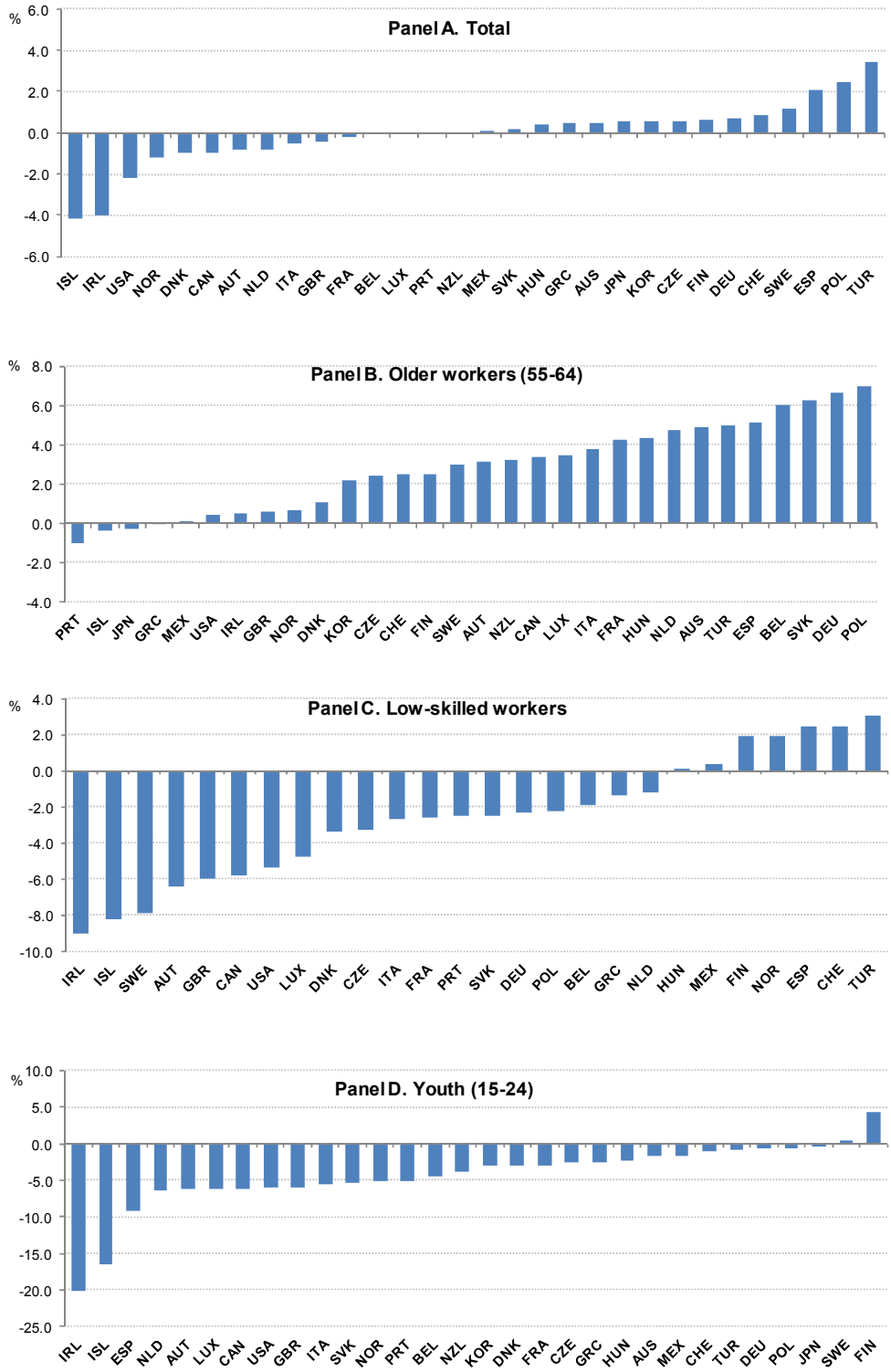
Figure 13. Measures of dispersion of regional unemployment rates show no clear indication of mismatch



Source: Spain, Instituto Nacional de Estadistica; United Kingdom, Office for National Statistics and US Bureau of Labor Statistics.

Figure 14. Labour force withdrawal has so far been limited except for youth and low-skilled

Percentage point change in labour force participation rates from 2007Q3 to 2011Q21

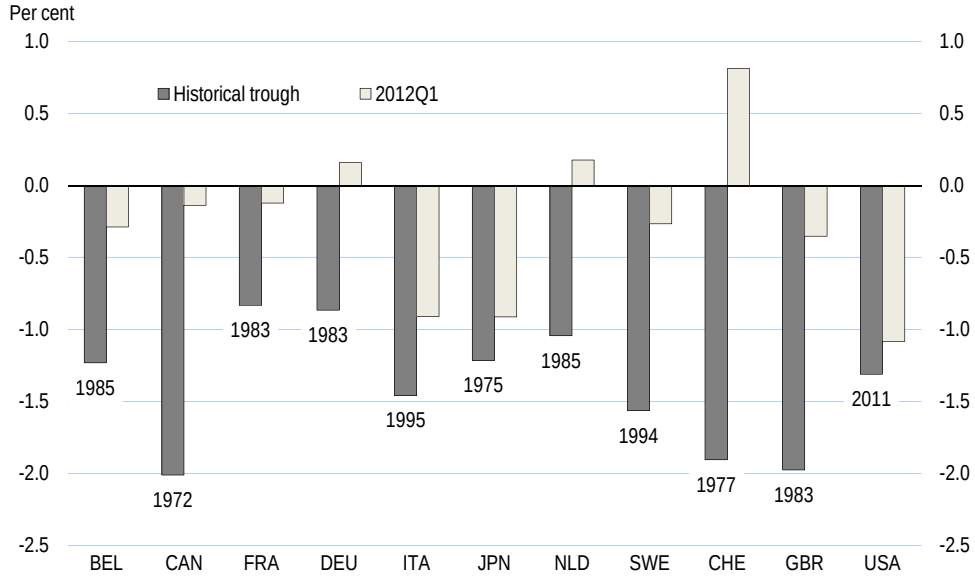


1. For Iceland the period is 2007Q3 to 2011Q1 and for Switzerland 2007Q2 to 2011Q2.

Source: OECD (2011), Quarterly Labour Market Indicators Database, Directorate for Employment, Labour and Social Affairs, October, Unpublished data.

Figure 15. Participation gaps are smaller than in historical troughs in most countries

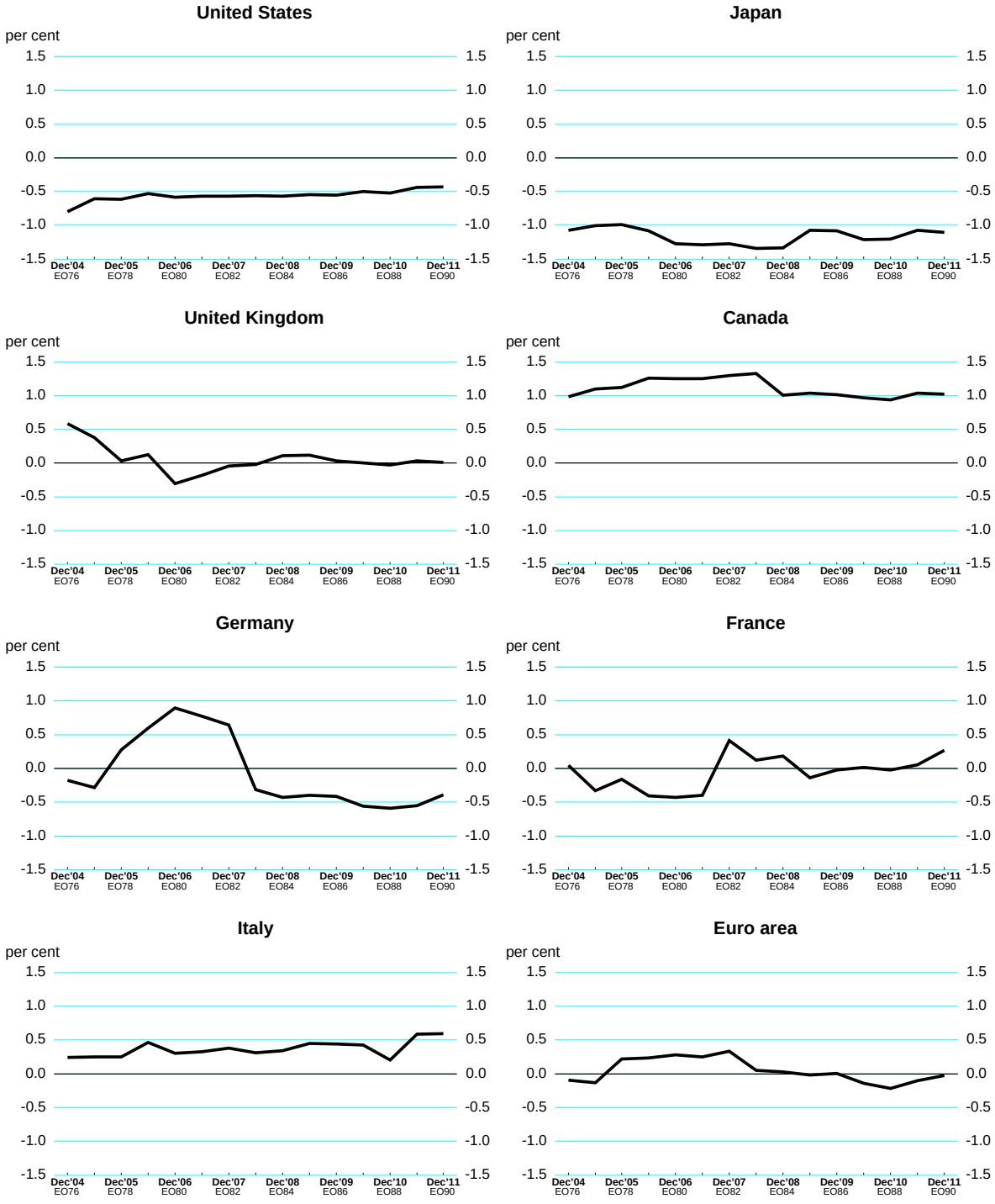
Difference of the actual and trend participation rate as a percentage of trend participation rate



Source: OECD Economic Outlook No. 90 database.

Figure 16. Successive vintages of participation gap estimates for 2004Q1

Estimates of the 2004Q1 participation rate gap in successive Economic Outlooks

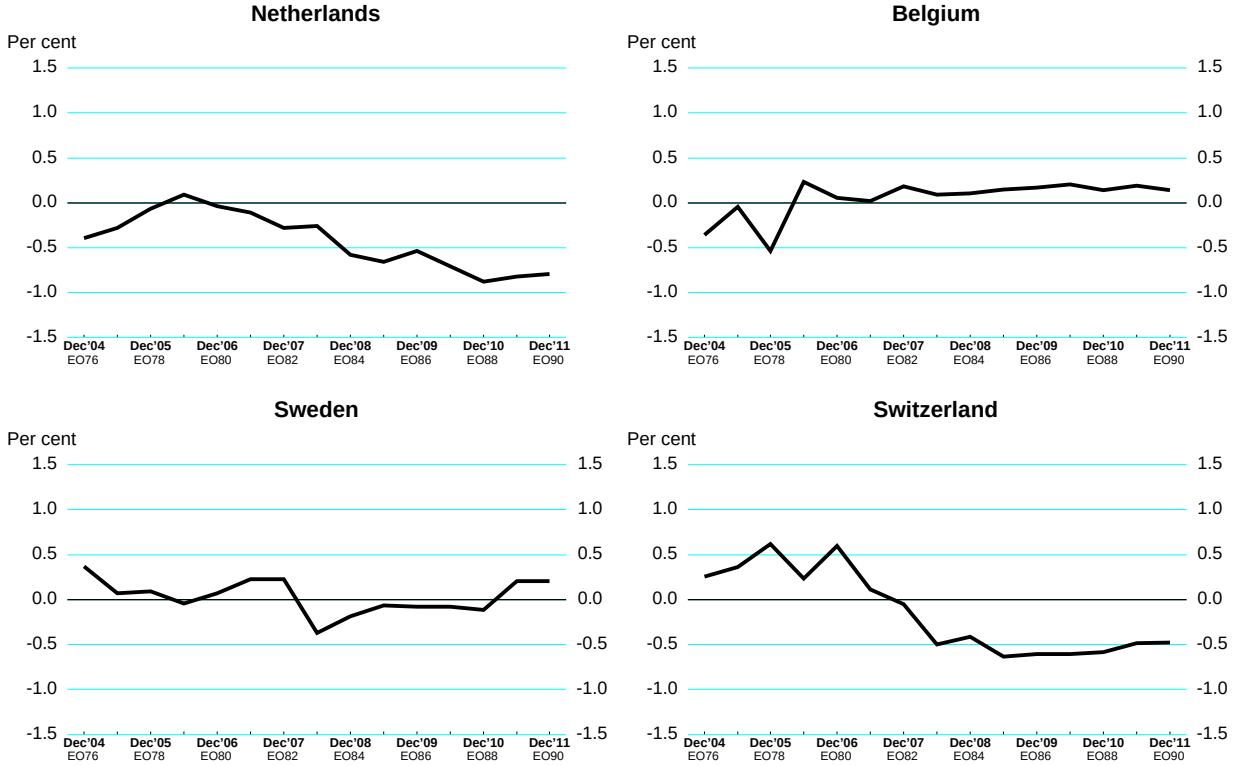


Note: These figures represent the successive OECD participation gap estimates for 2004Q1 from December 2004 (EO 76) to December 2011 (EO 90). The participation gap is calculated as the percentage difference between the actual and the potential labour force participation rate.

Source: OECD Economic Outlook databases.

Figure 16. Successive vintages of participation gap estimates for 2004Q1 (cont)

Estimates of the 2004Q1 participation rate gap in successive Economic Outlooks

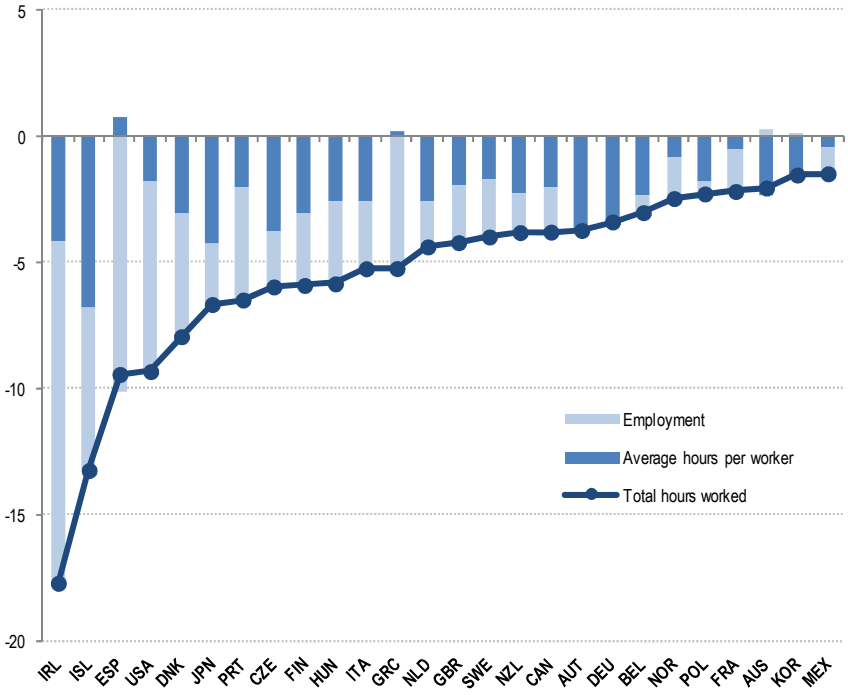


Note: These figures represent the successive OECD participation gap estimates for 2004Q1 from December 2004 (EO 76) to December 2011 (EO 90). The participation gap is calculated as the percentage difference between the actual and the potential labour force participation rate.

Source: OECD Economic Outlook databases.

Figure 17. The decline in total hours worked has been absorbed differently across countries

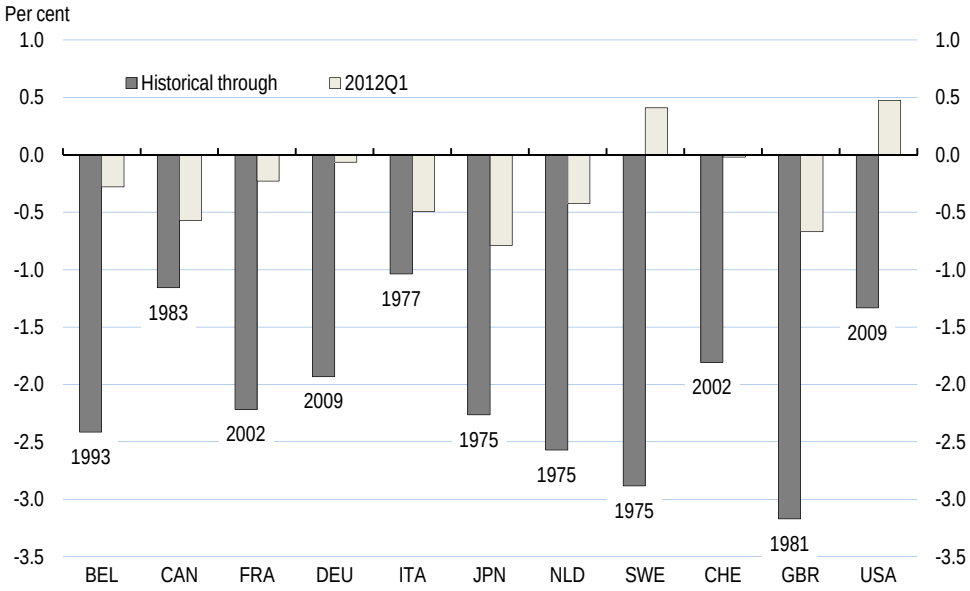
Decomposition of the % change in total hours from peak to trough



Source: OECD (2011), Quarterly Labour Market Indicators Database, Directorate for Employment, Labour and Social Affairs, November, Unpublished data.

Figure 18. Hours gaps are small

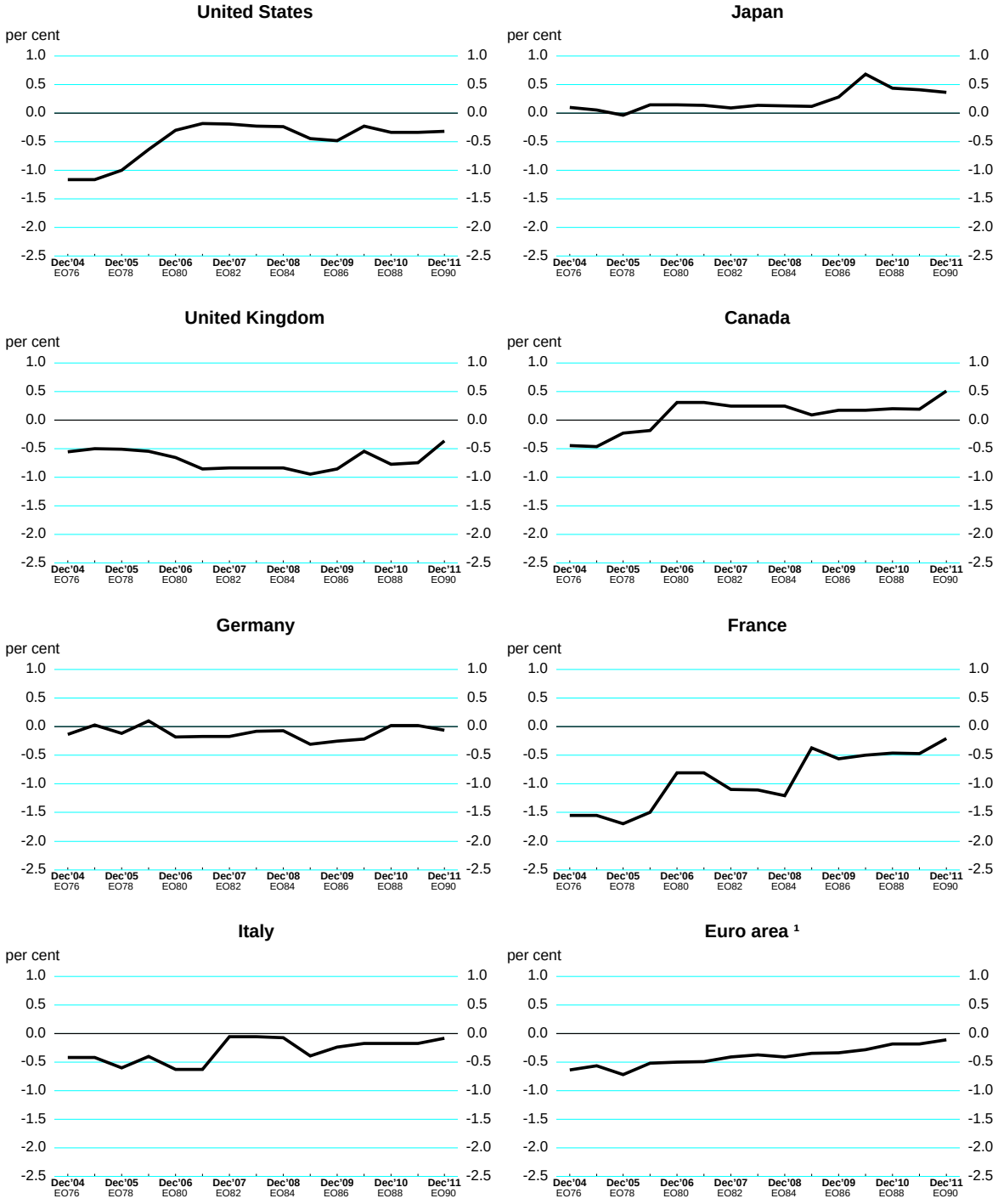
Difference of the actual and trend hours worked per employee as percent of trend hours worked per employee



Source: OECD Economic Outlook No. 90 database.

Figure 19. Successive vintages of hours gap estimates for 2004Q1

Estimates of the 2004Q1 hours worked gap in successive Economic Outlooks



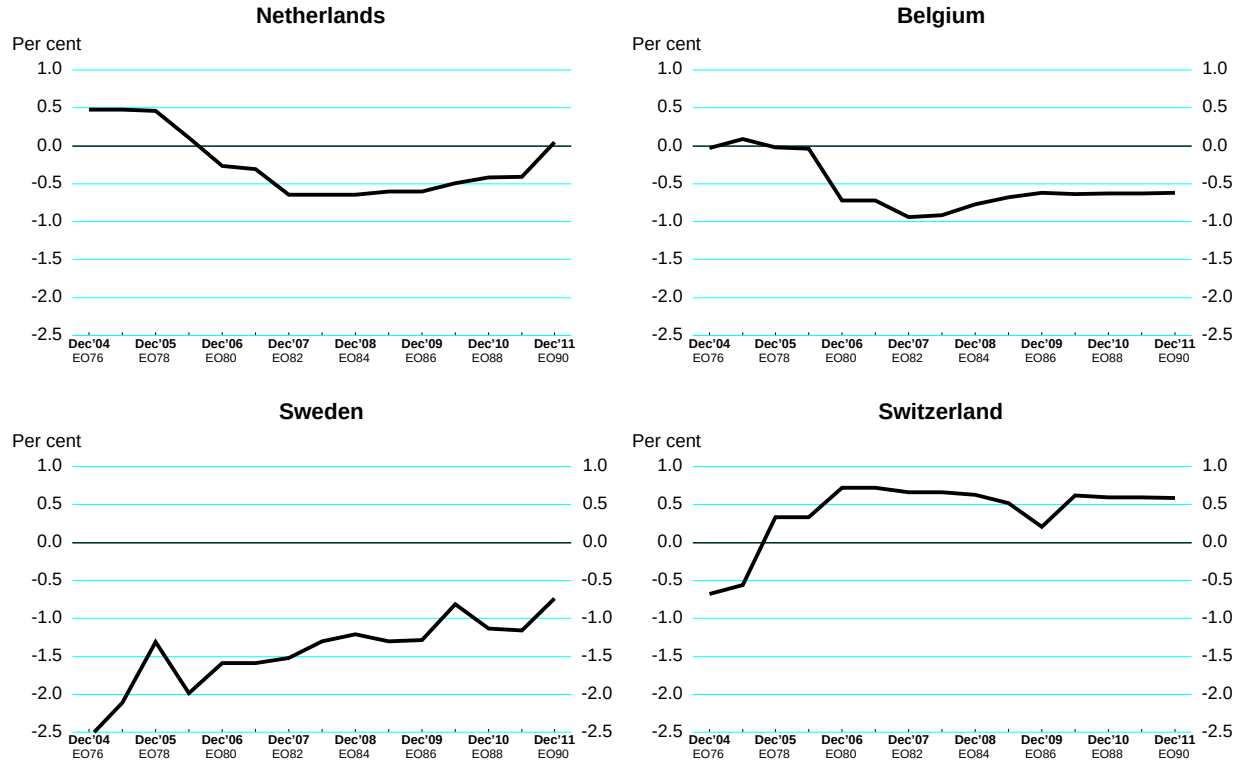
Note: These figures represent the successive OECD hours gap estimates for 2004Q1 from December 2004 (EO 76) to December 2011 (EO 90). The hours gap is calculated as the percentage difference between the actual and the trend hours worked per employee.

1. Hours gap for the euro area is a population-weighted average of France, Germany and Italy.

Source: OECD Economic Outlook databases.

Figure 19. Successive vintages of hours gap estimates for 2004Q1 (cont.)

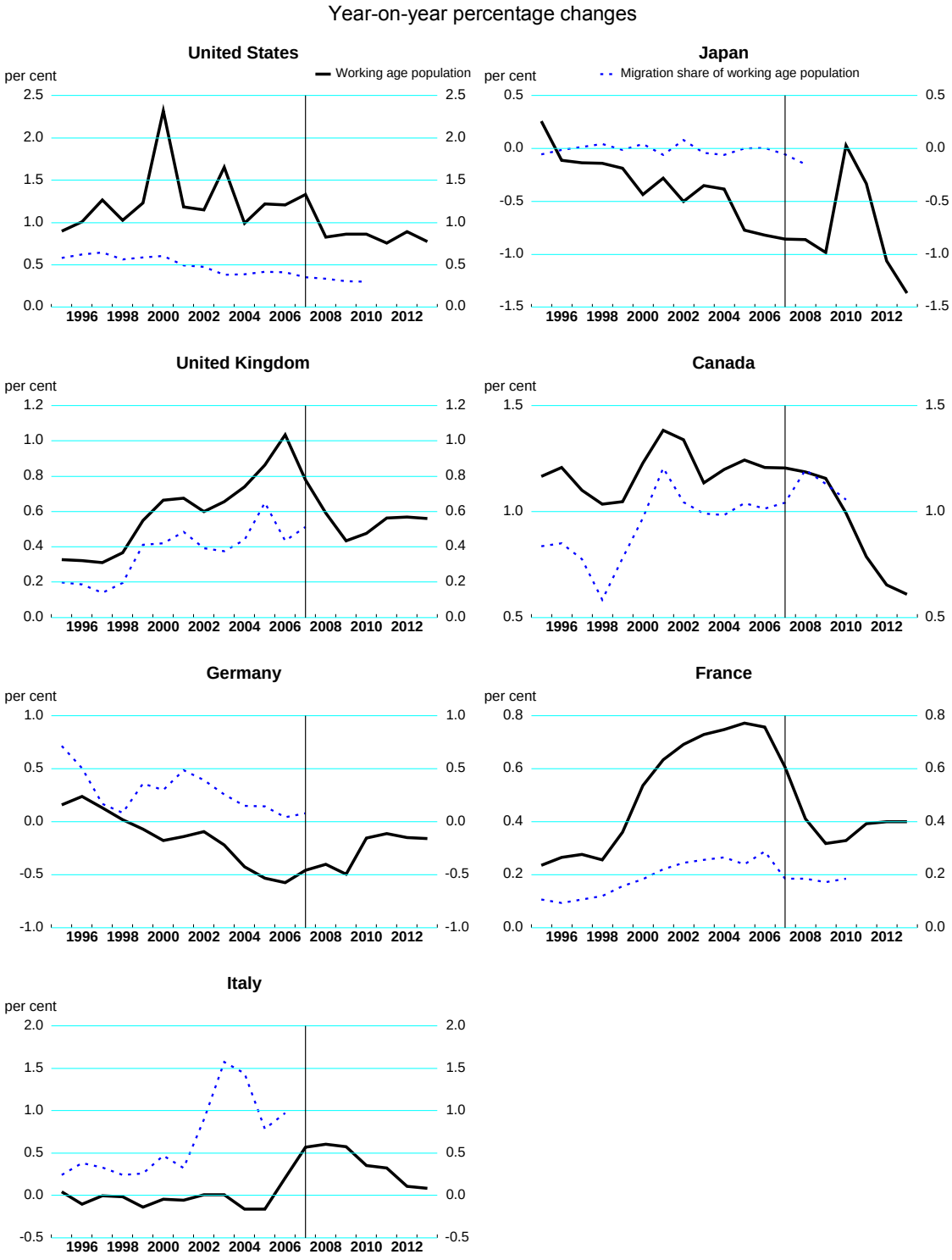
Estimates of the 2004Q1 hours worked gap in successive Economic Outlooks



Note: These figures represent the successive OECD hours gap estimates for 2004Q1 from December 2004 (EO 76) to December 2011 (EO 90). The hours gap is calculated as the percentage difference between the actual and the trend hours worked per employee.

Source: OECD Economic Outlook databases.

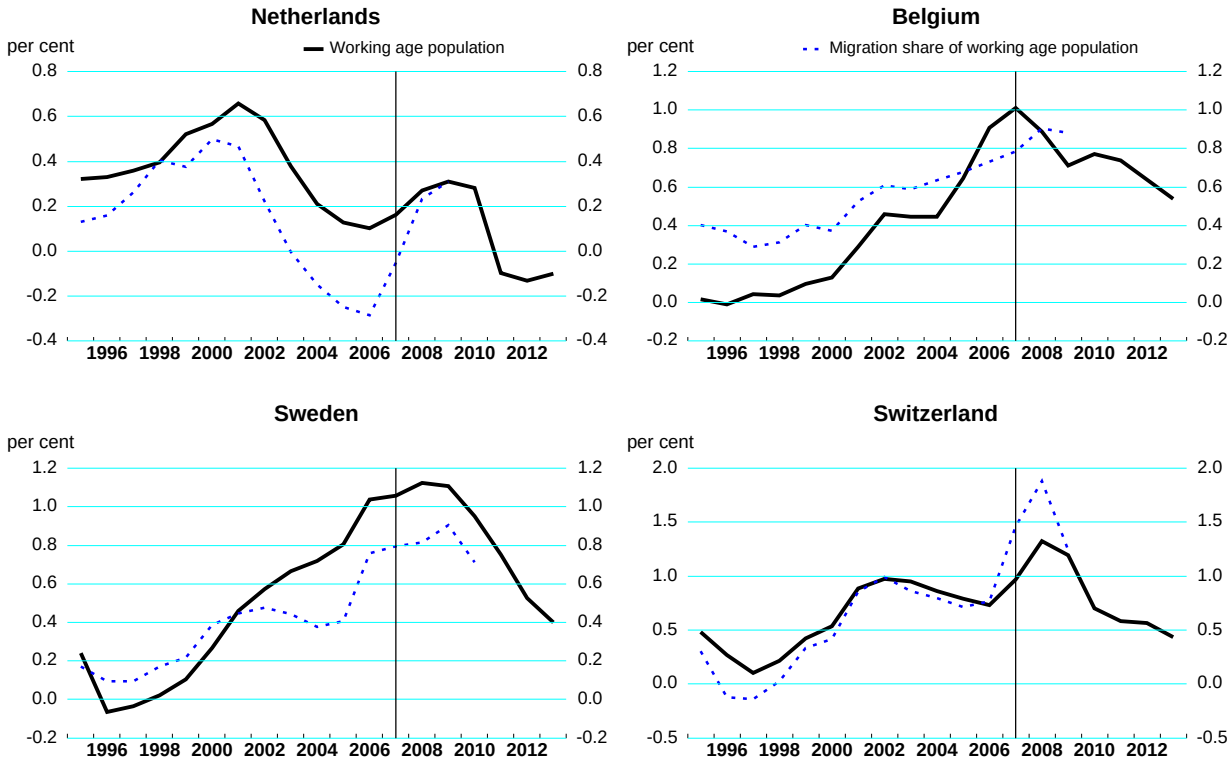
Figure 20. The evolution of the share of migration in the working age population differs across countries



Source: OECD Economic Outlook database and OECD, Population and vital statistics.

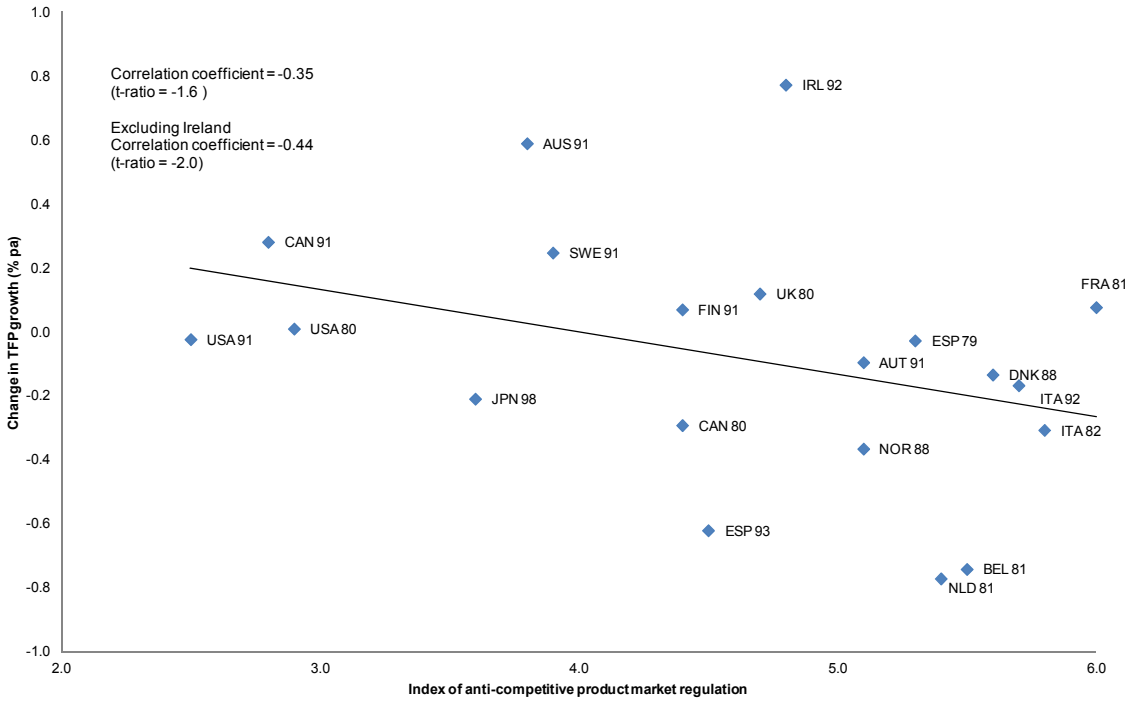
Figure 20. The evolution of the share of migration in the working age population differs across countries (cont.)

Year-on-year percentage changes



Source: OECD Economic Outlook database and OECD, Population and vital statistics.

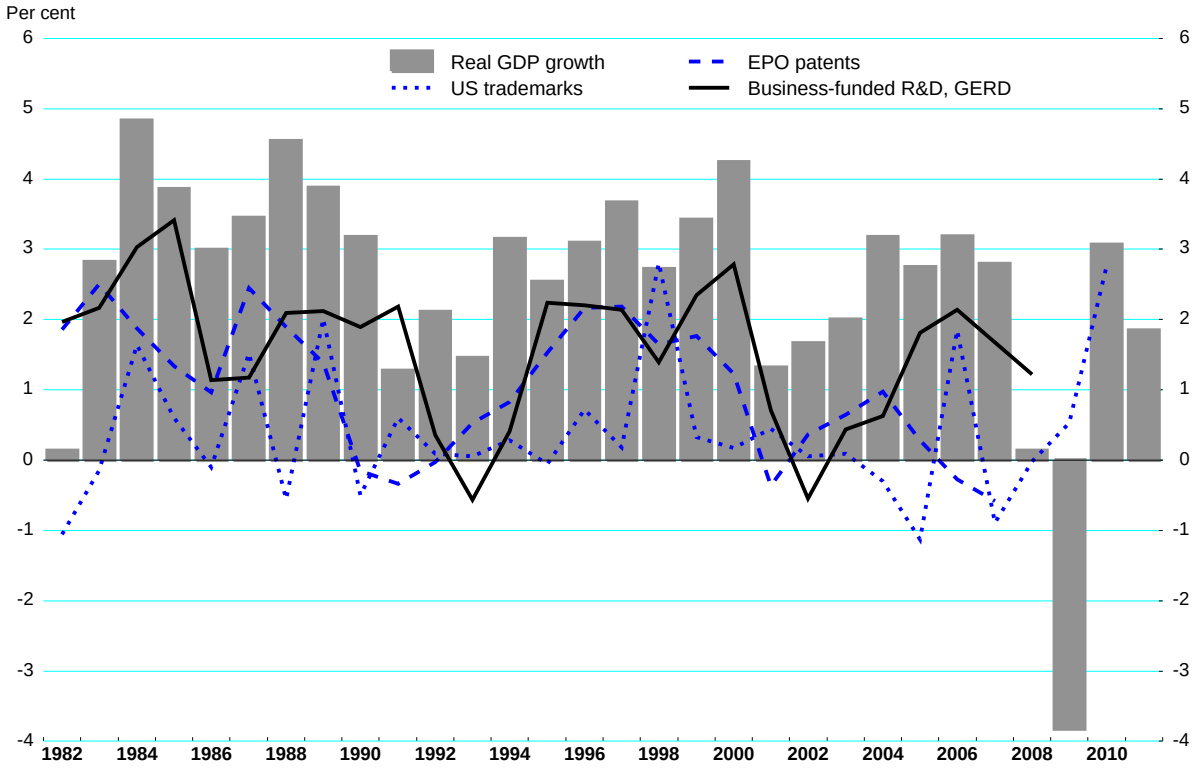
Figure 21. Positive TFP effects following a downturn are more likely when regulation favours competition



Note: The chart shows the change in annual average TFP growth following severe downturn episodes, comparing the five years following the onset of the downturn with the five years preceding it. The index of product market competition is the indicator of regulatory conditions in seven non-manufacturing sectors reported in the OECD Economics Department Working Paper No. 530 "Product market regulation of non-manufacturing sectors in OECD countries: measurement and highlights". A lower value of the index indicates that regulatory conditions are more favourable to competition. TFP is the variable used by the Secretariat in the calculation of potential output.

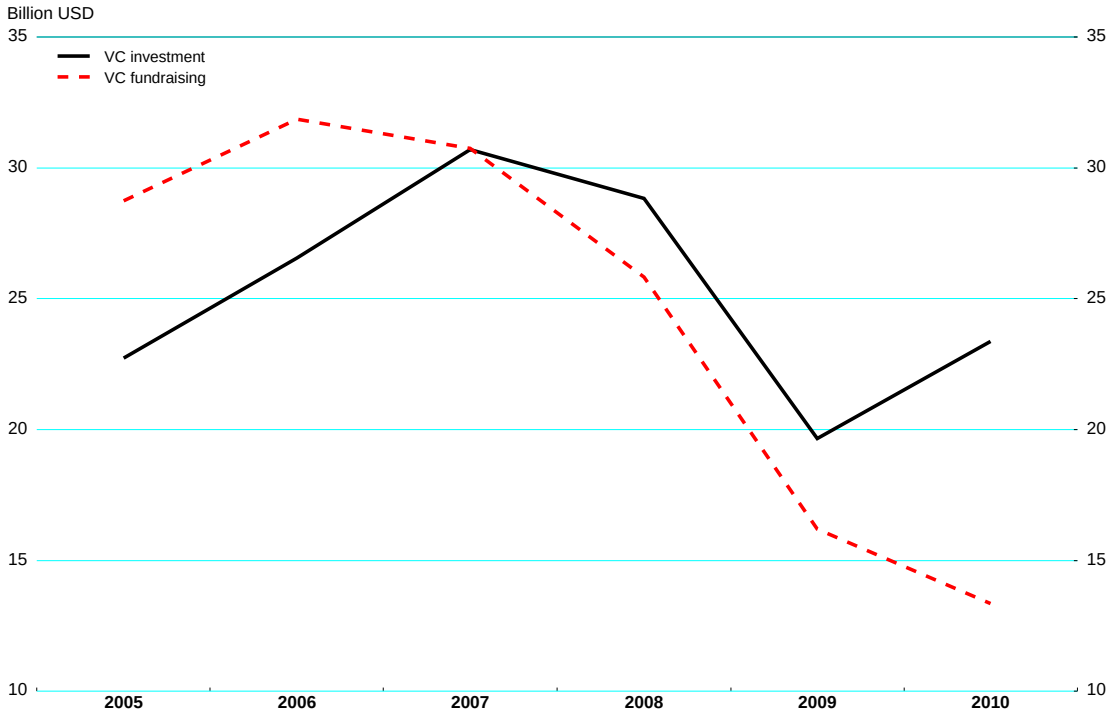
Figure 22. The impact of the business cycle on business R&D

Annual growth rate for the total of OECD countries; divided by standard deviation



Source: OECD, MSTI and Patent database and OECD Economic Outlook database.

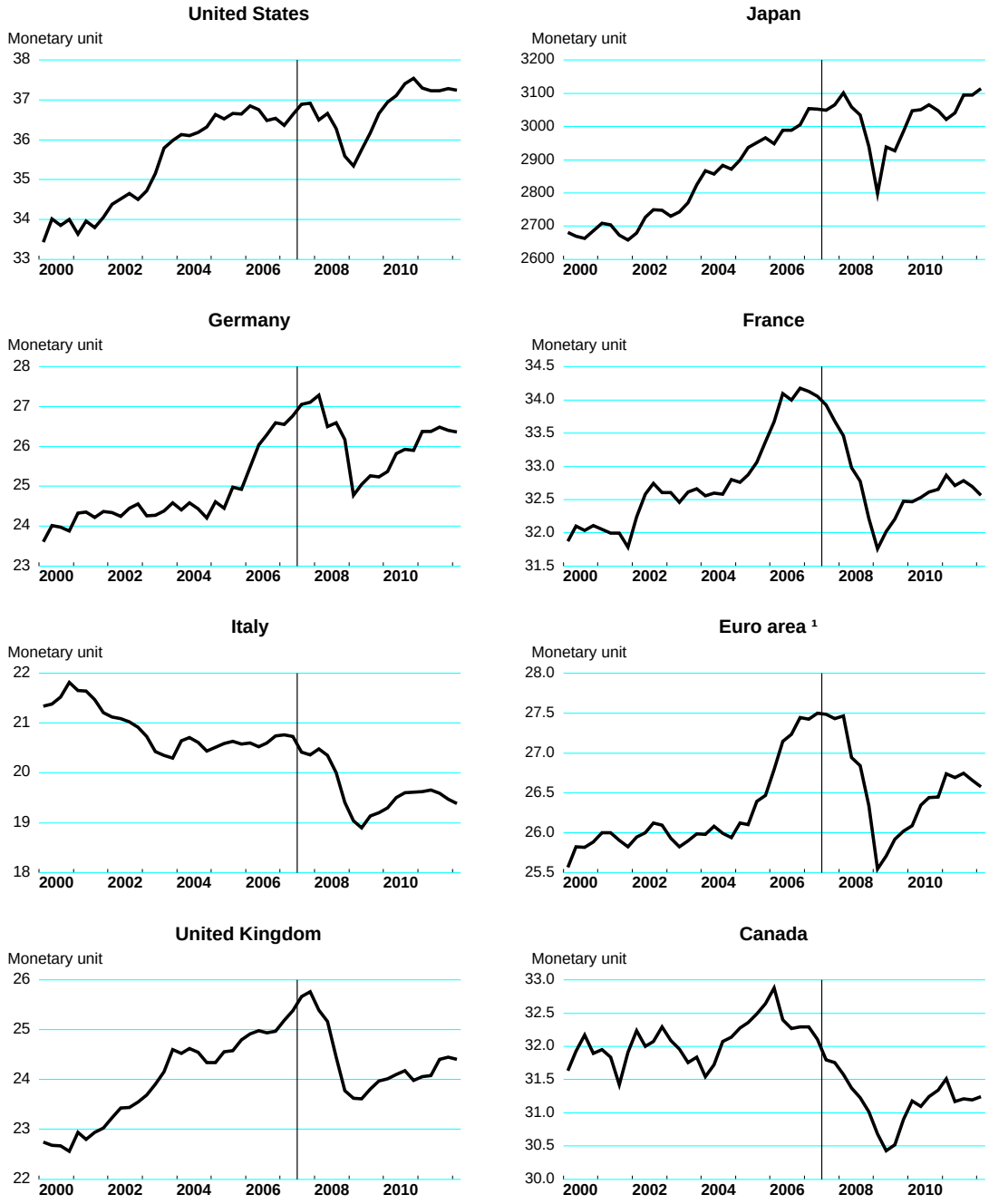
Figure 23. Investments and commitments in venture capital have fallen sharply



Source: PricewaterhouseCoopers/National Venture Capital Association.

Figure 24. TFP trends during the recession and initial recovery

Monetary unit per hours of labour input

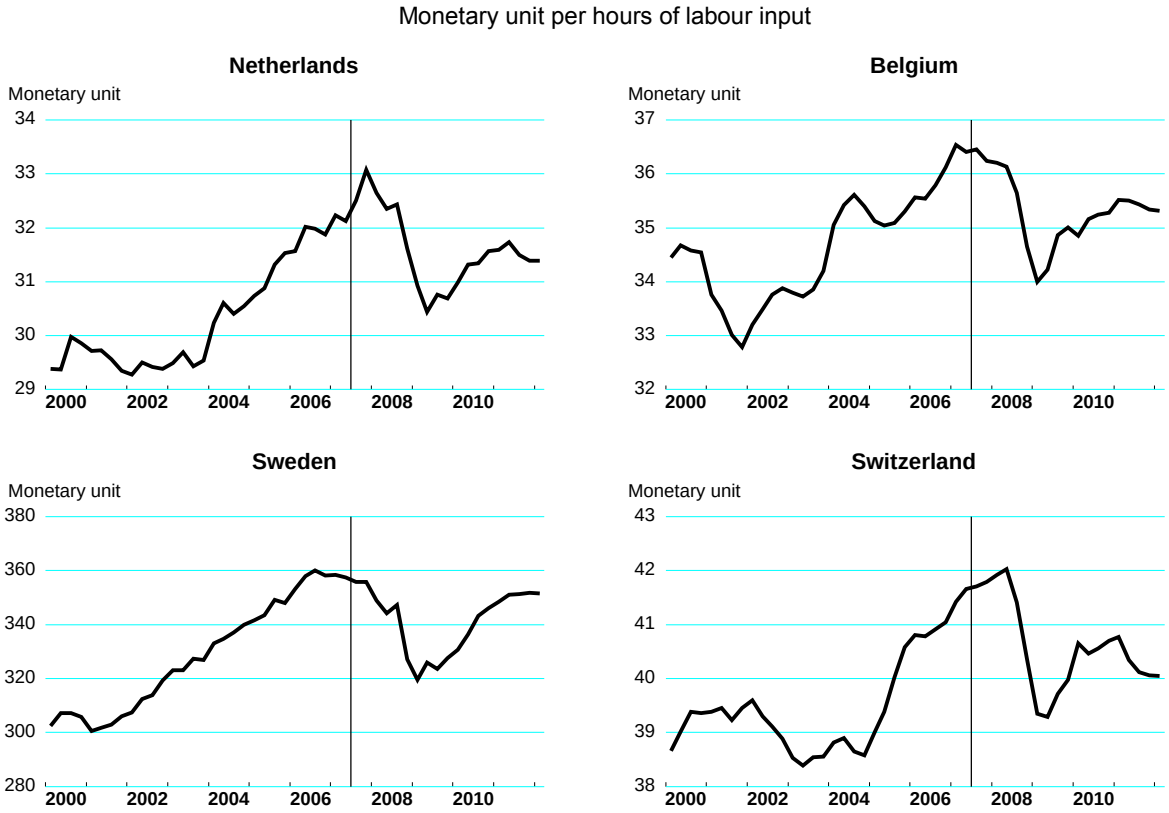


Note: Total factor productivity (TFP) is calculated as a residual of a Cobb-Douglas production function, derived from real GDP per capita, capital stock and employment according to the following equation: TFP = (GDPV/(((ET*HRS)**ALPHA)*KTV**(1-ALPHA)))**(1/ALPHA), where GDPV is the gross domestic product, volumes, ET is total employment, HRS is hours worked by employees, KTV is the capital stock of total economy in volume and ALPHA is the share of labour in production. Marking at the beginning of the financial crisis, 2007Q3.

1. TFP for the euro area is a GDP-weighted average of France, Germany and Italy.

Source: OECD Economic Outlook database.

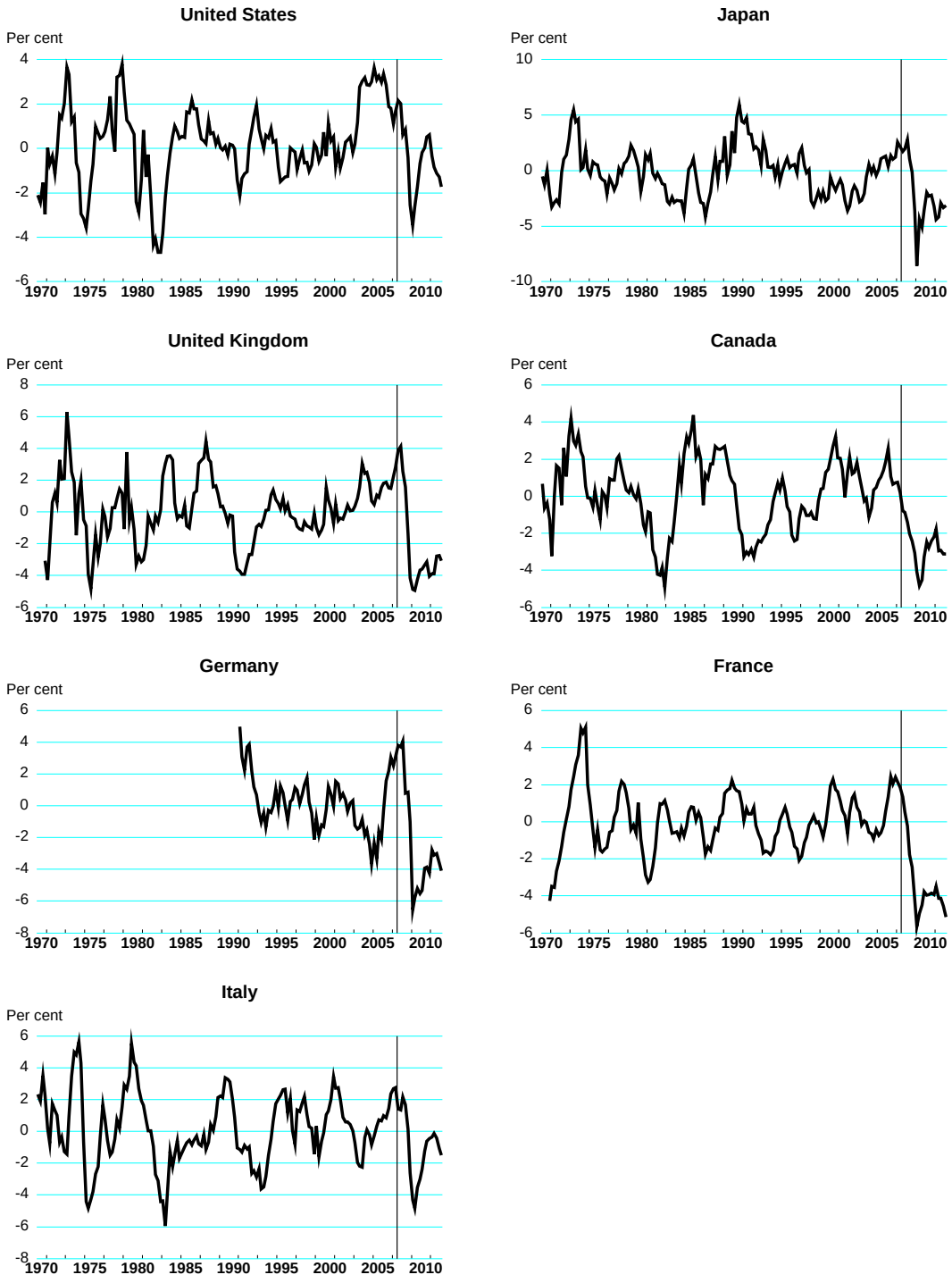
Figure 24. TFP trends during the recession and initial recovery (cont.)



Note: Total factor productivity (TFP) is calculated as a residual of a Cobb-Douglas production function, derived from real GDP per capita, capital stock and employment according to the following equation: TFP = (GDPV/(((ET*HRS)**ALPHA)*KTV**(1-ALPHA)))**(1/ALPHA), where GDPV is the gross domestic product, volumes, ET is total employment, HRS is hours worked by employees, KTV is the capital stock of total economy in volume and ALPHA is the share of labour in production. Marking at the beginning of the financial crisis, 2007Q3.

Source: OECD Economic Outlook database.

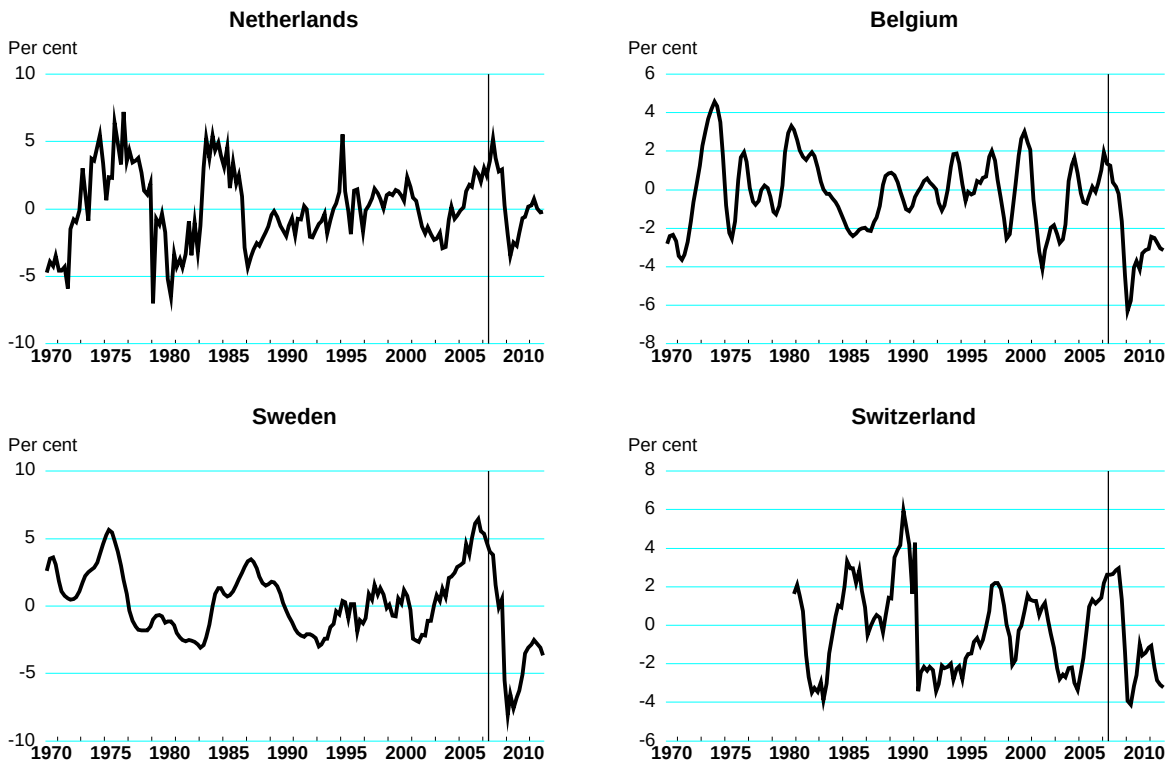
Figure 25. OECD TFP gap estimates



Note: The gap of total factor productivity (TFP) is calculated as the percentage difference between the actual TFP and the potential TFP. Marking at the beginning of the financial crisis, 2007Q3.

Source: OECD Economic Outlook database.

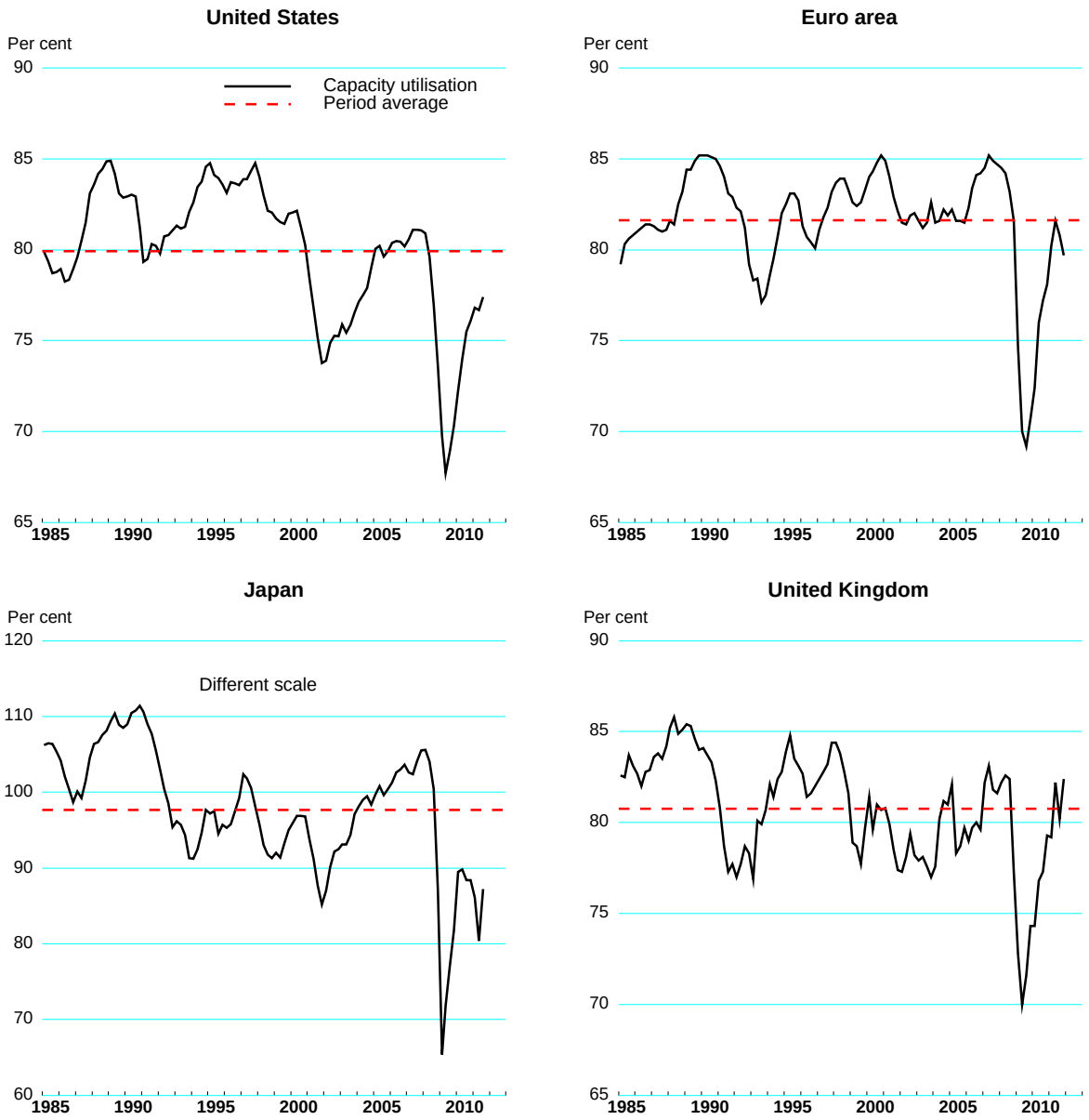
Figure 25. OECD TFP gap estimates (cont.)



Note: The gap of total factor productivity (TFP) is calculated as the percentage difference between the actual TFP and the potential TFP. Marking at the beginning of the financial crisis, 2007Q3.

Source: OECD Economic Outlook database.

Figure 26. Capacity utilisation

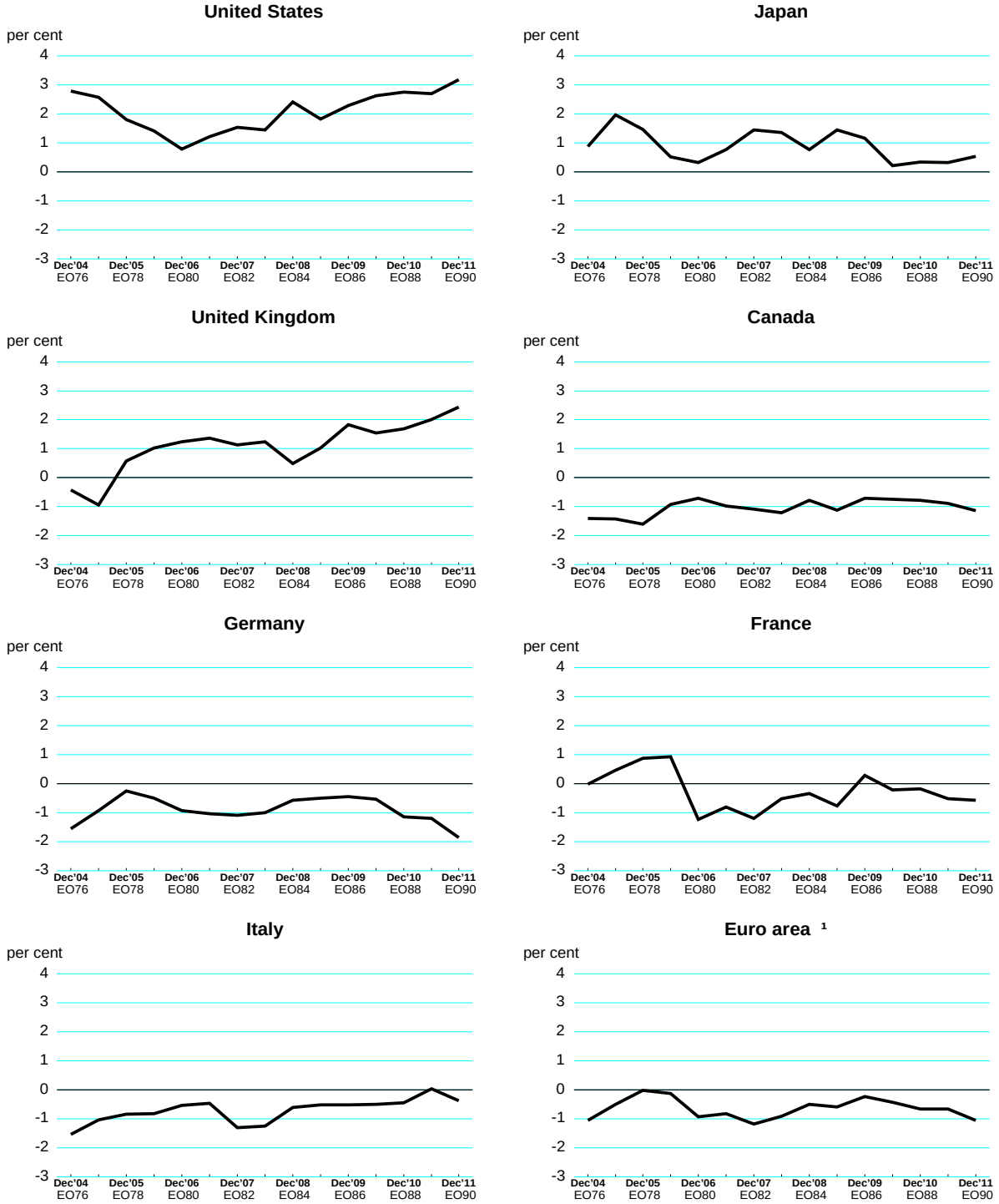


Note: United States: Rate of capacity utilisation in industry. Japan: Rate of capacity utilisation in manufacturing. Euro area and United Kingdom: EC indicator of capacity utilisation in manufacturing.

Source: Datastream and OECD.

Figure 27. Successive estimates of TFP gaps for 2004Q1 show large revisions in many countries

Estimates of the 2004Q1 TFP gap in successive Economic Outlooks

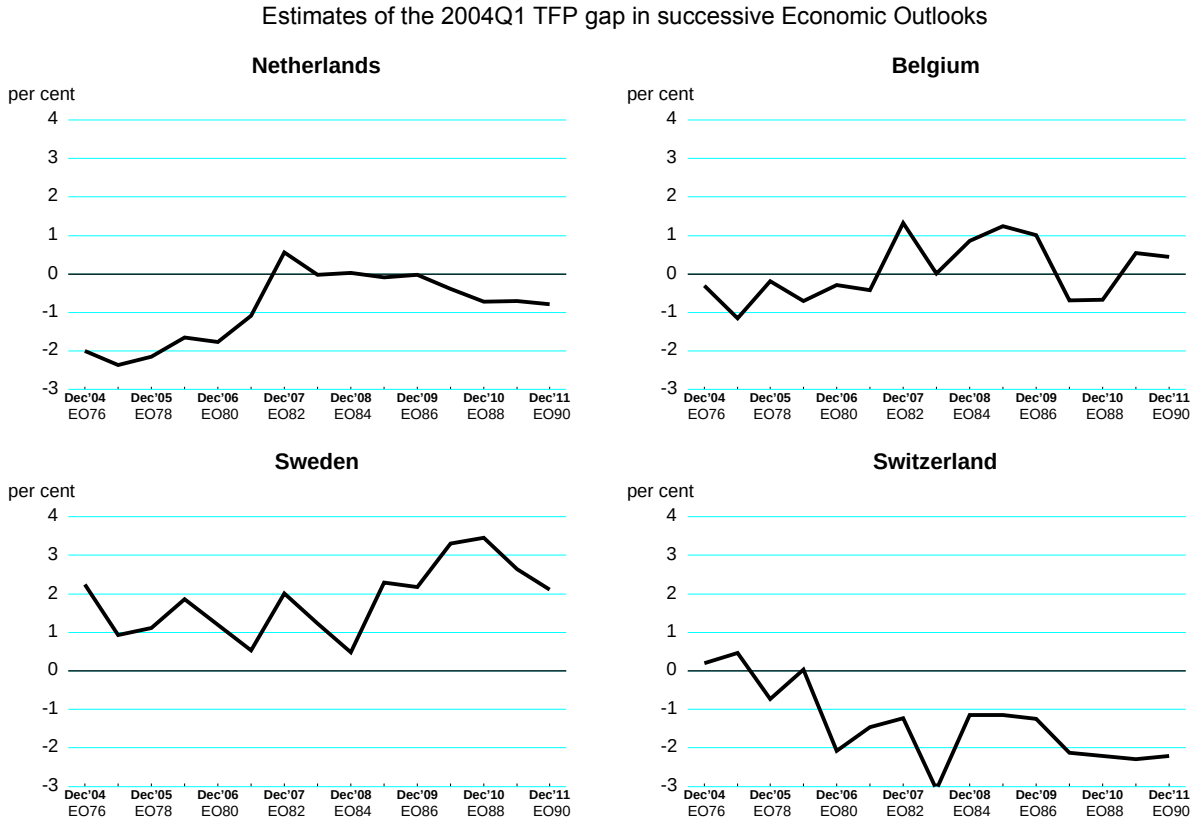


Note: These figures represent the successive OECD TFP gap estimates for 2004Q1 from December 2004 (EO 76) to December 2011 (EO 90). The gap of total factor productivity (TFP) is calculated as the percentage difference between the actual and the potential TFP.

1. Euro area hours gap is a weighted average of France, Germany and Italy's hours gap, weighted by real GDP.

Source: OECD Economic Outlook database.

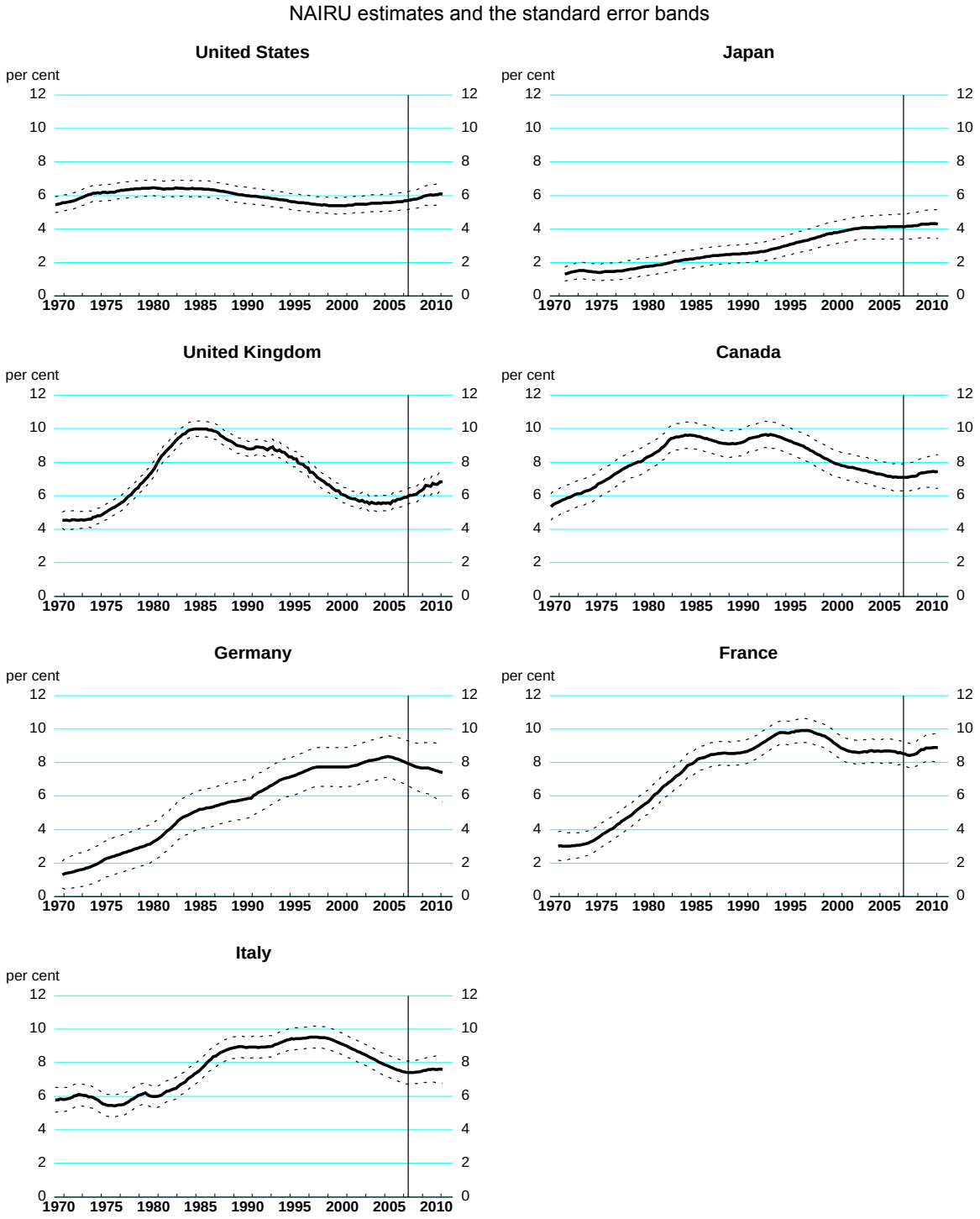
Figure 27. Successive estimates of TFP gaps for 2004Q1 show large revisions in many countries (cont.)



Note: These figures represent the successive OECD TFP gap estimates for 2004Q1 from December 2004 (EO 76) to December 2011 (EO 90). The gap of total factor productivity (TFP) is calculated as the percentage difference between the actual TFP and the potential TFP.

Source: OECD Economic Outlook database.

Figure 28. The rises in the NAIRU during the crisis are consistent with hysteresis effects in most countries

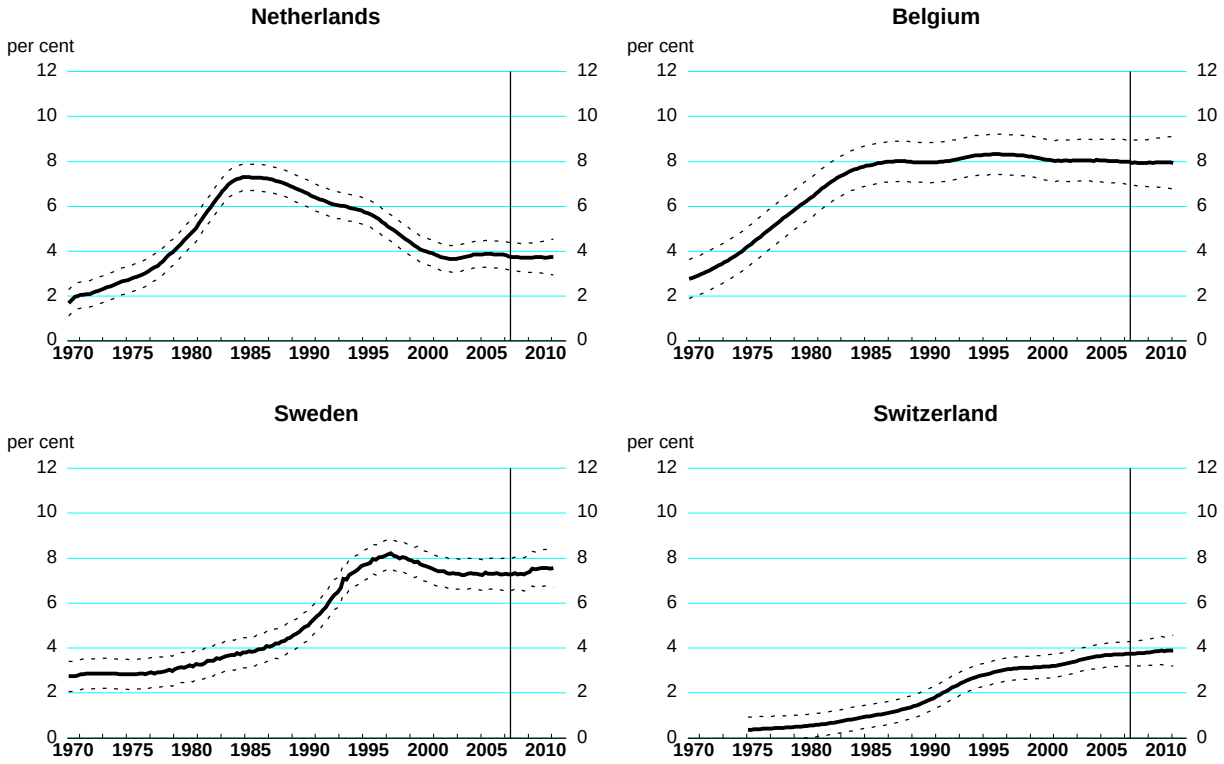


Note: The OECD NAIRU is derived from the information contained in a reduced Phillips curve equation (linking inflation to the unemployment gap) by means of a Kalman filter. Standard errors around the NAIRU are estimated using Monte-Carlo simulation, November 2011. Marking at the beginning of the financial crisis, 2007Q3.

Source: Guichard Rusticelli (2011).

Figure 28. The rises in the NAIRU during the crisis are consistent with hysteresis effects in most countries (cont.)

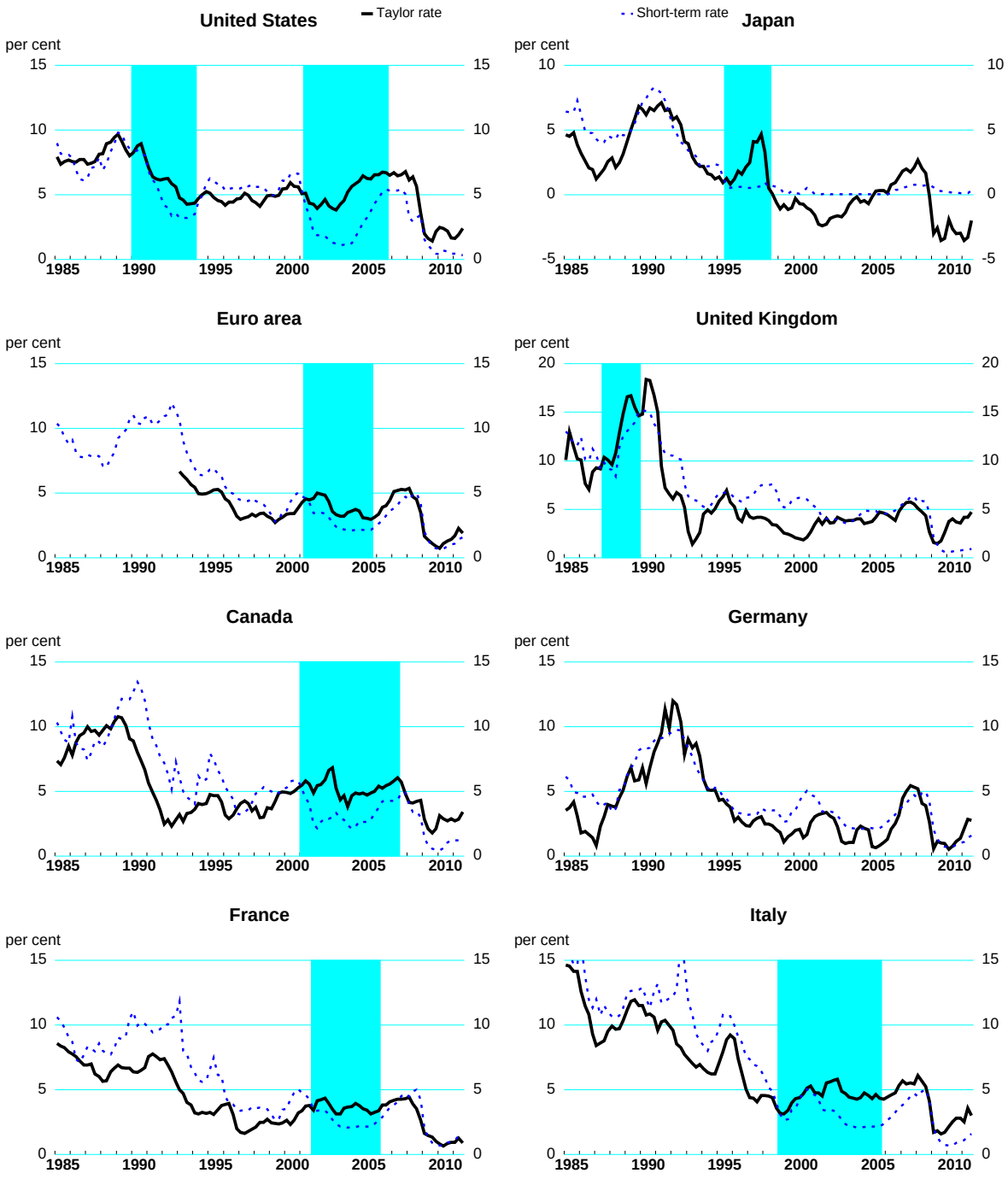
NAIRU estimates and the standard error bands



Note: The OECD NAIRU is derived from the information contained in a reduced Phillips curve equation (linking inflation to the unemployment gap) by means of a Kalman filter. Standard errors around the NAIRU are estimated using Monte-Carlo simulation, November 2011. Marking at the beginning of the financial crisis, 2007Q3.

Source: Guichard Rusticelli (2011).

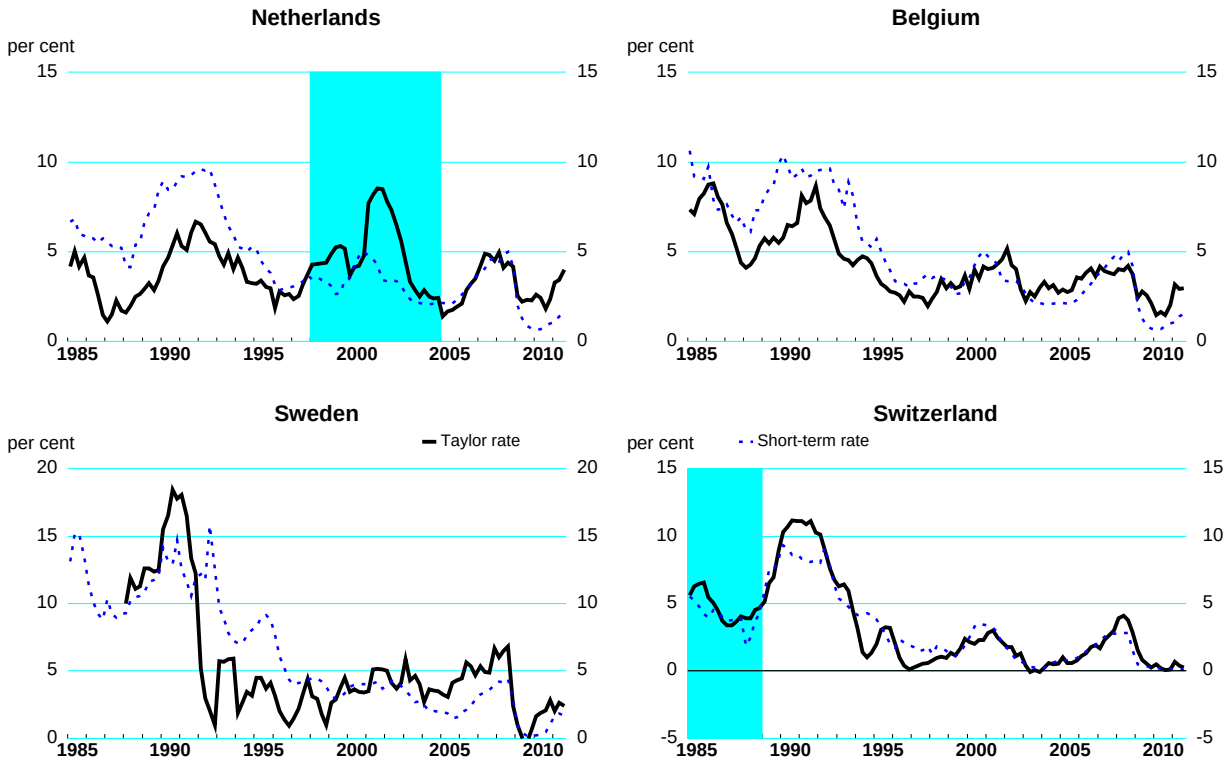
Figure 29. Taylor rules and actual short-term interest rates



Note: The Taylor rule rate is a function of an equilibrium real interest rate (short-term), the (implicit) inflation target, the average output gap and the gap between actual inflation and the implicit inflation target. Equal weight is given to the inflation gap and the output gap. For United States, the assumed price stability target is for inflation of 1.9% and the assumed equilibrium real interest rate is 2.85%. For Japan, the assumed price stability target is for inflation of 1.0% and the assumed equilibrium real interest rate is 1.2%. For the Euro area countries, the assumed price stability target is for inflation of 1.9% and the assumed equilibrium real interest rate is 2.1%. For United Kingdom, the assumed price stability target is for inflation of 2.0% and the assumed equilibrium real interest rate is 2.5%.

Source: OECD.

Figure 29. Taylor rules and actual short-term interest rates (cont.)

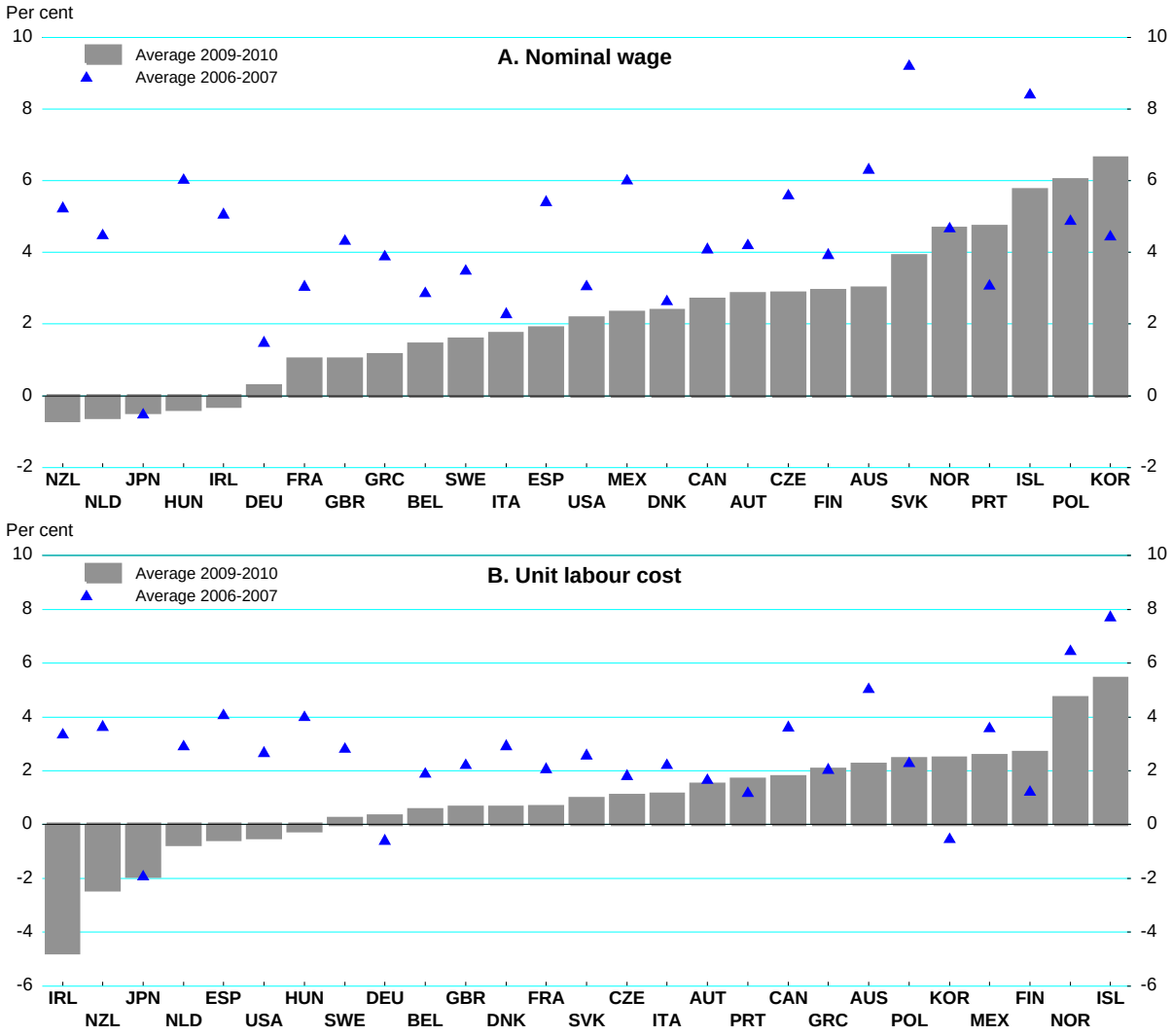


Note: The Taylor rule rate is a function of an equilibrium real interest rate (short-term), the (implicit) inflation target, the average output gap and the gap between actual inflation and the implicit inflation target. Equal weight is given to the inflation gap and the output gap. For Sweden, the assumed price stability target is for inflation of 2% and the assumed equilibrium real interest rate is 2.1%. For Switzerland, the assumed price stability target is for inflation of 2.0% and the assumed equilibrium real interest rate is 1.6%.

Source: OECD.

Figure 30. Nominal wages and unit labour costs have decelerated

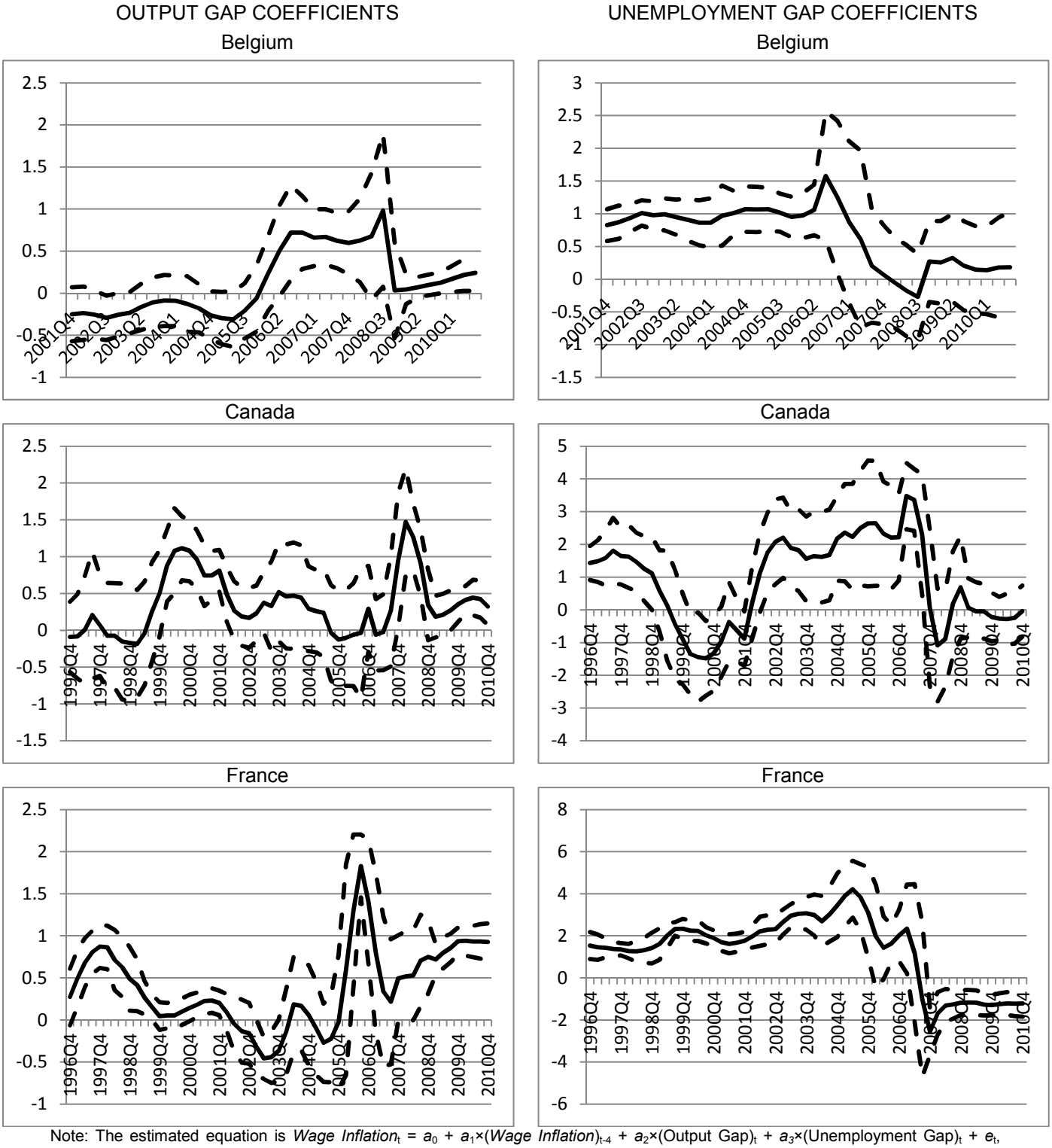
Annualised average percentage changes before and after the crisis



Source: OECD Economic Outlook database.

Figure 31. Nominal wage, output gap and unemployment gap

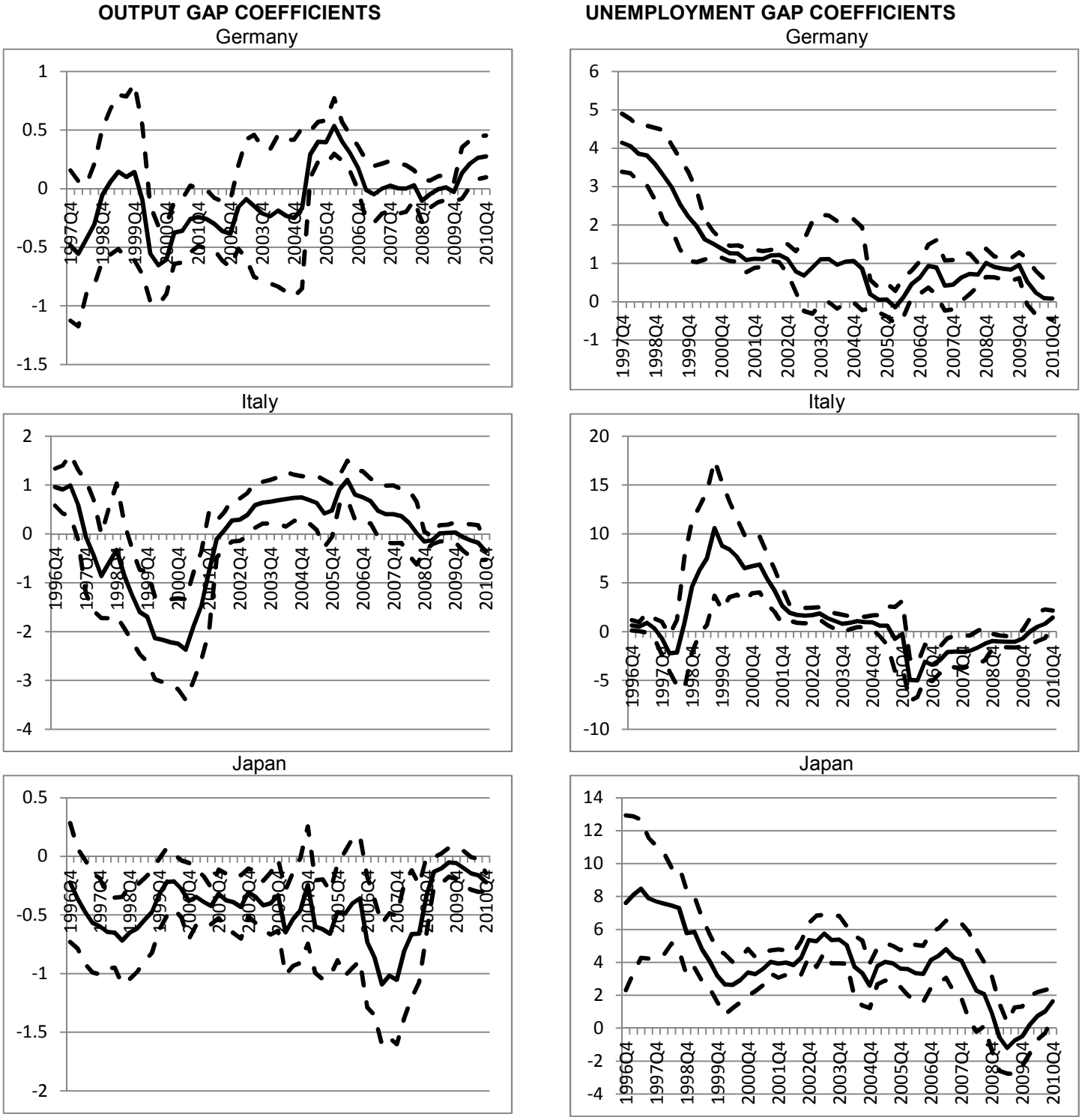
Output gap and unemployment gap, per cent



Note: The estimated equation is *Wage Inflation*$_t$ = a_0 + a_1×(*Wage Inflation*)$_{t-4}$ + a_2×(Output Gap)$_t$ + a_3×(Unemployment Gap)$_t$ + e_t, where Wage Inflation is the quarterly year-on-year rate of change in nominal wages.
Rolling estimates (over the past 20 quarters) with 10% confidence intervals using HAC Newey-West consistent standard errors.

Source: OECD calculations.

Figure 31. Nominal wage, output gap and unemployment gap (cont.)
Output gap and unemployment gap, per cent

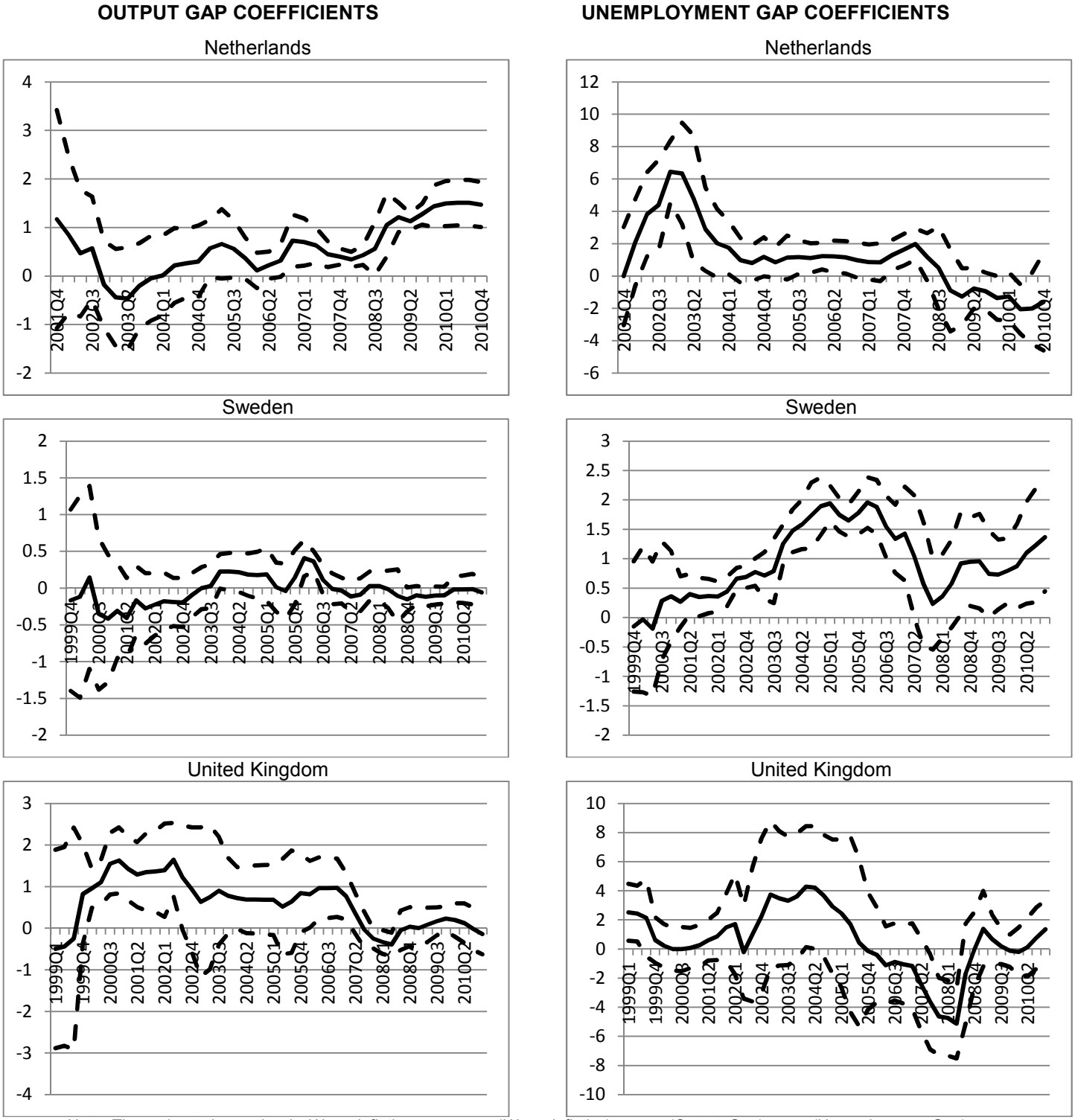


Note: The estimated equation is *Wage Inflation*$_t$ = a_0 + a_1×(*Wage Inflation*)$_{t-4}$ + a_2×(Output Gap)$_t$ + a_3×(Unemployment Gap)$_t$ + e_t, where Wage Inflation is the quarterly year-on-year rate of change in nominal wages.
Rolling estimates (over the past 20 quarters) with 10% confidence intervals using HAC Newey-West consistent standard errors.

Source: OECD calculations.

Figure 31. Nominal wage, output gap and unemployment gap (cont.)

Output gap and unemployment gap, per cent



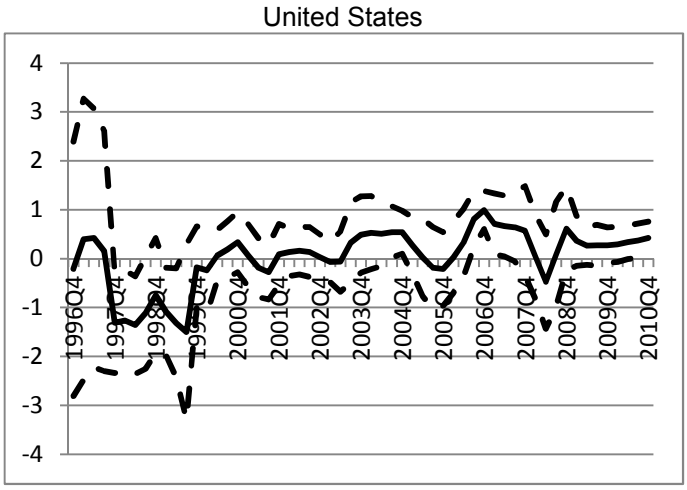
Note: The estimated equation is *Wage Inflation*$_t$ = a_0 + a_1×(*Wage Inflation*)$_{t-4}$ + a_2×(Output Gap)$_t$ + a_3×(Unemployment Gap)$_t$ + e_t, where Wage Inflation is the quarterly year-on-year rate of change in nominal wages.
Rolling estimates (over the past 20 quarters) with 10% confidence intervals using HAC Newey-West consistent standard errors.

Source: OECD calculations.

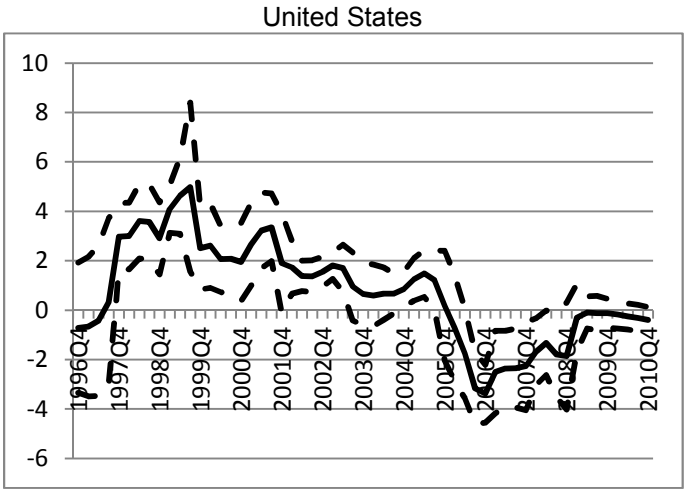
Figure 31. Nominal wage, output gap and unemployment gap (cont.)

Output gap and unemployment gap, per cent

OUTPUT GAP COEFFICIENTS



UNEMPLOYMENT GAP COEFFICIENTS

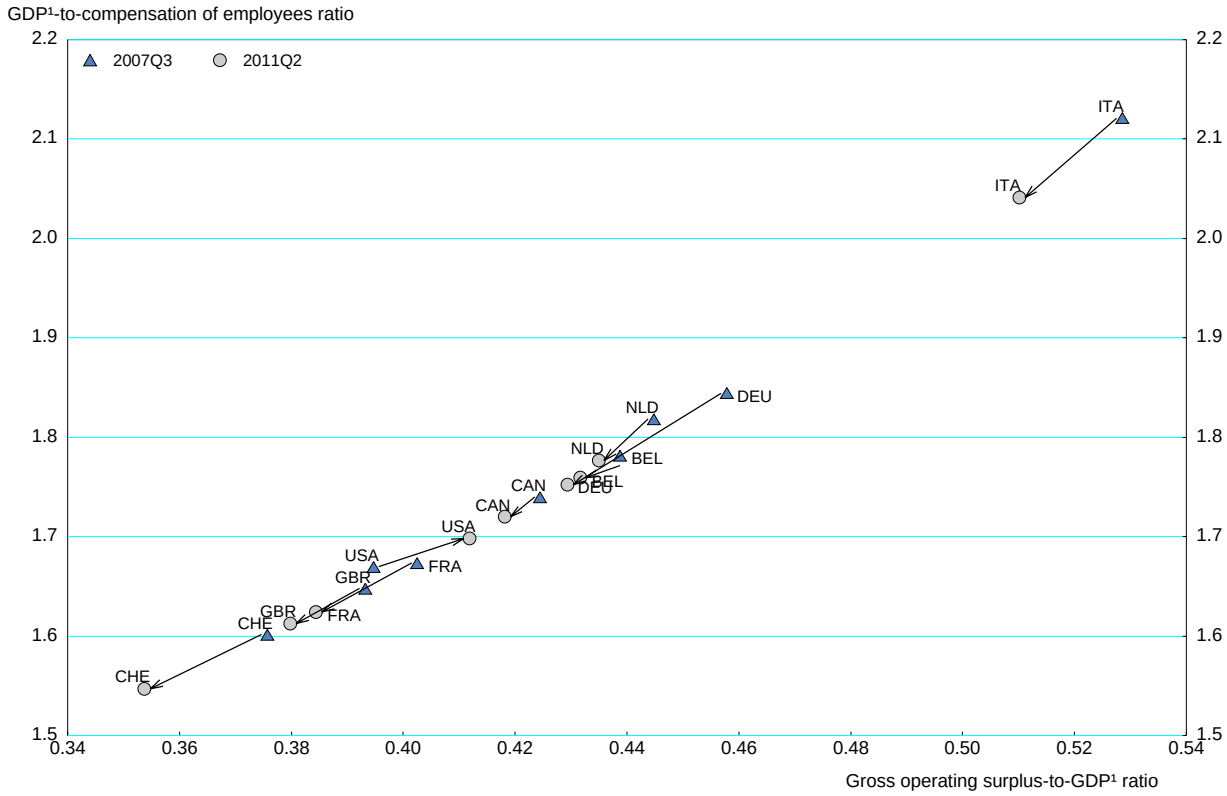


Note: The estimated equation is $Wage\ Inflation_t = a_0 + a_1 \times (Wage\ Inflation)_{t-4} + a_2 \times (\text{Output Gap})_t + a_3 \times (\text{Unemployment Gap})_t + e_t$, where Wage Inflation is the quarterly year-on-year rate of change in nominal wages.

Rolling estimates (over the past 20 quarters) with 10% confidence intervals using HAC Newey-West consistent standard errors.

Source: OECD calculations.

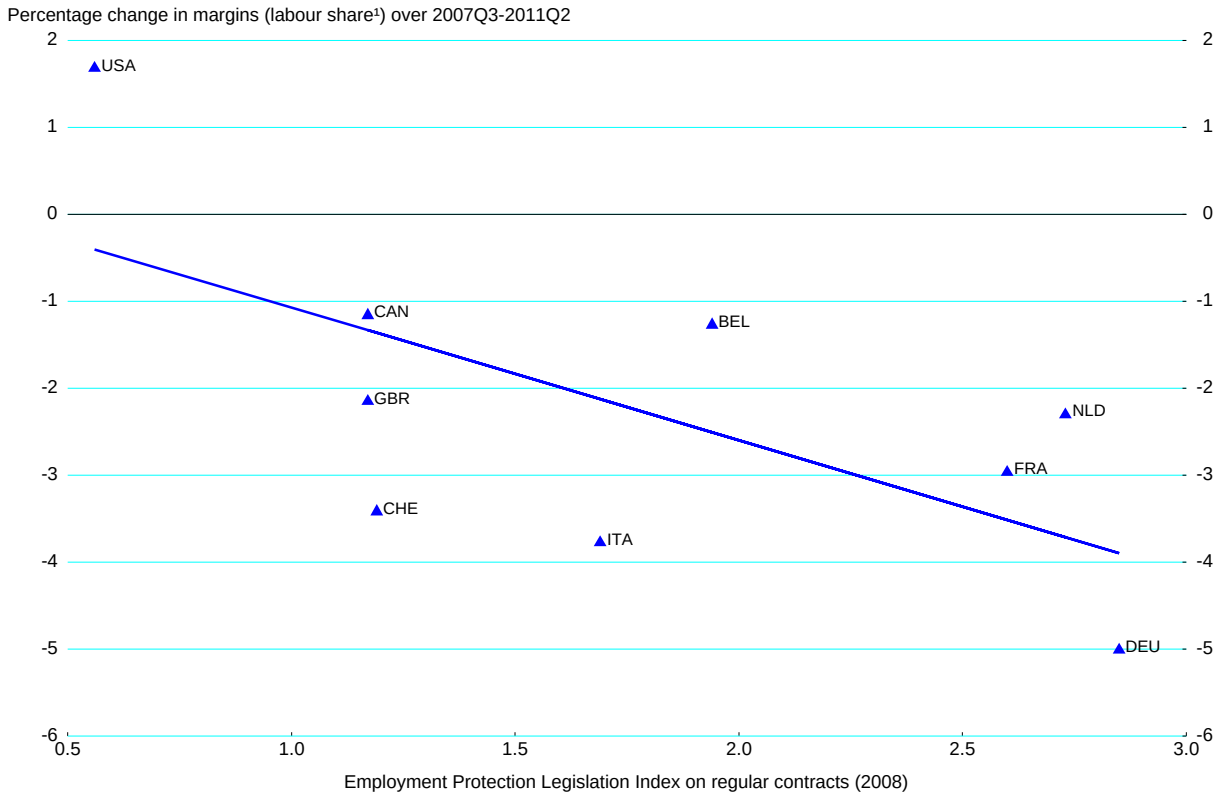
Figure 32. Margins during the crisis and the recovery



1. GDP at factor cost.

Source: OECD Economic Outlook database.

Figure 33. The decline in margins has been more severe in countries with stronger employment protection legislation on regular contracts

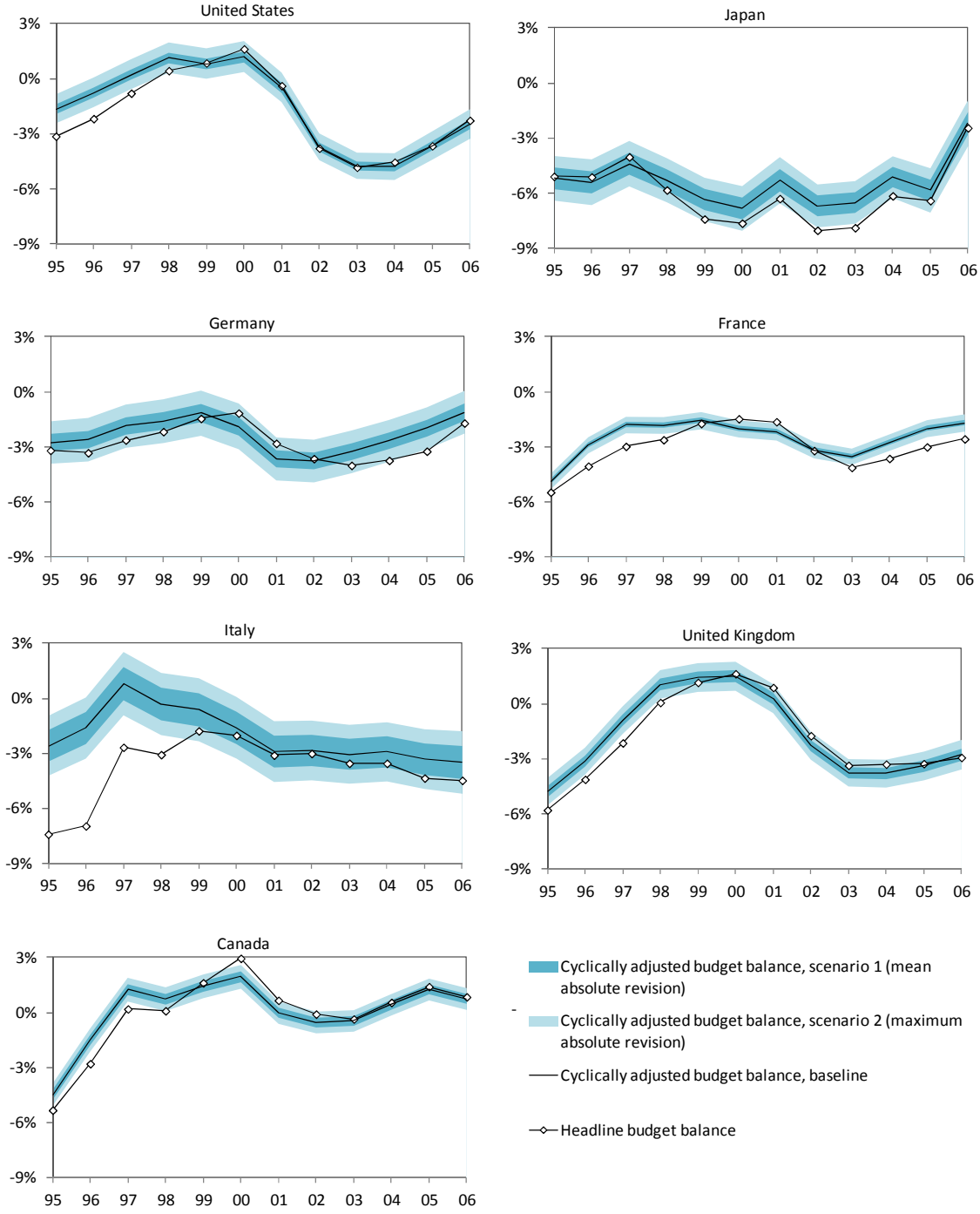


1. Labour share is GDP at factor cost to Compensation of employees - ratio.

Source: OECD, Quarterly national accounts and OECD Employment Outlook, Employment database.

Figure 34. Gap uncertainty spills over to the cyclically-adjusted budget balance moderately in most countries

Per cent of GDP

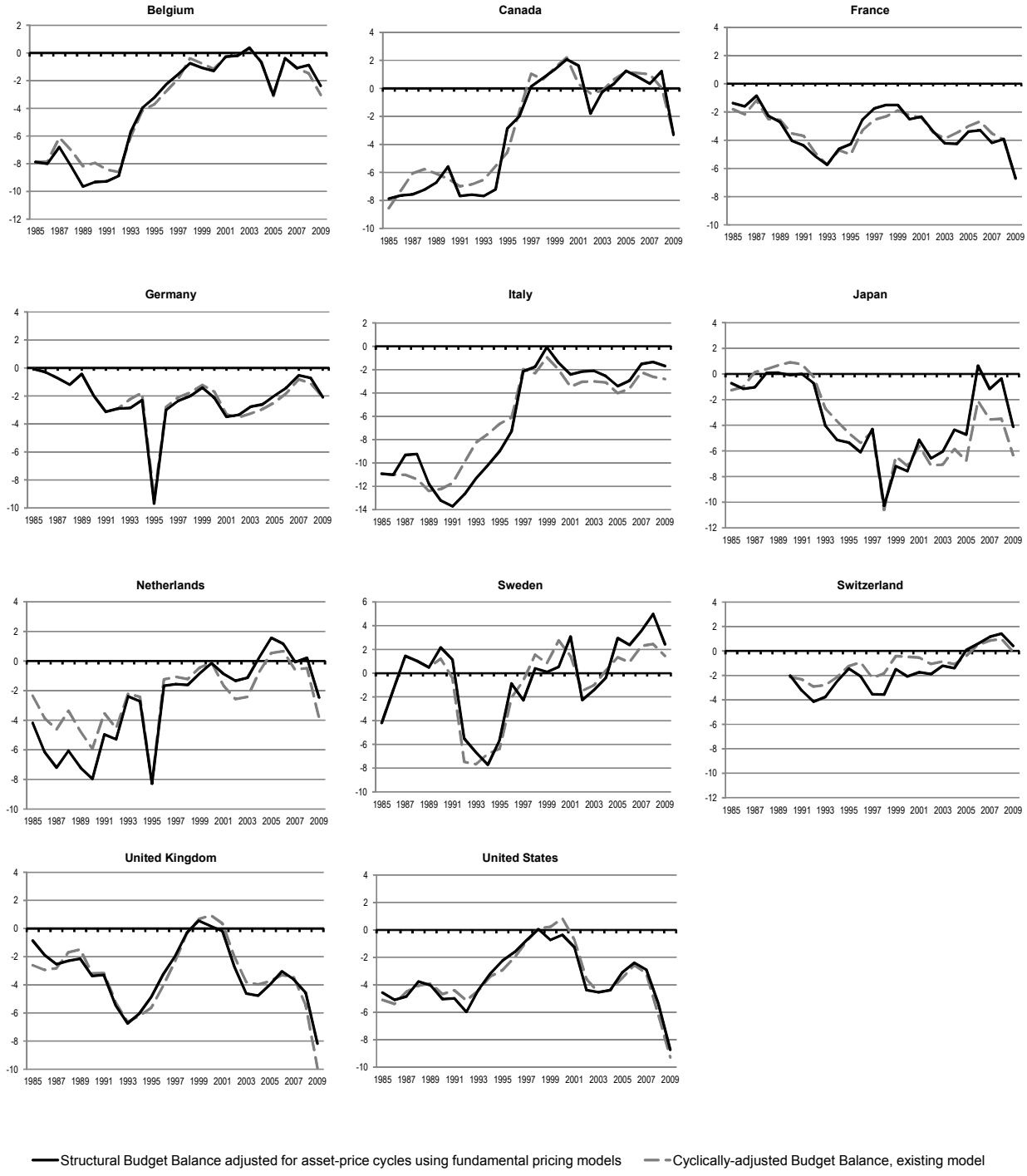


Notes: The budget balances exclude one-off revenues from the sale of mobile telephone licences. The baseline scenario employs actual data of the output and unemployment gaps as published in the June 2007 issue of the *OECD Economic Outlook* (EO81). In scenario 1 (scenario 2) the output and unemployment gaps are varied by the mean (maximum) absolute revision observed during the period 1995 to 2003 for the current-year-prediction versus the final outturn estimate at time *t*+4.

Source: Koske and Pain (2008).

Figure 35. Adjusting for asset prices in addition to the business cycle can modify structural balances sizeably

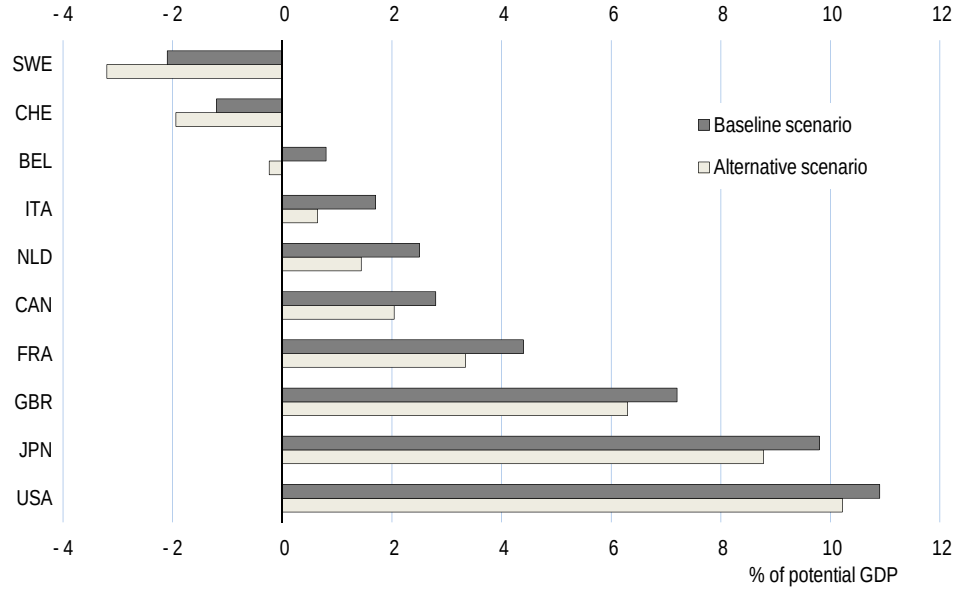
As percentage of potential GDP



Source: Price and Dang (2011).

Figure 36. Output gap measurement errors do not modify estimated consolidation needs much

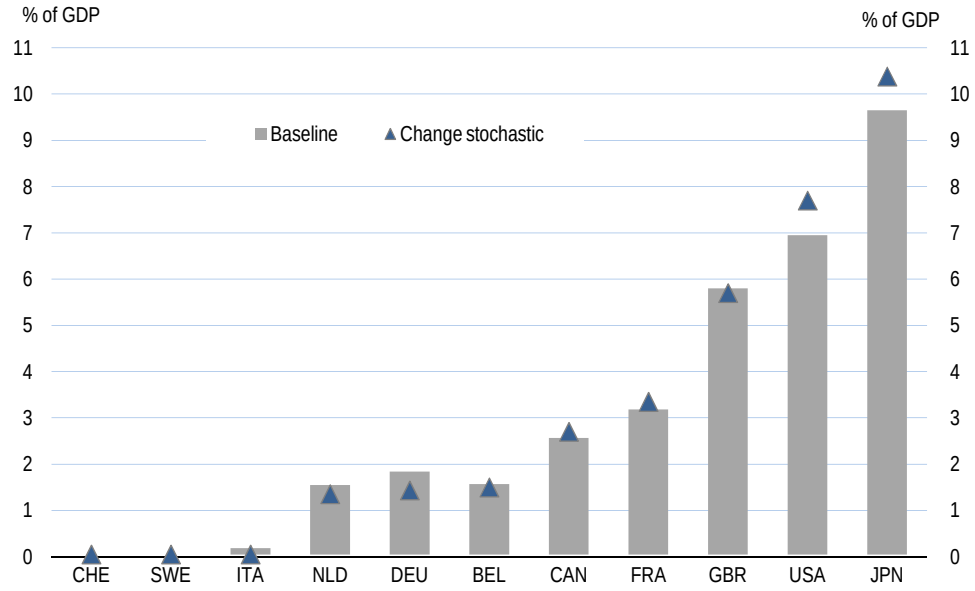
Required change in underlying primary balance to stabilise debt in the OECD (2011) long-term baseline scenario and in an alternative scenario where the 2011 output gap is two percentage points wider



Source: Girouard and André (2005), OECD (2011) and OECD calculations.

Figure 37. Guarding against shocks can modify estimated fiscal gaps substantially

Change in underlying primary balance needed so that gross financial liabilities are 50% of GDP in 2050 and change needed to ensure meeting this target with 75% probability when the baseline is hit by shocks



Note: The change is from the underlying primary balance projected for 2012.

Source: Fiscal consolidation, [ECO/CPE/WP1(2011)19].

Table 1. Sectoral employment changes

Employment growth between average in 2008 and 2011Q2

	Manufacturing	Construction	Wholesale and retail trade	Financial intermediation	Other services[1]	Total
Austria	-0.3	-1.9	-5.3	7.2	2.7	1.2
Belgium	-11.7	6.3	7.5	-11.2	6.1	2.1
Canada	-11.1	1.5	-2.5	2.9	-19.5	-0.7
Czech Republic	-6.4	-10.0	-3.6	7.8	3.5	-2.1
Denmark	-16.2	-22.5	-8.0	-4.8	-3.1	-5.1
Finland	-14.1	-3.5	0.8	1.9	0.0	-1.1
France	-7.5	-1.9	-3.4	3.4	3.2	-0.4
Germany	-3.6	3.5	1.9	-1.0	9.2	2.7
Greece	-22.5	-33.8	-6.6	-5.0	-3.4	-8.8
Hungary	-5.9	-14.3	-6.4	-2.1	1.5	-1.9
Ireland	-18.1	-56.0	-13.2	0.5	-8.1	-13.8
Italy	-8.4	-3.5	-5.9	-4.6	2.5	-1.3
Netherlands	-17.8	-14.4	-6.4	-12.8	-10.6	-2.9
Norway	-10.2	0.5	-2.9	-2.6	0.0	-0.1
Poland	-6.0	6.4	2.6	14.4	11.5	2.3
Portugal	-7.9	-18.1	-7.5	12.6	-3.2	-5.5
Slovakia	-11.8	-4.6	4.0	-1.8	0.8	-3.3
Spain	-21.1	-41.7	-8.4	-9.4	-4.7	-9.7
Sweden	-9.6	1.8	2.8	3.0	3.7	1.3
United Kingdom	-15.0	-17.3	-6.4	-7.4	3.4	-1.7
United States	-12.6	-22.8	-5.4	-5.7	-5.8	-4.2

1. Hotels and restaurants, Transport & communication, Real estate, Professional and business services.

Source: Eurostat, US Bureau of Labour Statistics and Statistics Canada.

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