Economic Resilience to Shocks: The Role of Structural Policies

by

Romain Duval and Lukas Vogel

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>Structural policy determinants of resilience to shocks</td>
<td>3</td>
</tr>
<tr>
<td>Modelling strategy and preliminary cross-country comparison of business cycle patterns</td>
<td>5</td>
</tr>
<tr>
<td>Empirical estimates</td>
<td>9</td>
</tr>
<tr>
<td>The impact of labour and product market regulation on business cycle patterns</td>
<td>9</td>
</tr>
<tr>
<td>Monetary and financial drivers of business cycle patterns</td>
<td>14</td>
</tr>
<tr>
<td>Sensitivity analysis</td>
<td>16</td>
</tr>
<tr>
<td>Assessing the overall degree of resilience of OECD countries</td>
<td>22</td>
</tr>
<tr>
<td>Summary and conclusions</td>
<td>24</td>
</tr>
<tr>
<td>Bibliography</td>
<td>32</td>
</tr>
<tr>
<td>Appendix: Data Sources and Methodology</td>
<td>35</td>
</tr>
</tbody>
</table>

The authors are, respectively, senior economist and economist at the OECD Economics Department. They are highly indebted to Jørgen Elmeskov for earlier joint work on OECD business cycle patterns (Duval et al., 2007). The authors would also like to thank Christophe André, Benoît Bellone, Jean-Philippe Cotis, Boris Cournède, Sébastien Jean and Dave Rae for helpful discussions. We also thank participants to the March 2007 OECD Working Party No. 1 workshop on resilience for comments and suggestions. Remaining errors and omissions are the responsibility of the authors. The views expressed do not necessarily represent those of the OECD or its member governments.
Introduction

A trend towards more moderate business cycle fluctuations is often quoted as a stylised feature of economic developments in OECD countries over the past several decades. Among the causes frequently cited are better macroeconomic policies that have helped to anchor inflation expectations, a lower incidence and size of outside exogenous shocks, better financial market instruments for risk allocation and a reduced role for, and better control of, inventories. Reflecting the more moderate cycle within countries, cyclical divergences across countries have also tended to shrink over time. As a result, macroeconomic policy requirements have become less divergent across countries. This is obviously important when it comes to countries inside the euro area, where monetary policy settings are by definition identical.

Much more controversial is whether, and to what extent, business cycles have become more synchronised across countries. A factor making for synchronous business cycles are common shocks. Historically, oil price hikes have been prominent in this respect, but the oil intensity of OECD economies has tended to decline over time, implying that oil price fluctuations have become less important as a source of large common shocks. Another factor potentially making for synchronous business cycles is propagation of shocks across countries. Here, the increasing trade and financial linkages between countries are likely to have led to faster and stronger transmission of shocks across borders. A particular issue relates to business cycles across euro area countries, with the common currency potentially leading to greater integration and faster transmission, and thereby better alignment of cycles (Frankel and Rose, 1998), but also to greater specialisation and thereby a larger role for idiosyncratic shocks (Krugman, 1993).

Apart from idiosyncratic shocks, business cycle divergence across countries may also reflect different responses to common shocks. At issue here is the extent to which some economies are more resilient than others to various shocks. Since 2001, the experience of the large continental European economies contrasts with that of English-speaking OECD countries and many smaller European economies. Many of the shocks hitting countries appeared to be similar between the two groups or even marginally larger in some of the countries in the second group, such as with mass terrorism, the bursting of the equity bubble and corporate governance scandals. Yet, growth performance was generally better in the second group of countries (even adjusting for typically higher rates of potential growth) and even when recessions occurred they were usually short-lived, with economies bouncing back strongly. It seems unlikely that the differences in performance between the two country groups can be explained by different macroeconomic policy settings, even if these may in some cases have contributed. As a result, the hypothesis has emerged that economic resilience is stronger in some countries than in others. Interestingly, and perhaps not coincidentally, the countries seen as more resilient also appear to be the ones that have made most progress on structural reform over the past two decades.
Economic resilience may be loosely defined as the ability to maintain output close to potential in the aftermath of shocks. Hence, it comprises at least two dimensions: the extent to which shocks are dampened and the speed with which economies revert to normal following a shock. Structural policies are likely to affect both the strength and persistence of the effects of outside exogenous shocks. Macroeconomic stabilisation policies will also play an important role for resilience, but their effectiveness will also be conditioned by structural policy settings. For example, structural policy settings may affect the strength of the monetary policy transmission mechanism.

Against this background, the current paper examines the impact of a range of structural policies on the resilience of economies to shocks, both across countries and over time. The next section sketches theoretical arguments on the effect of structural settings on business cycle moderation. The third section describes the empirical strategy, and the fourth presents the empirical results. The penultimate section builds on these results to assess the overall degree of economic resilience of OECD countries and a final section sums up the main findings and concludes.

**Structural policy determinants of resilience to shocks**

As already noted, two key dimensions of resilience are the ability of the policy and institutional framework to cushion the initial impact of shocks and to reduce the persistence of the ensuing output gap. In this respect, those policies and institutions that dampen the initial impact of a shock may actually increase its persistence, and vice versa, i.e. they may have conflicting effects on resilience. For instance, strict employment protection legislation (EPL) may reduce the extent to which firms lay off workers in the short run in response to a negative shock, thereby supporting employment and private consumption. At the same time, it may slow down the wage adjustment process (Blanchard and Summers, 1986) as well as workers’ reallocation towards other productive jobs, thereby delaying the return of employment and output to their initial levels. Box 1 offers a more coherent theoretical framework for thinking about links between rigidities in labour and product markets and resilience. The upshot is that there is no simple link between policy-induced rigidities and resilience and that the net effect of structural policies in product and labour markets is essentially an empirical issue.

Another potential determinant of economic resilience is the strength of monetary policy transmission channels. Here the expected effect is less ambiguous: in general, the more powerful the monetary transmission mechanism, the smaller and the less persistent the monetary policy and output responses to demand shocks. Among the host of factors that contribute to shape monetary transmission channels, the degree of liberalisation of financial markets plays an important role, not least by facilitating intertemporal consumption smoothing. For example, the degree of mortgage market “completeness” (the range and variety of mortgage products available to borrowers) has been shown to amplify the transmission channel from housing wealth to consumption (Catte et al., 2004). More broadly, econometric analyses of consumption behaviour typically find larger “wealth effects” from housing and financial assets in those countries that have the most liberalised financial markets (see e.g. Deroose, 2006). That said, the use a country can make of an effective monetary transmission mechanism depends on the chosen exchange rate policy. For example, small members of a monetary union will not be helped by a strong transmission mechanism when faced with an idiosyncratic shock because monetary policy, calibrated on the union average, will not respond. Likewise, when confronted with a
Box 1. **Theoretical considerations on the link between product and labour market rigidities and resilience**

Business cycle theory allows some analysis of the links between rigidities and resilience. In a basic New Keynesian model, greater (nominal) wage and/or price stickiness flattens the (New Keynesian) Phillips curve and increases the sacrifice ratio. In turn, under optimal monetary policy, an independent central bank credibly committed to medium-term price stability will react less aggressively to most shocks – including temporary but persistent cost-push or technology shocks – thereby engineering a smaller but more prolonged output gap response (see e.g. Altissimo et al., 2006). The intuition is that since nominal rigidities worsen the inflation-output variability trade-off, a more aggressive policy reaction to a cost-push shock would induce large output losses for a limited gain in terms of reduced inflation. By contrast, in the case of pure demand shocks, rigidities may be of little influence since monetary policy can readily stabilise aggregate demand without facing any trade-off between output and inflation stabilisation.

Any policy or institution that increases wage and/or price stickiness would therefore be expected to lead to a smaller but more persistent output reaction to certain shocks. Among the many theoretical underpinnings of price stickiness, imperfect competition in product markets features prominently, e.g. through menu costs or coordination failure approaches. On the empirical side, there is now fairly strong evidence at the microeconomic level that firms tend to reset their prices more frequently in more competitive markets, lending some support to the view that low product market competition increases price stickiness (see e.g. the recent analysis carried out within the context of the Eurosystem Inflation Persistence Network, including inter alia Álvaréz et al., 2006, and Fabiani et al., 2006). Likewise, among the various theoretical explanations for wage stickiness, some authors have stressed the role played by labour market policies and institutions. For example, stringent EPL and/or high coverage of collective agreements bargained between unions and firms may slow down the adjustment of labour contracts in the face of shocks and thereby be conducive to nominal wage rigidities (Holden, 1994, 2004).

Like price stickiness, real wage rigidities flatten the Phillips curve and increase the sacrifice ratio. Real wage rigidities may be strengthened, for example, by high unemployment benefit replacement rates available over long periods. Ceteris paribus, rigid real wages should induce a less aggressive monetary policy response, and therefore a smaller but more persistent output reaction, to a variety of shocks. However, unlike price stickiness, real wage rigidities also increase the persistence of inflation, which should prompt monetary authorities to be more aggressive, thereby engineering a larger but less persistent output reaction to shocks. The latter effect may dominate in practice. To sum up, while nominal rigidities should lead to smaller but more persistent output gaps, real rigidities might go in the opposite direction. In both cases, the implications for resilience are ambiguous a priori.

1. Minimising a quadratic loss function defined over both inflation and output gaps.
2. Given the convexity of the central bank's welfare loss function, such a policy response would not be optimal. Another reason for the central bank to react less aggressively to a cost-push shock in the presence of price stickiness is that the initial impact of the shock on inflation will be smaller, for example because firms reset prices less frequently.
3. Co-ordination failure relates to the observation that in oligopolistic markets, following a shock, firms may choose not to change their prices unless their competitors move first.
4. Furthermore, Rotemberg and Woodford (1991) have suggested that during upswings, oligopolistic firms have greater incentives to free ride on other firms' efforts to maintain collusive price behaviour, so that mark-ups should fall. This counter-cyclicality of mark-ups provides another reason to expect that low product market competition flattens the Phillips curve.
5. Other factors may also play a role. For example, in conditions of low and stable inflation, contracts may lengthen which could induce greater nominal inertia.
common shock, some members of a monetary union can have too much of a good thing in the sense that a transmission mechanism that is stronger than average, together with a monetary policy response that is calibrated on the average, could be destabilizing. The analysis below controls for the influence of exchange rate policy as a constraint on monetary policy that may make it more difficult to stabilise the economy in the face of idiosyncratic shocks and/or heterogeneous propagation mechanisms of common shocks.

Some structural features of fiscal policy also affect resilience patterns, mainly via two channels. First, automatic stabilisers are expected to dampen the impact of shocks. Strong automatic stabilisers are typically associated with large public sectors, which in turn partly reflect some of the policies and institutions mentioned above – such as high and long-lasting unemployment benefits. Second, discretionary fiscal policy may be stabilising or destabilising, depending on whether it is counter or pro-cyclical. Here, one might expect government size, which allows strong automatic stabilisers, to be associated with a reduced need for discretionary fiscal impulses. This may not always be the case in practice, however. Evidence in Ahrend et al. (2006) suggests that several countries with large public sectors have supplemented automatic stabilisers with sizeable discretionary actions over the past two decades. These were on balance stabilising in Nordic countries, but destabilising in many euro-area countries. Fiscal policy was more in line with expectations in countries with smaller public sectors – such as a number of English-speaking and Asian OECD countries – with sizeable discretionary impulses contributing to output stabilisation.

Modelling strategy and preliminary cross-country comparison of business cycle patterns

With resilience determined by both amplification and persistence mechanisms, an empirical investigation of the phenomenon has to be dynamic in nature. This sub-section explores the determinants of cross-country business cycle patterns by means of dynamic, panel data output gap equations. Two issues that arise in this context are:

- The choice of the output gap measure. There are several possible approaches to estimate output gaps, including the Hodrick-Prescott (HP) and Baxter-King (BK) filters or the OECD methodology, which derives potential output from a production function approach (Box 2).
Box 2. Empirical measures of business cycles and the output gap

The output gap is the difference in per cent between actual and potential output. While actual output is observed with some precision, potential output is unobservable and must be inferred from available data.

Broadly speaking, there are two approaches to estimate potential output and the output gap, namely statistical and economic methods. Statistical methods implicitly assume that GDP embodies a long-run equilibrium component plus short-run disturbances around this trend. They perform a trend-cycle decomposition to extract the trend, which is then defined as potential output. Economic approaches derive an estimate of potential output from economic supply-side relationships, e.g. from the “equilibrium” value of the various components (e.g. population, labour force participation, unemployment, the capital stock and total factor productivity) of an aggregate production function.1

The analysis in this paper focuses primarily on the OECD economic (production function) approach, and checks the robustness of the results to the use of two alternative statistical measures of the output gap, namely the trend-cycle decompositions of Hodrick and Prescott (1997) and Baxter and King (1999).2

The (univariate) Hodrick-Prescott (HP) filter extracts a stochastic trend by introducing a trade off between achieving a good fit of the actual series and a high degree of smoothness of the trend series. The stochastic trend is assumed to measure potential output, and the residual denotes the business cycle component or the output gap. Formally, the HP filter minimises:

$$\min \sum_{t=1}^{T} (\ln Y_t - \ln Y_t^*)^2 + \lambda \sum_{t=1}^{T-1} \left( (\ln Y_{t+1}^* - \ln Y_t^*) - (\ln Y_t^* - \ln Y_{t-1}^*) \right)^2$$

where $Y_t$ is actual and $Y_t^*$ is trend output. $\lambda$ is a parameter that determines the smoothness of the trend component. Small values of $\lambda$ produce a trend close to actual GDP, while high values create a trend component converging to a linear trend. Consequently, $\lambda$ also determines the length of the cycle. Small values of $\lambda$ will only identify high frequency cycles and include cycles with longer duration in the trend, whereas higher values of $\lambda$ yield longer cycles and tend to produce larger values of the output gap. In line with most of the literature, $\lambda = 1600$ is chosen for quarterly data, consistent with an average duration of cycles of 4-6 years.

The Baxter-King (BK) filter decomposes the actual series and eliminates slow moving (trend) components, derived as a moving average of the series, as well as very high frequency (irregular) components from the series. Intermediate components of GDP volatility are retained as business cycle or output gap series. The basic idea is that business cycles are fluctuations of a certain frequency. BK allows for sharp cut-off points at predefined cycle length. In line with the literature, this paper fixes the range of cycle duration at 6-32 quarters and neglects all cyclical components outside these lower and upper bounds.

Unlike statistical methods, economic approaches derive their assumptions from economic theory. OECD output gap estimates adopt a production function approach, where potential output is estimated taking into account the capital stock, changes in labour supply, factor productivity and underlying non-accelerating wage rates of unemployment.3 The methodology is hybrid in the sense that some components are still derived from statistical filters (e.g. the trend growth of productivity and labour supply, see Giorno et al., 1995).
Most features of business cycles appear to be robust to these methodological choices (for details, see Duval et al., 2007). Therefore, the analysis undertaken below focuses on one method, namely the OECD output gap measure. As a complement, sensitivity analysis (towards the end of the next section) investigates the robustness of the results to the use of HP, BK and unemployment gaps.

The specification of output gap dynamics. The modelled dynamics should fit output gap patterns. As discussed in Box 3, visual inspection and specification tests point to an AR(2) specification for describing output gaps (as well as unemployment gaps, dealt with later in Box 4).

As a starting point, the following dynamic (non-linear) panel regression is estimated for a sample of 20 OECD countries7 using annual OECD output gap data over the period 1982-2003.8

\[
GAP_i = \phi_i(GAP_{i-1} - \eta GAP_{i-2}) + \lambda_t(1 + \gamma_i) + \alpha_i + \epsilon_{it} \tag{1}
\]

where i and t are country and time suffixes, GAP is the OECD measure of the output gap, \(\lambda_t\) is a time dummy variable which aims to capture an undefined set of shocks that are common to all countries, and \(\alpha_i\) is a country fixed effect which controls for the fact that output gaps may not have a zero mean over the finite sample period considered here. Equation [1] disentangles amplification from persistence mechanisms through the parameters \(\phi_i\) and \(\gamma_i\). \(\phi_i\) captures country-specific output gap persistence, while \(\gamma_i\) captures the country-specific reaction to common shocks \(\lambda_t\), i.e. the amplification mechanism. As explained in Box 3, the higher the value of \(\eta\phi_i\), the higher the degree of output gap
persistence in country \(i\). Likewise, the higher the value of \(\gamma_i\), the larger the initial impact of a common shock in country \(i\). The assumption of a common \(\eta\) in equation [1] simplifies the analysis and is not rejected by a formal statistical test.9

Focusing on unobserved shocks is appealing on two grounds: i) it puts clear emphasis on how country-specific factors shape the output gap effects of common shocks, which is the primary purpose of this paper; ii) it is a safe approach given the wide diversity of shocks actually experienced in practice, some of which would be difficult to capture within the econometric framework adopted here.10 However, this modelling choice also involves limitations. In particular, the omission of idiosyncratic shocks and the absence of a
distinction between supply and demand shocks increase the risk of omitted variable bias in the econometric estimates in this section. Another potential source of estimation bias is that output gap estimates are subject to measurement error.

Non-linear least squares estimates of $\eta$, the implied half-life of output gaps, and $\gamma$ are presented in Table 1, which also tests for each OECD country whether its estimated parameter values differ statistically from those estimated for the United States. Estimated output gap persistence is low relative to that of the United States among some other English-speaking countries (Australia, Canada, New Zealand) as well as in Denmark. By contrast, output gaps are found to be relatively persistent in a number of continental European countries as well as in Japan. As concerns the initial output gap effect of common shocks, most countries appear to have smaller impacts than the United States.

Some caution needs to be exerted when interpreting such descriptive results, however. In particular, estimates of equation [1] do not allow for changes in resilience over time. Yet, such changes may well have taken place in recent years, with substantial declines in business cycle volatility as described in the first section. These declines might, at least to some extent, reflect a variety of structural reforms in labour, product and financial markets. In any event, Table 1 provides information neither about the determinants of resilience nor about overall resilience (combining the persistence and amplification dimensions).

Empirical estimates

The impact of labour and product market regulation on business cycle patterns

Correlations between policies and resilience parameters

As preliminary evidence of the effects of labour and product market regulation on business cycle patterns, the country-specific persistence and amplification coefficients $\phi$ and $\gamma$ estimated in Table 1 are regressed on the following indicators (averaged for each country over the period 1982-2003) in separate regressions:

- The unemployment benefit replacement rate (averaged across a variety of income levels, family situations and unemployment durations).
- The stringency of employment protection legislation for regular workers (EPL).
- The stringency of product market regulation (PMR) across seven non-manufacturing industries.
- Collective bargaining coverage, i.e. the share of workers covered by a collective agreement, a measure of union influence in wage bargaining.
- The degree of centralisation/co-ordination of wage bargaining, a proxy for the concept of “corporatism” which has received widespread attention in the comparative political economy literature. In practice, the variable entered in the econometric estimates is a “low corporatism” dummy variable, which equals one if bargaining is decentralised and uncoordinated and zero otherwise.

Cross-country correlation coefficients between persistence and amplification coefficients $\phi$ and $\gamma$ on the one hand, and the above policy indicators on the other, are presented in Table 2. Given that persistence and amplification coefficients are estimated rather than observed – so that standard statistical inference could be misleading – the critical values used to assess the statistical significance of each correlation coefficient are obtained by bootstrapping the regression residuals. Strict EPL, stringent PMR and a high
degree of corporatism appear to be negatively correlated with the initial impact of shocks but positively with output gap persistence. Similar but insignificant correlation signs are obtained for collective bargaining coverage and the unemployment benefit replacement rate. In a nutshell, the results from Table 2 suggest that strict labour and product market regulations may dampen the initial impact of a common shock while making it more persistent.

This is further supported by the last row of Table 2, which finds similar and statistically significant cross-country correlations between persistence/amplification coefficients and a synthetic indicator of labour and product market regulation (averaged for each country over 1982-2003). The rationale for constructing this indicator is that countries tend to have similar stances across policy areas, thereby making it difficult to isolate the impact of a particular policy (Table 3). For instance, those countries that have strict EPL also tend to have stringent PMR, and vice versa. Here, this synthetic indicator is computed as the first principal component of the previous set of policy indicators.

Table 1. **Output gap equations with country dummies**

<table>
<thead>
<tr>
<th>Estimate for the United States:</th>
<th>Persistence of shocks: coefficient $\eta \phi$</th>
<th>Implied half-life of output gaps (in years)</th>
<th>Amplification of shocks: coefficient $\gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>0.44</td>
<td>1.67</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Estimates for other OECD countries and test for statistical differences in coefficients with respect to the United States:

<table>
<thead>
<tr>
<th>Country</th>
<th>Persistence of shocks: coefficient $\eta \phi$</th>
<th>Implied half-life of output gaps (in years)</th>
<th>Amplification of shocks: coefficient $\gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUS</td>
<td>0.34*</td>
<td>1.3*</td>
<td>0.24</td>
</tr>
<tr>
<td>AUT</td>
<td>0.47</td>
<td>1.8</td>
<td>-0.85***</td>
</tr>
<tr>
<td>BEL</td>
<td>0.45</td>
<td>1.7</td>
<td>-0.25*</td>
</tr>
<tr>
<td>CAN</td>
<td>0.27**</td>
<td>1.1**</td>
<td>0.34</td>
</tr>
<tr>
<td>CHE</td>
<td>0.41</td>
<td>1.6</td>
<td>-0.16*</td>
</tr>
<tr>
<td>DEU1</td>
<td>0.42</td>
<td>1.6</td>
<td>-0.15</td>
</tr>
<tr>
<td>DNK</td>
<td>0.31*</td>
<td>1.2*</td>
<td>-0.49**</td>
</tr>
<tr>
<td>ESP</td>
<td>0.54**</td>
<td>2.3**</td>
<td>-0.41**</td>
</tr>
<tr>
<td>FIN1</td>
<td>0.49</td>
<td>2.0</td>
<td>0.24</td>
</tr>
<tr>
<td>FRA</td>
<td>0.50</td>
<td>2.0</td>
<td>-0.53***</td>
</tr>
<tr>
<td>GBR</td>
<td>0.41</td>
<td>1.6</td>
<td>-0.30*</td>
</tr>
<tr>
<td>IRL</td>
<td>0.49</td>
<td>1.9</td>
<td>0.37</td>
</tr>
<tr>
<td>ITA</td>
<td>0.47</td>
<td>1.9</td>
<td>-0.37**</td>
</tr>
<tr>
<td>JPN</td>
<td>0.50</td>
<td>2.0</td>
<td>-0.57***</td>
</tr>
<tr>
<td>NLD</td>
<td>0.50</td>
<td>2.0</td>
<td>-0.55**</td>
</tr>
<tr>
<td>NOR</td>
<td>0.57***</td>
<td>2.5***</td>
<td>-0.97***</td>
</tr>
<tr>
<td>NZL</td>
<td>0.38</td>
<td>1.4</td>
<td>-0.61***</td>
</tr>
<tr>
<td>PRT</td>
<td>0.58***</td>
<td>2.4***</td>
<td>-0.38**</td>
</tr>
<tr>
<td>SWE1</td>
<td>0.40</td>
<td>1.5</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Time dummies Yes
Observations 434
R² 0.85

Note: Non-linear least squares.
* (**, ***): estimated coefficient differs significantly from corresponding coefficient obtained for the US at the 10% (5%, 1%) level.

Source: Authors’ estimates.
(see e.g. Nicoletti and Scarpetta, 2005). Based on the factor loadings produced by the analysis, it can be written as:

\[
\text{Labour and product market regulation}_{it} = 0.42(\text{replacement rate}_{it}) + 0.45(\text{EPL}_{it}) + 0.48(\text{collective bargaining coverage}_{it}) - 0.51(\text{low corporatism}_{it}) + 0.37(\text{PMR}_{it})
\]

This synthetic indicator has intuitive appeal. It is not very different from a simple average of the underlying policy indicators, so that it can to some extent be interpreted as a simple summary measure of the stringency of labour and product market regulation in the economy. Furthermore, it appears to explain over half of the total variance in the institutional data, which suggests that the dataset can be reduced into one single component without losing too much information in the process.\(^\text{18}\)

Table 2. **Cross-country correlation coefficients between persistence/amplification coefficients and labour/product market policy indicators**

Based on simple regressions of country-specific coefficients on the average value of each policy indicator over the period 1982-2003, using bootstrapped critical values to assess statistical significance.

<table>
<thead>
<tr>
<th>Persistent of shocks: Coefficient (\phi_i)</th>
<th>Amplification of shocks: Coefficient (\gamma_i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefit replacement rate</td>
<td>0.12</td>
</tr>
<tr>
<td>EPL for regular contracts</td>
<td>0.62***</td>
</tr>
<tr>
<td>PMR</td>
<td>0.58***</td>
</tr>
<tr>
<td>Collective bargaining coverage</td>
<td>0.29</td>
</tr>
<tr>
<td>Low corporatism</td>
<td>-0.52***</td>
</tr>
<tr>
<td>Labour and product market regulation (synthetic indicator)</td>
<td>0.50**</td>
</tr>
</tbody>
</table>

Source: Authors’ estimates on the basis of country-specific persistence and amplification coefficients estimated in Table 1 and data sources described in the appendix.

Table 3. **Correlation coefficients between labour and product market regulation indicators**

Correlation coefficients, 1982-2003

<table>
<thead>
<tr>
<th>Benefit replacement rate</th>
<th>EPL</th>
<th>PMR</th>
<th>Collective bargaining coverage(^1)</th>
<th>Low corporatism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefit replacement rate</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPL</td>
<td>0.29</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMR</td>
<td>0.15</td>
<td>0.37</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Collective bargaining coverage(^1)</td>
<td>0.52</td>
<td>0.44</td>
<td>0.40</td>
<td>1</td>
</tr>
<tr>
<td>Low corporatism</td>
<td>-0.53</td>
<td>-0.57</td>
<td>-0.38</td>
<td>-0.48</td>
</tr>
</tbody>
</table>


Source: Authors’ estimates on the basis of data sources described in the appendix.

**Estimating the effects of policies on business cycle patterns**

In order to undertake more in-depth econometric analysis of the effects of labour and product market regulation on business cycle patterns and resilience, persistence and amplification coefficients \(\phi_i\) and \(\gamma_i\) in equation [1] are replaced by a linear function of time-varying indicators of labour and product market regulation:

\[
GAP_{it} = \left( \varphi + \sum_j \phi_j (X_{it} - \bar{X}_j) \right) (GAP_{it-1} - \eta GAP_{it-2}) + \lambda \left( 1 + \sum_k \gamma_k (X_{ik} - \bar{X}_k) \right) + \alpha_i + \epsilon_{it}
\]

[2]
where the $X_j$'s and $X_k$'s are the indicators of policies and institutions in labour and product markets, namely the unemployment benefit replacement rate, EPL, PMR, collective bargaining coverage and the low corporatism dummy variable.

In equation [2] both the persistence and amplification of unobserved shocks are supposed to be functions of policies and institutions, while they were assumed to be constant and country-specific in equation [1]. This specification implicitly assumes that persistence and amplification coefficients depend exclusively on policy and institutional factors, and therefore does not allow for cross-country differences in these effects due to other factors. A positive (negative) and significant $\phi$ implies that the policy or institution $X_j$ increases (reduces) the persistence of output gaps. Likewise, a positive (negative) and significant $\gamma_k$ implies that the policy or institution $X_k$ amplifies (mitigates) the initial output gap effect of a shock.

The tendency for policy settings in different domains to be correlated, as discussed above, tends to generate multicollinearity which prevents the estimation of equation [2] with the full set of policies and institutions. There is no straightforward way to address this issue, all the more so as standard “general-to-specific” model selection procedures are applicable only for linear dynamic models (see e.g. Hoover and Perez, 1999; Krolzig and Hendry, 2001). Here, the multicollinearity issue is addressed in two alternative ways:

- A “statistical tournament” is undertaken in order to identify the most influential policy indicators within the full set of policies and institutions.
- Equation [2] is estimated using the synthetic indicator of labour and product market regulation instead of individual policy indicators.

**Identifying the labour and product market policies with most influence on the business cycle**

In order to identify the policies and institutions with the greatest influence on resilience patterns, the following “statistical tournament” is undertaken. As a preliminary step, equation [2] is estimated with policy indicators entered individually in separate regressions. These results, which are presented in Table 4, are fairly consistent with theoretical priors and with the simple correlation exercise above. Strict EPL and stringent PMR are found to reduce the initial impact of shocks on output gaps while at the same time increasing persistence (Table 4, Columns 2 and 5). Decentralised and uncoordinated wage bargaining processes appear to amplify the initial impact of shocks, providing some support for the view that real wages are more responsive to changes in overall macroeconomic conditions in highly corporatist systems (Table 4, Column 3). However, somewhat in contrast with this view, a low degree of corporatism appears to reduce output gap persistence. One explanation for these findings might be that decentralised bargaining processes do not properly internalise the effects of changes in the macroeconomic environment but otherwise bring in more wage flexibility. As might be expected, high rates of collective bargaining coverage are associated with stronger output gap persistence (Table 4, Column 4). In a number of OECD countries, high collective bargaining coverage stems from legal extension procedures, by which collective agreements become binding on parties which were originally non-signatories. One interpretation might be that such extension mechanisms are conducive to greater wage rigidity, thereby lengthening the adjustment process. Finally, unemployment benefit replacement rates are not found to bear any significant impact on output gap fluctuations (Table 4, Column 1).
As a second step, those persistence and/or amplification terms that are insignificant in the individual regressions are seen as having no robust impact on output gap patterns and are thus dropped from the analysis. This leaves a set of seven significant policy and institutional terms to focus upon, four related to persistence and three concerned with the initial impact of shocks. Equation [2] is then estimated with two terms for all possible pairs of policies and institutions among the seven remaining terms. Those terms that are found to be insignificant (at the 10% confidence level) in at least one of the regressions are discarded, and the remaining ones are built upon to estimate equations with three variables. The selection procedure continues until a final model is selected. It can be safely inferred from this “statistical tournament” that “surviving” policy and/or institutional terms significantly affect output gap patterns. By contrast, no firm conclusions can be

Table 4. Output gap equations with labour and product market regulation indicators
20 OECD countries, 1982-2003

<table>
<thead>
<tr>
<th>Benefit replacement</th>
<th>EPL</th>
<th>Low corporatism</th>
<th>Bargaining coverage</th>
<th>PMR</th>
<th>Final model selected</th>
<th>Full model with all policies and institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>ϕ</td>
<td>1.077</td>
<td>1.081</td>
<td>1.069</td>
<td>1.123</td>
<td>1.112</td>
<td>1.085</td>
</tr>
<tr>
<td>η</td>
<td>0.395</td>
<td>0.425</td>
<td>0.390</td>
<td>0.393</td>
<td>0.399</td>
<td>0.425</td>
</tr>
<tr>
<td>ϕ</td>
<td>[22.96]***</td>
<td>[24.71]***</td>
<td>[23.54]***</td>
<td>[23.98]***</td>
<td>[25.46]***</td>
<td>[24.96]***</td>
</tr>
</tbody>
</table>

Effect of institutions on persistence: $\phi$

<table>
<thead>
<tr>
<th>Benefit replacement rate</th>
<th>0.002</th>
<th>-0.004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[0.75]</td>
<td>[1.23]</td>
</tr>
<tr>
<td>EPL</td>
<td>0.141</td>
<td>0.128</td>
</tr>
<tr>
<td></td>
<td>[5.11]***</td>
<td>[4.77]***</td>
</tr>
<tr>
<td>Low corporatism</td>
<td>-0.279</td>
<td>-0.070</td>
</tr>
<tr>
<td></td>
<td>[3.40]***</td>
<td>[0.69]</td>
</tr>
<tr>
<td>Collective bargaining coverage</td>
<td>0.004</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>[2.63]***</td>
<td>[1.11]</td>
</tr>
<tr>
<td>PMR</td>
<td>0.099</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>[3.15]***</td>
<td>[0.68]</td>
</tr>
</tbody>
</table>

Effect of institutions on amplification of shocks: $\gamma$

<table>
<thead>
<tr>
<th>Benefit replacement rate</th>
<th>-0.007</th>
<th>0.002</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[1.09]</td>
<td>[0.33]</td>
</tr>
<tr>
<td>EPL</td>
<td>-0.242</td>
<td>-0.088</td>
</tr>
<tr>
<td></td>
<td>[2.39]***</td>
<td>[0.89]</td>
</tr>
<tr>
<td>Low corporatism</td>
<td>0.493</td>
<td>0.364</td>
</tr>
<tr>
<td></td>
<td>[2.47]**</td>
<td>[1.47]</td>
</tr>
<tr>
<td>Collective bargaining coverage</td>
<td>-0.002</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>[0.51]</td>
<td>[1.22]</td>
</tr>
<tr>
<td>PMR</td>
<td>-0.508</td>
<td>-0.537</td>
</tr>
<tr>
<td></td>
<td>[6.15]***</td>
<td>[5.93]***</td>
</tr>
<tr>
<td>Country fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Time dummies</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>434</td>
<td>434</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.82</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Note: Non-linear least squares. Absolute value of t statistics shown in parentheses.
*, ** and *** = significant at 10%, 5% and 1%, respectively.
Source: Authors’ estimates.
drawn from this procedure as regards discarded terms – given that possible significant impacts may have been obscured by the even more significant effect of other variables – and, more broadly, as regards the “true” model.

The final model selected through this procedure contains two variables, namely EPL and PMR (Table 4, Column 6). It is reassuring to note that estimating the full model from the outset would point to a similar selection (Table 4, Column 7). There is therefore robust evidence that stringent PMR dampens the initial impact of shocks while strict EPL increases persistence. Overall, these findings are consistent with those obtained by Bassanini and Duval (2006) regarding unemployment patterns, although unemployment benefits are also found to have a robust positive effect on persistence in their paper.

For the average OECD country, the estimated half-life of output gaps is 1.8 years. The estimates suggest that for this “average” OECD country, a two standard deviation decline in EPL stringency would reduce the half-life of output gaps by almost half a year.23 Similarly, a two standard deviation decline in PMR would raise the initial impact of a shock by about one-half. While the magnitude of the estimated effects does not look implausible, caution should be exercised when interpreting them. As already noted, it is plausible that although the statistical tournament approach helps single out the most significant policies and institutions, it is not guaranteed to select the “true” model. For instance, the separate impact of EPL and collective bargaining coverage may be difficult to disentangle insofar as they are highly correlated and interact with shocks through comparable channels.

The impact of overall labour and product market policies on the business cycle

An alternative approach is to re-estimate equation [2] using the synthetic indicator of labour and product market regulation as the only structural policy variable. As expected, amplification and persistence coefficients are of opposite signs and they are statistically significant at the 1% confidence level (Table 5, Column 1). This strongly suggests that strict labour and product market regulation dampens the initial impact of a shock but makes the effect more persistent.

Monetary and financial drivers of business cycle patterns

As noted earlier, output gap dynamics in the aftermath of a shock depend not only on supply-side rigidities in the economy but also on the monetary policy response as well as on the strength of the monetary policy transmission channel. A tentative and limited attempt to tackle these issues is provided here by considering three monetary and financial variables that may impact on resilience. First, household mortgage debt (as a share of GDP) can be seen as an indicator of financial market flexibility – it tends to bear a negative relationship with measures of mortgage market regulation24 – and as such it is expected to strengthen monetary policy transmission. Second, a flexible exchange rate dummy variable25 is aimed at capturing whether domestic monetary policy can react to shocks and thereby (under efficient monetary policy) both cushion the initial impact of shocks and make their effects less persistent.26 Finally, a financial intermediation variable, computed as the ratio of total bank credit to stock market value traded, captures the extent to which the financial system is dominated by bank intermediation rather than by market institutions. Bank-based systems might be conducive to slower initial pass-through but more persistence of shocks than market-based systems (see e.g. Artis, 2005).27 Table 6 finds estimated output gap persistence to be correlated negatively across countries with
Table 5. **Output gap equations with synthetic indicators of labour and product market regulation**

20 OECD countries, 1982-2003

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With synthetic indicators of labour and product market regulation alone</td>
<td>' = 1 + household mortgage debt</td>
<td>' = 1 + flexible exchange rate regime</td>
<td>' = 1 + financial intermediation</td>
<td>Final model with synthetic indicators of labour and product market regulation and monetary factors</td>
</tr>
<tr>
<td>Persistence coefficients:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ϕ</td>
<td>1.065</td>
<td>1.060</td>
<td>1.057</td>
<td>0.918</td>
<td>1.060</td>
</tr>
<tr>
<td></td>
<td>[23.82]***</td>
<td>[22.81]***</td>
<td>[23.02]***</td>
<td>[11.76]***</td>
<td>[22.98]***</td>
</tr>
<tr>
<td>η</td>
<td>0.397</td>
<td>0.392</td>
<td>0.395</td>
<td>0.382</td>
<td>0.392</td>
</tr>
<tr>
<td>Effect of institutions on persistence: ϕ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour and product market regulation</td>
<td>0.090</td>
<td>0.083</td>
<td>0.103</td>
<td>0.079</td>
<td>0.073</td>
</tr>
<tr>
<td></td>
<td>[4.20]***</td>
<td>[3.80]***</td>
<td>[3.64]***</td>
<td>[3.71]***</td>
<td>[3.81]***</td>
</tr>
<tr>
<td>Household mortgage debt</td>
<td>−0.54</td>
<td>−0.478</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[2.01]**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexible exchange rate regime</td>
<td></td>
<td>0.073</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.87]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial intermediation</td>
<td></td>
<td></td>
<td></td>
<td>0.0002</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[1.90]*</td>
<td></td>
</tr>
<tr>
<td>Effect of institutions on amplification of shocks: γ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour and product market regulation</td>
<td>−0.147</td>
<td>−0.136</td>
<td>−0.195</td>
<td>−0.281</td>
<td>−0.136</td>
</tr>
<tr>
<td></td>
<td>[2.93]***</td>
<td>[2.74]***</td>
<td>[2.91]***</td>
<td>[1.50]</td>
<td>[2.77]***</td>
</tr>
<tr>
<td>Household mortgage debt</td>
<td>0.076</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.13]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexible exchange rate regime</td>
<td></td>
<td>−0.286</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[1.38]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial intermediation</td>
<td></td>
<td>−0.003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[1.16]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Time dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>434</td>
<td>412</td>
<td>434</td>
<td>410</td>
<td>412</td>
</tr>
<tr>
<td>R²</td>
<td>0.83</td>
<td>0.83</td>
<td>0.83</td>
<td>0.85</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Note: Non-linear least squares. Absolute value of t statistics shown in parentheses.

*, ** and *** = significant at 10%, 5% and 1%, respectively.

1. Synthetic indicators calculated as the first component of a factor analysis performed on the following set of policies and institutions: unemployment benefit replacement rate, EPL, corporatism regime, collective bargaining coverage and PMR.
2. Time-invariant indicator (country average over period 1990-2002).

Source: Authors’ estimates.

household mortgage debt and the flexible exchange rate dummy variable, and positively with financial intermediation.

Table 5 extends the baseline equation featuring the synthetic indicator of labour and product market regulation (Table 5, Column 1) to incorporate the indicator of household mortgage debt (Column 2), the flexible exchange rate dummy variable (Column 3), or the financial intermediation variable (Column 4). These extensions yield only one significant finding at the 5% confidence level, namely that high levels of household mortgage debt tend to lower output gap persistence, consistent with the view that they strengthen monetary transmission. Furthermore, only household mortgage debt survives a “statistical
tournament” between the three monetary and financial variables. Reflecting this, a final, preferred specification features labour and product market regulation and household mortgage debt in the persistence term and labour and product market regulation in the amplification term (Column 5). While household mortgage debt – and the strength of monetary transmission channels more broadly – would be expected to improve resilience mainly under flexible exchange rates, in practice no significant interaction was found here between these two variables.

**Sensitivity analysis**

**Using alternative output gap measures**

The previous empirical findings are derived from OECD output gap estimates, and as such they may be sensitive to the specific methods used to produce these output gap estimates. In particular, the use of filtering methods could produce some correlation between explanatory variables (lagged output gaps) and residuals, thereby leading to biased coefficient estimates. Against this background, sensitivity analysis is carried out using three alternative measures of the output gap: the Hodrick-Prescott and Baxter-King filter estimates described in Box 1 and unemployment gap estimates, with structural unemployment being derived from the panel estimation of a standard model of equilibrium unemployment, without the use of any filtering method (see Box 4 for details).

Table 7 presents the re-estimation of three key equations – the model selected from the “statistical tournament” on labour and product market policies (Table 4, Column 6), the model using the synthetic indicator of labour and product market regulation (Table 5, Column 1) and the model incorporating the synthetic indicator of labour and product market regulation and household mortgage debt (Table 5, Column 5) – using the three alternative gap estimates. The main conclusion is that the findings are reasonably robust to the method used to construct the gaps. The only two noticeable differences with respect to previous results are the following: labour and product market regulation is no longer found to mitigate the initial impact of shocks when unemployment gap estimates are used, and household mortgage debt no longer appears to reduce gap persistence when Baxter-King filter estimates are used.

**Incorporating interactions between institutions and observed shocks**

All econometric estimates from the two previous sub-sections are based on equation [2], which focuses on interactions between institutions and common, unobserved shocks. One potential issue with such estimates is the omission of interactions between institutions and country-specific shocks. Such omission is a potential source of estimation...
Box 4. **Computing unemployment gaps**

The unemployment gap is defined as the gap between actual and structural unemployment. Therefore, computing unemployment gap estimates requires an estimate of structural unemployment. The latter is obtained here through panel data estimation of a theoretical model of unemployment. In practice, the following reduced-form unemployment equation is estimated, consistent with a variety of theoretical models of labour market equilibrium, including standard job-search (Pissarides, 2000) and wage-setting/price-setting (e.g. Layard et al., 1991; Nickell and Layard, 1999) models:

$$U_t = \sum \beta_j X_j t + \gamma G_t t + \delta_t + \epsilon_t$$  \[3\]

where $U_t$ is the aggregate unemployment rate, $\delta_t$ is a country fixed effect, and $G_t$ is a cyclical variable which aims to control for the unemployment effects of aggregate demand fluctuations over the business cycle. Here, the contemporaneous GDP growth rate and six lags of it are used. The $X_j$'s are policies and institutions which theory suggests may affect structural unemployment, namely: the unemployment benefit replacement rate, EPL, PMR, the degree of centralisation/co-ordination of wage bargaining, the tax-wedge between labour cost and take-home pay and union density. Estimating variants of equation [3] has become mainstream in the macroeconomic literature on the determinants of structural unemployment (see e.g. Bassanini and Duval, 2006; Belot and Van Ours, 2004; Blanchard and Wolfers, 2000; Nickell et al., 2005).

Estimates of equation [3] are presented in the table below. The model is first estimated with all policies and institutions (Column 1). The unemployment benefit replacement rate, the labour tax wedge and product market regulation appear to increase structural unemployment, while a high degree of corporatism reduces it. By contrast, EPL and union density are not found to have any impact on structural unemployment, which in the case of EPL is consistent with most of the theoretical and empirical literature. Both variables are thus dropped from the analysis to obtain a streamlined equation (Column 2). Based on the latter estimates, one can then compute a measure of the unemployment gap as:

$$U_{gap} = (U_t^* - U_t) = (\sum \beta_j X_j t + \delta_t) - U_t$$  \[4\]

With these unemployment gap estimates in hand, the output gap equations shown previously can be re-estimated in order to check the robustness of the findings.

1. The inclusion of country effects – which are found to be jointly significant – aims to control for omitted, country-specific determinants of structural unemployment.
2. Starting from a model with 10 lags, insignificant lags were eliminated sequentially until all remaining lags were found to be significant.
4. In line with Bassanini and Duval (2006), its influence is captured in the table through a dummy for “high corporatism” – instead of the “low corporatism” dummy used above.
5. See the appendix for details on sources and methods.
6. Union density, which is defined as the rate of union membership (see appendix for details), aims to capture union power. While the rate of collective bargaining coverage would be arguably a better proxy – which is why it was used in the econometric analysis above, it is not available over the whole sample for most OECD countries and therefore cannot be used here.
7. Ideally, one would rather estimate a dynamic unemployment equation in one step, identifying simultaneously the policy determinants of equilibrium unemployment and those of short-run unemployment dynamics. However, compared with the two-step estimation approach followed here, the large number of additional parameters to be estimated would imply a sizeable loss in the number of degrees of freedom and would make it more difficult for the non-linear estimation procedure to converge.
bias insofar as institutions that shape the propagation of common shocks would also be expected to influence the propagation of country-specific shocks.

In order to check whether this issue affects the estimates, the three key equations are re-estimated by adding several macroeconomic variables, or “observed shocks”, to the set of unobserved shocks (Table 8). Concretely, the following equation is estimated:

$$GAP_{it} = \left( \varphi + \sum_{j} \varphi^{j} \left( X_{jt} - \overline{X}_{jt} \right) \right) \left( GAP_{t-1} - \eta GAP_{t-2} \right) + \left( \gamma_{t} + \sum_{k} \gamma^{k} \left( Z_{it}^{k} - \overline{Z}_{it}^{k} \right) \right) \left( 1 + \sum_{k} \gamma^{k} \left( X_{it}^{k} - \overline{X}_{it}^{k} \right) \right) + \alpha_{it} + \epsilon_{it}$$

[5]
Table 7. Equations with alternative output gap definitions

<table>
<thead>
<tr>
<th></th>
<th>Model selected from statistical tournament</th>
<th>Model with synthetic indicators of labour and product market regulation alone</th>
<th>Model with synthetic indicators of labour and product market regulation and monetary factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hodrick-Prescott filter gap estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persistence coefficients:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \phi )</td>
<td>0.995</td>
<td>0.983</td>
<td>0.975</td>
</tr>
<tr>
<td>( \eta )</td>
<td>0.430</td>
<td>0.408</td>
<td>0.394</td>
</tr>
<tr>
<td><strong>Effect of institutions on persistence: ( \phi^j )</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour and product market regulation</td>
<td>0.094</td>
<td>0.090</td>
<td></td>
</tr>
<tr>
<td>Households mortgage debt</td>
<td>0.145</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Baxter-King filter gap estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persistence coefficients:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \phi )</td>
<td>0.551</td>
<td>0.541</td>
<td>0.541</td>
</tr>
<tr>
<td>( \eta )</td>
<td>0.480</td>
<td>0.439</td>
<td>0.428</td>
</tr>
<tr>
<td><strong>Effect of institutions on persistence: ( \phi^j )</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour and product market regulation</td>
<td>0.112</td>
<td>0.116</td>
<td></td>
</tr>
<tr>
<td>Household mortgage debt</td>
<td>-0.452</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Country fixed effects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>Time dummies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>431</td>
<td>431</td>
<td>409</td>
<td></td>
</tr>
<tr>
<td><strong>R^2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.81</td>
<td>0.80</td>
<td>0.89</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- PMR: Permanent income measure
- EPL: Employment protection legislation
- Observations: Number of observations
- R^2: Coefficient of determination

**Significance Levels:**
- \( *** \): p < 0.01
- \( ** \): p < 0.05
- \( * \): p < 0.1

---

OECD ECONOMIC STUDIES No. 44, 2008/1 – ISSN 0255-0822 – © OECD 2008
where the $Z^h$s are the “observed shocks” to be interacted with policies and institutions.

In line with recent empirical literature (Bassanini and Duval, 2006; Blanchard and Wolfers, 2000; Nickell et al., 2005), four types of “observed shocks” $Z^h$ are considered for analysis (see appendix for definitions and methodological details): i) total factor productivity (TFP) shocks; ii) terms of trade shocks; iii) labour demand shocks; and, iv) real interest rate shocks, defined as the difference between the 10-year nominal US government bond yield and annual US GDP price inflation. These are country-specific observed shocks, except for the last one which is a common observed shock in order to avoid endogeneity with respect to the output gap. As shown in Table 8, the main findings are robust to the use of both observed and unobserved shocks in the estimated equation.

### Controlling for fiscal policy

The response to shocks depends on both existing institutional settings in labour, product and financial markets and the monetary and fiscal policy reactions. Equation [2] focuses only
on the former, based on the implicit assumption that monetary and fiscal policy is not exogenous but rather is shaped by the institutional framework. Assuming that monetary policy reaction to shocks is entirely driven by existing nominal and real rigidities may not be implausible. By contrast, the assumption that fiscal policy responds optimally to shocks is arguably a stronger one, for at least two reasons. First, as noted earlier, the response of the fiscal balance depends partly on automatic stabilisers, which vary across countries and are only partially captured by the structural policy indicators in equation [2]. Second, the discretionary fiscal policy reaction is likely to be shaped by a wide range of considerations in practice. For these reasons, it cannot be ruled out that estimates of equation [2] might suffer from an omitted variable bias.

A limited attempt to tackle this issue is made here by re-estimating the three key equations with the share of overall tax receipts in GDP as an additional institutional variable to be interacted with shocks (Table 9). This variable directly captures the size of automatic stabilisers and would therefore be expected to dampen the initial impact of shocks. No attempt is made here at addressing its potential endogeneity, however. Therefore, the results from Table 9 should not be seen as an attempt to study the role of fiscal policy for resilience but rather as a robustness check on the previous findings. The latter are found to be robust to such sensitivity analysis.

Table 8. Output gap equations with both observed and unobserved shocks

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model selected from statistical tournament</td>
<td>Model with synthetic indicators of labour and product market regulation alone</td>
<td>Model with synthetic indicators of labour and product market regulation and monetary factors</td>
</tr>
<tr>
<td>Persistence coefficients:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \varphi )</td>
<td>1.203</td>
<td>1.229</td>
<td>1.221</td>
</tr>
<tr>
<td></td>
<td>([35.54]^{***})</td>
<td>([36.87]^{***})</td>
<td>([34.85]^{***})</td>
</tr>
<tr>
<td>( \eta )</td>
<td>0.277</td>
<td>0.278</td>
<td>0.271</td>
</tr>
<tr>
<td></td>
<td>([10.38]^{***})</td>
<td>([10.64]^{***})</td>
<td>([9.76]^{***})</td>
</tr>
<tr>
<td>Effect of institutions on persistence: ( \varphi )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour and product market regulation(^1)</td>
<td>0.028</td>
<td>0.029</td>
<td></td>
</tr>
<tr>
<td></td>
<td>([2.07]^{**})</td>
<td>([2.05]^{**})</td>
<td></td>
</tr>
<tr>
<td>Household mortgage debt(^2)</td>
<td></td>
<td>-0.322</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>([1.80]^{*})</td>
<td></td>
</tr>
<tr>
<td>EPL</td>
<td>0.066</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>([3.72]^{***})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effect of institutions on amplification of shocks: ( \gamma )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour and product market regulation(^1)</td>
<td>-0.070</td>
<td>-0.063</td>
<td></td>
</tr>
<tr>
<td></td>
<td>([2.96]^{***})</td>
<td>([2.60]^{***})</td>
<td></td>
</tr>
<tr>
<td>Household mortgage debt(^2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMR</td>
<td>-0.074</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>([2.06]^{**})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Time dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>394</td>
<td>394</td>
<td>376</td>
</tr>
<tr>
<td>R(^2)</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
</tr>
</tbody>
</table>

Note: Non-linear least squares. Absolute value of t statistics shown in parentheses.
*, ** and *** = significant at 10%, 5% and 1%, respectively.
1. Synthetic indicators calculated as the first component of a factor analysis performed on the following set of policies and institutions: unemployment benefit replacement rate, EPL, corporatism regime, collective bargaining coverage and PMR.
2. Time-invariant indicator (country average over period 1990-2002).
Source: Authors’ estimates.
Assessing the overall degree of resilience of OECD countries

What the previous analysis implies for the analysis of the policy and institutional determinants of resilience is somewhat ambiguous. Overall, strict labour and product market regulations appear to reduce resilience to shocks by increasing output gap persistence. Strict mortgage regulations have a similar – albeit somewhat less robust – effect. At the same time, there seems to be an offsetting effect insofar as strict labour and product market regulations improve resilience by cushioning the initial impact of shocks in most specifications.

In order to determine which of these offsetting effects dominates in practice, it is possible to devise a number of resilience criteria, and then to simulate the “preferred” equation of Table 5 (column 5) for different values of policy and institutional indicators to see how the latter affect the score on each resilience criteria. Three alternative criteria for assessing resilience are defined: i) the time T needed for output to get back to potential in the aftermath of a 1 percentage point negative common shock to the output gap; ii)
cumulative output loss between 0 and $T$; and, iii) the conditional volatility of output gaps, which unlike the other criteria is not derived from simulations but rather can be calculated from the equation for any value of policy and institutional indicators, under the assumption that only common shocks $\lambda_t$ with standard deviation $\sigma_\lambda$ occur. The lower is the time needed for output to get back to potential, and/or the smaller is the cumulative output loss and/or the lower is the volatility of output gaps, the greater is the degree of resilience to common shocks. In practice, the simulations indicate that rigid labour and product markets delay output recovery and increase the cumulative output loss on the one hand, but reduce output gap volatility on the other. By contrast, on all three criteria, a flexible mortgage market strengthens resilience through its impact on output gap persistence.

It is also possible to simulate the “preferred” equation for each OECD country, based on its current set of policy and institutional settings, to see how it is expected to score on each resilience criterion. Concretely, the analysis proceeds in two steps:

- First, a dynamic output gap equation is computed for each country, replacing the synthetic indicator of labour and product market regulation and the level of household mortgage debt by their most recent values in the “preferred” econometric regression. Three main groups of OECD countries emerge from these two indicators (Figure 1): most English-speaking countries (Australia, Canada, New Zealand, UK, US), which combine relatively flexible labour, product and mortgage markets; most continental European countries (Austria, Belgium, France, Italy, Spain and, to a lesser extent, Germany), where regulation remains comparatively stringent in all three areas; Northern European countries (Denmark, Netherlands, Norway and, to a lesser extent, Sweden) and Switzerland, which combine moderately regulated labour and product markets and well-developed mortgage markets. Japan is a special case, where labour and product markets are relatively flexible, while mortgage markets remain under-developed.

- These country-specific output gap equations are then used to simulate the impact of a (common) shock on output gap dynamics. Based on these simulations, illustrative cross-country comparisons of resilience are made according to each of the three resilience criteria defined above.

Impulse-response functions derived from these country-specific output gap equations are presented in Figure 2, and associated comparisons of the degree of resilience across OECD countries are summarised in Figure 3. The main cross-country patterns that emerge from these simulations are the following:

- Following a common shock, the time needed to get back to potential and the cumulative output loss appear to be relatively low in English-speaking countries with more flexible labour, product and/or mortgage markets (Figure 3, upper and middle panels). At the same time, however, output gap volatility tends to be comparatively high in this group of countries (Figure 3, lower panel). This reflects primarily their relatively flexible labour and product markets, which act in the direction of amplifying the initial shock.

- By contrast, some small European countries (Denmark, the Netherlands, and Switzerland) tend to perform relatively well on all accounts, reflecting their highly developed mortgage markets along with a moderate degree of labour and product market regulation. To a lesser extent, Germany appears to fall into this category.
Most other continental European countries perform poorly on all accounts, reflecting both their less-developed mortgage markets and the stringency of their labour and product market regulation.

**Summary and conclusions**

While recent economic research shows that cyclical fluctuations have become smaller over the past three to four decades, it provides no strong evidence that cycles have become more synchronised across OECD countries, except perhaps among euro area countries. One possible explanation, which this paper focuses on, is that economies differ in their degree of resilience to otherwise similar shocks as a result of existing cross-country differences in labour, product and financial market regulation.

Resilience may be loosely defined as the ability to maintain output close to potential in the aftermath of shocks. This in turn hinges on the ability of the institutional framework to cushion the initial impact of exogenous shocks and to reduce the persistence of the ensuing gap between actual and potential output. Both of these components of resilience are likely to be undermined by stringent financial market regulation, insofar as the latter...
Figure 2. Impulse-response functions

Assuming a 1 percentage point common negative shock to the output gap, based on Table 4, column 5

Source: Authors’ estimates. See text for details.
Figure 2. **Impulse-response functions (cont.)**

Assuming a 1 percentage point common negative shock to the output gap, based on Table 4, column 5

Source: Authors' estimates. See text for details.
weaken the monetary policy transmission mechanism. By contrast, the resilience effects of labour and product market regulations are theoretically ambiguous and represent essentially an empirical issue.

The paper therefore presents a univariate econometric framework in which the determinants of both amplification and persistence aspects of economic resilience can be tested. Concretely, output gap equations are estimated for a panel of 20 countries over the period 1982-2003 in order to disentangle the effect of policies and institutions on the initial impact of (unobserved) common shocks from their effect on output gap persistence. The key findings are the following:

- Employment protection legislation is found to increase output gap persistence, while product market regulation appears to dampen the initial output gap effect of (unobserved) exogenous shocks. Other individual policy and institutional indicators are not robust across all specifications, making it difficult to draw clear conclusions regarding their effects. When instead of individual indicators a synthetic indicator of labour and product market regulation is used, the analysis provides strong evidence that heavy regulation dampens the initial impact of shocks but makes it more persistent.

- Household mortgage debt, which bears a negative relationship with mortgage market regulation and can be seen as an indicator of financial market flexibility, seems to reduce output gap persistence. This is consistent with the view that monetary policy transmission channels are stronger in less regulated financial markets.
Figure 3. **Simulated degrees of resilience according to three alternative criteria**

Based on Table 4, column 5, using 2003 values of policy and institutional indicators

**Time T needed for output to get back to potential**
In years, following a 1 percentage point negative common shock to output gaps

**Cumulative output loss between 0 and T**
As a percentage of output, following a 1 percentage point negative common shock to output gaps

**Output gap volatility**
Number of squared standard deviations of the common shock, assuming there are no idiosyncratic shocks

Source: Authors’ estimates. See text for details.
Most of the above findings appear to be reasonably robust to the use of alternative output gap measures, to the analysis of both observed and unobserved shocks and to some control for the fiscal policy stance.

Insofar as strict labour and product market regulations may dampen the initial impact of shocks but make it more persistent, the implications for resilience are a priori unclear. In order to determine which of these offsetting effects dominates in practice, the preferred equation was simulated so as to assess the impact of policies and institutions on different resilience criteria. The simulations indicate that rigid labour and product markets lengthen the time it takes for output to return to potential following a shock and increase the cumulative output loss incurred over the period. However, economies with more flexible labour and product markets appear to exhibit greater output gap volatility. By contrast, whatever the resilience criterion used, strict mortgage market regulation reduces resilience by increasing output gap persistence.

Simulations of the preferred equation were also run in order to see how individual OECD countries are expected to score on these resilience criteria, based on their most recent policy and institutional settings. This exercise points to three main groups of countries:

- English-speaking countries with flexible labour and product markets and well-developed mortgage markets, where the time needed for output to get back to potential in the aftermath of a shock and the cumulative output loss are estimated to be among the lowest across the OECD, but where output gap volatility is comparatively high.

- Some small European countries with moderately stringent labour and product market regulation and well-developed mortgage markets, which according to the simulations perform relatively well on all of the resilience criteria. To a lesser extent, Germany also falls into this group.

- Most other continental European countries with comparatively strict labour and product market regulation and less-developed mortgage markets, which are estimated to be less resilient on all counts.

The purpose of this paper was to explore the reasons why in recent years a number of English-speaking and Nordic countries seem to have been more resilient than most continental European countries to a range of otherwise fairly similar shocks. Overall, the evidence linking resilience to rigidities in labour and product markets is somewhat ambiguous – both theoretically and empirically. By contrast, the analysis tentatively suggests that policy settings strengthening monetary policy transmission – such as the low degree of mortgage market regulation prevailing within the group of resilient countries – are unambiguously good for resilience. This result is in line with the conclusions drawn by Cotis and Coppel (2005) who, based on an analysis of recent cross-country business cycle patterns, suggest that financial market flexibility has been key to the strong resilience of certain OECD countries. However, it remains tentative insofar as it is not based on a detailed analysis of the policy and institutional determinants of monetary policy transmission. Furthermore, the univariate approach adopted here could only to a limited extent distinguish between different kinds of shocks hitting economies. It is possible that such a distinction could overturn some of the above conclusions. As well, the specifications assume symmetry in the way structural policies affect the response to positive and negative shocks. In practice, however, effects may differ depending on the direction of a shock. It is also conceivable that the impact of policies in labour, product and financial
markets on resilience could depend on the size of shocks. There is therefore ample scope for further research.

Notes
1. See e.g. Dalsgaard et al. (2002); Stock and Watson (2003).
2. See e.g. Bergman (2006); Camacho et al. (2006); Helbling and Bayoumi (2003).
4. In principle, this could of course reflect reverse causation, i.e. reduced macroeconomic volatility facilitating structural reforms.
5. In principle, output could also be stabilised in response to demand shocks under a weak transmission mechanism but this would be associated with an instrument variability that might be unpalatable. In the face of supply shocks, the strength of the transmission mechanism might be irrelevant to the inflation and output pattern.
6. The exchange rate is part of the monetary transmission mechanism, but this aspect is not explicitly covered in the current analysis.
7. Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.
8. The choice of the time period is driven by the availability of policy and institutional indicators, in particular the OECD EPL index which starts in 1982.
9. F-stat = 0.88, p-value = 0.60.
10. Identifying these shocks would in principle require a fully-fledged, country-specific VAR analysis in a preliminary step, given that there is a two-way causal relationship between output gaps and such variables as interest rates, exchange rates or even oil prices.
11. Given the fairly wide cross-country variance in idiosyncratic components shown in the first section, one way to minimise this source of estimation bias would be to correct the variance-covariance matrix of the residuals for group-wise (country-wise) heteroskedasticity. However, this would entail a sizeable loss in the number of degrees of freedom and would make it more difficult for the non-linear estimation procedure to converge.
12. Against this background, following Bassanini and Duval (2006) and OECD (2004), observations for Finland, Germany and Sweden in 1990 and 1991 are removed from the sample, reflecting the view that large country-specific shocks had a major effect on output gap fluctuations during this period – the collapse of the Soviet Union, the unification and the banking crises, respectively – which were behind the upward shift in unemployment over this two-year period. However, sensitivity analysis (not reported here) shows that key findings from the analysis presented below do not hinge on whether these observations are excluded from the sample.
13. Note that not all these cross-country differences are statistically significant, however (see Table 1).
14. See appendix for full details on data sources and methods. These indicators are time-varying and available at an annual frequency, with the exception of collective bargaining coverage which is time-invariant (country average over 1980-2000) due to lack of data at an annual frequency.
15. This sector-based PMR indicator is used in this paper because it covers the whole sample period, unlike the OECD’s economy-wide indicator which is available only for 1998 and 2003. One drawback is that changes in the indicator for non-manufacturing sectors do not incorporate all aspects of regulatory reforms that have been undertaken by a number of OECD countries in the past decades, such as administrative reforms affecting all sectors. As a result, the resilience effects of regulatory reforms may not be fully captured by the econometric estimates presented in this paper.
16. This variable is less imperfect than union density, not least because administrative extension practices – which remain in place in a number of continental European countries – extend collective agreements to the non-affiliated, providing unions with greater bargaining power in practice than union membership rates would suggest.
17. Lack of significance of the unemployment benefit measure – which combines initial replacement rate and unemployment duration components – is somewhat at odds with micro-econometric evidence showing spikes in job-finding rates around the end of unemployment spells.

18. The so-called “Kaiser rule” suggests that one should retain only factors with eigenvalues greater than one (Kaiser, 1960). Here, only the first component meets this criterion.

19. For example, the impact of a common oil-price shock depends not only on policy and institutional settings but also on the oil intensity of output, which may vary across countries.

20. Also apparent from [2] is the fact that policies and institutions enter the estimated equation in deviations from their sample means. One implication is that $\eta_\phi$ provides a measure of output gap persistence in the “average” OECD country.

21. The multicollinearity issue may not be extremely severe, however. The condition number of matrix $X'X$, where $X$ is a $(6 \times 22)$ matrix containing all five policy and institutional variables above and the unit vector as column vectors, is about 9. Only values in excess of 20 have been suggested as indicative of an important multicollinearity problem (Belsley et al., 1980).

22. Splitting the average unemployment benefit replacement rate into its initial replacement rate and benefit duration components yields similar results.

23. By construction, the values of both the EPL indicator and that of product market regulation for seven non-manufacturing industries range from 0 to 6. In 2003, their average values across the 20 countries included in the sample were equal to 1.84 and 2.1, and their standard deviations were equal to 0.87 and 0.55, respectively. For the “average” OECD country, a decline in EPL by two standard deviations would be equivalent to bringing it down to the stance observed in the some of the most liberal OECD countries (Canada and the United Kingdom, where EPL is estimated to be slightly more stringent than in the most liberal country, namely the United States). Likewise, a decline in PMR by two standard deviations would be equivalent to undertaking product market liberalisation of the same order of magnitude as that which has taken place in the average OECD country over the past ten years.

24. See Catte et al. (2004). Household mortgage debt is expressed as a share of GDP and is time-invariant (country average over 1990-2002), due to lack of data at an annual frequency for most countries over the sample period. See appendix for details.

25. This dummy variable takes value 1 if the country is not engaged in any fixed exchange rate agreement in year $t$ and zero otherwise. See appendix for details.

26. For euro area countries, which according to the first section have seen an increased synchronisation of cycles, the common monetary policy may of course react to common shocks. The dummy variable is not able to capture such nuances, which could explain its lack of significance in the regressions discussed below. As well, it could be argued that what matters is the combination of monetary policy autonomy and the strength of the transmission mechanism, i.e. that the two variables should be interacted. However, such interactions (not reported here) were tested but appeared to be statistically insignificant.

27. See appendix. The value of trades in domestic shares is used as denominator because the main alternative, namely stock market capitalisation, does not measure the amount of funding available to firms but rather the discounted value of future earnings. Stock market capitalisation provides an indication of the size rather than the activity of stock markets. That said, it should be acknowledged that stock market value traded primarily captures turnover in stock markets and therefore is also an imperfect proxy for firms’ access to capital.

28. It should be stressed that this variable is particularly robust since it would also survive the statistical tournament between labour and product market regulation indicators carried out in the previous section, and would therefore appear in the “final” model along with the other variables selected.

29. As discussed in Box 1, this assumption holds under optimal monetary policy.

30. One way at least to mitigate the endogeneity issue is to consider the country average of the fiscal policy variable over the sample period. In practice, however, using this time-invariant variable does not change the conclusions from Table 9.


32. However, it should be borne in mind that such simulations have no clear-cut normative implications, given that none of the three resilience criteria correspond to clear welfare measures.
For instance, in a so-called “New Keynesian” model of the business cycle model, the utility-based welfare loss function would combine both inflation and the output gap and would imply some trade-off between inflation and output stabilisation, at least for certain types of shocks. Welfare-based evaluations go beyond the scope of this paper, whose primary purpose is to shed some light on the policy and institutional determinants of business cycle patterns.

Bibliography


Appendix: Data Sources and Methodology

**OECD measure of the output gap:**
Definition: OECD measure of the gap between actual and potential output as a percentage of potential output. The methodology followed by the OECD in order to estimate output gaps is based on a Cobb-Douglas production function with Harrod-neutral technological progress and is described in detail in Giorno et al. (1995). The approach may best be qualified as hybrid in the sense that it relies on both structural economic relationships to estimate NAIRUs (see Richardson et al., 2000) – and univariate filters – mostly HP filters, to estimate trend participation rates, trend hours worked, trend capital services and trend total factor productivity.

Source: OECD, OECD Economic Outlook 80, December 2006.

**Aggregate unemployment rate:**
Definition: unemployed workers as share of the labour force, in %.
Data adjustments: while the primary source is the OECD Database on Labour Force Statistics, Annual Labour Force Statistics – which are usually available over longer time periods – were also used in some cases to extrapolate unemployment rates backwards (under the assumption of similar percentage changes in unemployment rates in both sources).

**Unemployment benefit replacement rate:**
Definition: average unemployment benefit replacement rate across two income situations (100% and 67% of average production worker (APW) earnings), three family situations (single, with dependent spouse, with spouse in work) and three different unemployment durations (1st year, 2nd and 3rd years, and 4th and 5th years of unemployment).
Source: OECD, Benefits and Wages.
Data adjustments: original data are available only for odd years. Data for even years are obtained by linear interpolation.

**Employment Protection Legislation (EPL):**
Definition: OECD summary indicator of the stringency of Employment Protection Legislation.

**Product Market Regulation (PMR):**
Definition: OECD summary indicator of regulatory impediments to product market competition in seven non-manufacturing industries:1 gas, electricity, post, telecoms
(mobile and fixed services), passenger air transport, railways (passenger and freight services) and road freight.


**Degree of corporatism:**
Definition: indicator of the degree of centralisation/co-ordination of the wage bargaining processes, which takes values 1 for decentralised and uncoordinated processes, and 2 and 3 for intermediate and high degrees of centralisation/co-ordination, respectively. The “low corporatism” dummy variable frequently used in this paper equals 1 when bargaining is decentralised and uncoordinated and 0 otherwise. The “high corporatism” dummy variable used in structural unemployment regressions equals 1 when bargaining is highly centralised and/or co-ordinated and 0 otherwise.


Data adjustments: original data are five-year averages and classify countries in each period along a 0-5 scale from least to most “corporatist” countries. In the present paper, annual data have been reconstructed based on various sources on the timing of past changes in centralisation and/or co-ordination of wage bargaining. Furthermore, the indicator has been rescaled along a 1-3 scale. In this process, it has been assumed that wage bargaining in France predominantly occurs at the intermediate level, while original data describe it as a mix of firm-level and industry-level bargaining. For other countries, values 1, 2 and 3 correspond to values 1-2, 3 and 4-5 in the original dataset, respectively.

**Collective bargaining coverage:**
Definition: share of workers covered by a collective agreement, in %. The variable used in the econometric estimates is the country average computed over the period 1980-2000.


**Union density**
Definition: trade union density rate, i.e. the share of workers affiliated to a trade union, in %.


Data adjustments: data for missing years are obtained by linear interpolation. Furthermore, original data are typically available until 2001 for most OECD countries. Extrapolations have therefore been made in order to expand data availability up to 2003. These are mainly based on national sources but, in some cases, an assumption of unchanged union densities over the period 2001-03 had to be made due to lack of data.

**Labour tax wedge**
Definition: tax wedge between the labour cost to the employer and the corresponding net take-home pay of the employee for a single-earner couple with two children earning 100% of APW earnings. The tax wedge corresponds to the sum of personal income tax and all social security contributions as a percentage of total labour cost.

Source: OECD, Taxing Wages.
Data adjustments: Austria: original data includes employers' social security contributions starting from 1997 only, thereby inducing an upward shift in tax wedge from this year; the tax wedge starting from 1997 is therefore recalculated based on the fact that employers' contribution rates to social security remained unchanged between 1996 and 1997. Netherlands: unlike other years, in 2002 and 2003 APW earnings are just above the threshold beyond which employers and employees do no longer have to contribute to the national health insurance plan (private medical insurance is typically provided instead), thereby inducing a temporary decline in the tax wedge; this issue is addressed by replacing the 2002 and 2003 observations by data obtained from linear interpolations between the 2001 and 2004 observations.

**Monetary policy autonomy:**

Definition: dummy variable which equals 1 when a country’s (de jure) exchange rate regime is “floating” or “floating with discretionary intervention” and 0 otherwise.


**Household mortgage debt:**

Definition: Household mortgage debt as a share of GDP, in %. The variable used in the econometric estimates is the country average computed over the period 1990-2002. In the absence of available data for Switzerland before 2000, this country is excluded from all those regressions that include household mortgage debt among the set of explanatory variables. However, it is included in the illustrative impulse-response functions that are produced using the estimated regressions.


**Financial intermediation:**

Definition: Ratio of private credit by deposit money banks and other financial institutions to total stock market value traded – which is the value of the trades of domestic shares on domestic exchanges.

Source: World Bank, Financial Structure Database.

**Total factor productivity shock:**

Definition: deviation of the logarithm of Total Factor Productivity (TFP) from its trend calculated by means of a Hodrick-Prescott (HP) filter (smoothing parameter $\lambda = 100$). The calculation proceeds in three steps. First, growth in the Solow residual in the business sector is calculated as: $\Delta \log(TFP) = \Delta \log(Y) - \alpha \Delta \log(N) - (1 - \alpha) \Delta \log(K) / \alpha$, where $Y$ refers to real business sector GDP, $N$ to total employment, $K$ to the gross capital stock and $\alpha$ to labour income as a share of business sector income. Second, an index $\log(TFP)$ of the logarithm of TFP is obtained by cumulating the annual values of $\Delta \log(TFP)$. Finally, the TFP shock variable is computed as the difference between $\log(TFP)$ and its HP filtered trend.

Terms of trade shock:
Definition: logarithm of the relative price of imports weighted by the share of imports in GDP, i.e. terms of trade shock = (M/Y) * log(P_M / P_Y), where M and Y denote total imports and GDP in nominal terms, respectively, and (P_M / P_Y) is the ratio of the deflator of total imports to the GDP deflator.

Real interest shock:
Definition: difference between the 10-year nominal US government bond yield (in %) and the annual change in the US GDP deflator (in %).

Labour demand shocks:
Definition: logarithm of the labour share in business sector GDP purged from the short-run influence of factor prices.
The methodology follows Blanchard, O. and J. Wolfers (2000). First, measures of real wages and employment in efficiency units are computed as W_{efficiency units} = (W / P_Y) / TFP and N_{efficiency units} = N * TFP, respectively. The simplest possible measure of labour demand shocks would be the negative of the sum of the logarithm of the ratio of labour input in efficiency units to real output in the business sector, on the one hand, and the logarithm of real wages in efficiency units, on the other hand: – [log(N_{efficiency units} / Y) + log(W_{efficiency units})] = – log[(N * TFP) / Y] – log[(W / P_Y) / TFP] = –log [(W * N) / (P_Y * Y)] = – (labour's share of business sector income). However, this simple measure of labour demand shocks is accurate only to the extent that the production function is Cobb-Douglas and factor proportions adjust instantaneously to changes in factor prices. Insofar as the latter assumption is unlikely to be verified in the short-run, changes in the labour share reflect both genuine labour demand shocks and the lagged adjustment of factor proportions to changes in factor prices.
Therefore, it is necessary to purge the labour share from the short-run influence of factor prices. For simplicity and comparative purposes, this is done here by following the same methodology as Blanchard (1998). Concretely, a wage measure which takes into account the gradual adjustment of factor proportions is computed as: log(W_{adjusted}) = \lambda * log(W_{adjusted}) + (1–\lambda) * log(W_{efficiency units}), where the value of parameter \lambda is set equal to 0.8 in line with estimates on annual data provided by Blanchard. The labour demand shock is then constructed as – [log(N_{efficiency units} / Y) + log(W_{adjusted})]. The negative sign implies that an increase in this variable should be interpreted as an adverse labour demand shock. Finally, this variable is set equal to zero in 1970 (or in the first year of data availability for those countries where long time series are unavailable).

Cyclically-adjusted primary fiscal surplus:
Definition: Primary fiscal surplus adjusted for cyclical factors.
Source: OECD, OECD Economic Outlook 80.

Note
1. Details on the broader PMR indicator for the whole economy – which is available only over the period 1998-2003 and therefore is not used in this paper – can be found in Conway, P., V. Janod and G. Nicoletti (2005), “Product Market Regulation in OECD Countries: 1998 to 2003”, OECD Economics Department Working Paper No. 41.