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# Do Structural Policies Affect Macroeconomic Stability?

**Volker Ziemann**

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## ABSTRACT/RÉSUMÉ

### **Do structural policies affect macroeconomic stability?**

Using a panel of OECD countries, this study assesses the linkages between structural policies and macroeconomic stability. Business cycle and time-series characteristics of GDP and its components are employed to define various measures for economic instability and for the persistence of adverse shocks. The results suggest that some growth-enhancing policies such as lowering employment protection also reduce macroeconomic fluctuations, while others may generate trade-offs between growth and stability. A pro-cyclical tax structure seems to help alleviating the persistence of adverse macroeconomic shocks.

*JEL classification:* E32; E61; F41; G38; H21; I31; J51; J68; L51

*Keywords:* structural policies, macroeconomic stability, business cycles

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### **Les politiques structurelles affectent-elles la stabilité macroéconomique ?**

À partir d'un panel de pays de l'OCDE, cette étude évalue les liens entre les politiques structurelles et la stabilité macroéconomique. Les caractéristiques du cycle économique et des séries temporelles du PIB et de ses composantes sont utilisées pour définir divers indicateurs de mesure de la stabilité économique et de la persistance de chocs néfastes. Les résultats donnent à penser que certaines mesures en faveur de la croissance, telles que l'allègement des dispositions de protection de l'emploi, peuvent aussi avoir pour effet de réduire les fluctuations macroéconomiques, alors que d'autres obligent à des arbitrages entre croissance et stabilité. Il semble qu'une structure pro-cyclique de la fiscalité aide à atténuer la persistance des chocs macroéconomiques néfastes.

*Classification JEL:* E32 ; E61 ; F41 ; G38 ; H21 ; I31 ; J51 ; J68 ; L51

*Mots clés :* politiques structurelles, stabilité macroéconomique, cycles conjoncturels

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## DO STRUCTURAL POLICIES AFFECT MACROECONOMIC STABILITY?

By Volker Ziemann<sup>1</sup>

### 1. Introduction and main findings

1. The link between structural policies and potential growth has been intensively studied over the past decades (e.g. OECD's *Going for Growth*). Recent events have, however, demonstrated that vulnerabilities can build up in good times, leading to severe and protracted adverse shocks. This study complements the analysis of the nexus between structural policies and growth by investigating their link with macroeconomic stability.

2. Former OECD analysis has shed light on the question of how structural policies and institutions affect the propagation of shocks to the real economy. Duval et al. (2007) investigated the impact of policies on output gap persistence and on the amplification of common shocks. The present study complements the findings in Duval et al. (2007) by focussing on adverse shocks to aggregate output. Besides disentangling positive and negative shocks and providing a broader definition of macroeconomic stability, the present empirical setup differs from Duval et al. (2007) in that the interaction between policies and outcomes is lagged rather than instantaneous. Policy settings are related to macroeconomic stability over the subsequent 5-year period.

3. The notion of macroeconomic stability is assessed through two statistical exercises. First, time-series statistics and characteristics of growth distributions across the OECD are explored. Second, resilience and persistence patterns following macroeconomic shocks are investigated building on business cycle features. The different indicators span two conceptually different dimensions associated with macroeconomic fluctuations, namely instability and persistence. The first is determined by business cycle amplitudes, growth volatilities and the size of shocks, while the second reflects the probability and duration of falls in output, the strength of recoveries and average growth. Table 1 illustrates the main findings.

4. Some policies commonly identified to enhance long-term growth (OECD, 2013) also seem to support macroeconomic stability. For instance, more stringent employment protection, besides hampering growth, seems to increase instability and persistence of adverse macroeconomic shocks. Accordingly, policy recommendations towards lowering labour market rigidities receive an additional argument when the policy objectives include macroeconomic stability.

5. Conversely, some growth-promoting policies such as product market deregulation do not necessarily lead to greater stability and may amplify shocks, in particular, if these shocks are large. Deregulation of product markets can thus create trade-offs between growth and stability and the optimal level of regulation may depend on the country- and time-characteristics of risk aversion.

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1. Volker Ziemann is Economist at the Economics Department. I would like to thank Jorgen Elmeskov, Jean-Luc Schneider, Peter Hoeller, Douglas Sutherland for their support and very useful comments.

6. Finally, macroeconomic stability may benefit from the design of a counter-cyclical tax system by putting more weight on taxes that exhibit high elasticities with respect to changes in the output gap. Indeed, the empirical results suggest that the use of direct taxes on business reduces the level of persistence of adverse shocks while social security contributions increase persistence.

**Table 1. Impact of structural policies on macroeconomic stability**

	Instability	Persistence
<b>PMR</b>		
State control	– (○)	+ (+)
Barriers to entrepreneurship	– (+)	○ (+)
Barriers to trade and investment	– (○)	○ (+)
<b>Employment protection</b>		
Regular contracts	+ (○)	+ (+)
Temporary contracts	+ (+)	+ (+)
<b>Labour market programmes</b>		
Active	○ (+)	+ (+)
Passive	○ (+)	+ (+)
<b>Wage bargaining</b>		
Coverage	○ (○)	+ (+)
Centralisation	○ (+)	○ (○)
Coordination	○ (+)	+ (○)
<b>Taxation</b>		
Taxes on production and imports	○ (○)	○ (○)
Direct taxes on business	○ (○)	– (–)
Direct taxes on households	○ (+)	+ (+)
Social security contributions	○ (–)	+ (+)

Note: The table reports the impact of a higher value of a policy indicator on instability and persistence. The results excluding the great recession are given in parentheses. Findings are based on panel regressions with time and country-fixed effects controlling for GDP per capita, financial openness and trade openness (see Box 4).

7. These findings are broadly consistent with the conclusions drawn from an update of the Duval et al. (2007) exercise (see Sutherland and Hoeller, 2013). One major difference is that, in the present setup, more stringent product market regulation reduces instability when the recent financial crisis is taken into account while Sutherland and Hoeller (2013) find that it amplifies shocks, including or excluding the current crisis. This may be explained by the different country coverage. Indeed, some smaller OECD countries that have not been included in Duval et al. (2007) or Sutherland and Hoeller (2013) seem to drive the link between instability and product market regulation during the recent crisis.<sup>2</sup>

8. After a short introduction, Section 2 proposes a set of indicators that cover various aspects associated with macroeconomic stability and investigates whether they depend on the policy setting. Based on these indicators, Section 3 introduces synthetic indicators for instability and persistence and investigates their correlation with structural policies and institutions.

2. For instance, highly regulated countries like Poland and Israel were relatively less affected by the recent crisis, while less regulated countries like Iceland and Estonia exhibited great instability. These countries are not covered by Duval et al. (2007) or Sutherland and Hoeller (2013).

### 1.1. Why look at stability?

9. Standard utility functions imply that households and businesses do not only care about average growth but also about output and consumption volatility and higher order moments of their distribution. Indeed, Scott and Horvath (1980) show that standard assumptions for utility imply that investors have positive preferences for odd (e.g. mean and skewness) and negative preferences (aversion) towards even moments (volatility and kurtosis). Recently, Barro (2009) has shown that extreme events lead to considerable welfare losses exceeding those induced by volatility alone (see also Epaulard and Pommeret, 2003).

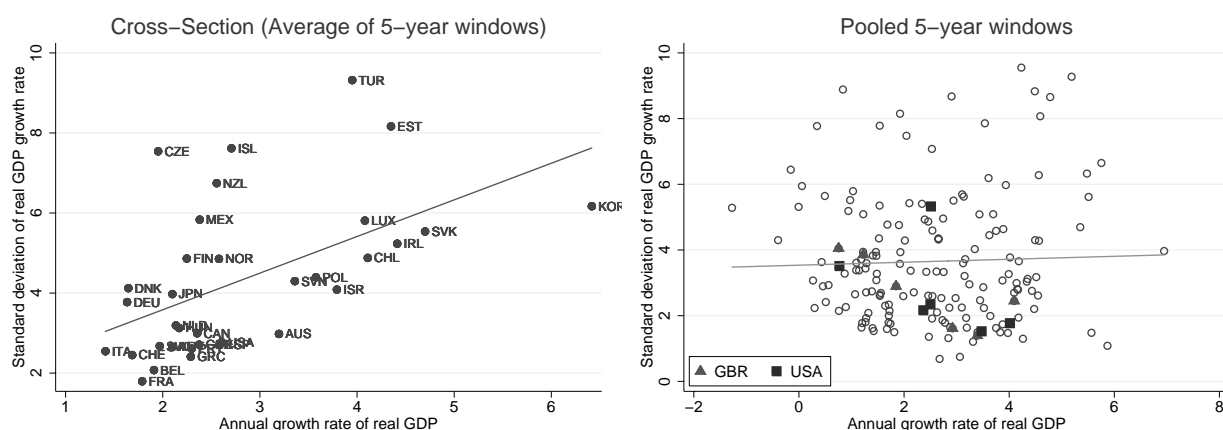
10. In addition, periods of severe instability can also directly affect potential growth. Two examples are i) the bursting of housing bubbles that led to financial market instability and a credit crunch and ii) the exacerbation and prolongation of downturns due to fiscal consolidation in the wake of the dramatic deterioration of public finances in many countries. Hysteresis effects on the labour market due to persistent declines of the construction sector and private as well as corporate bankruptcies and deleveraging in the private sector in order to return to sustainable balance sheets are main channels through which growth is negatively effected in the long term in these examples.

### 1.2. What is the relationship between growth and volatility?

11. In the microeconomic analysis of financial assets the trade-off between returns and volatility is well-researched and has been formalised since the seminal work by Markowitz (1952) and the subsequent foundation of the Capital Asset Pricing Model (Sharpe, 1964). In this model, investors demand a higher return for riskier assets and the position on the efficient frontier is chosen according to the investor's level of risk aversion. In macroeconomics, however, the potential trade-offs between expected returns (potential growth) and risks (stability) have received only little attention. It is important to distinguish between the cross-section and the inter-temporal relationship. Figure 1 suggests the following:

- No correlation between growth and volatility for the pooled 5-year windows of average growth rates and standard deviations of real GDP.
- A positive correlation in the cross section.
- A negative correlation within countries across time.

**Figure 1. Average GDP growth and volatility**



Note: Based on 5-year-windows of quarterly real GDP growth rates from 1990 through 2009.

Source: OECD (2013), *OECD Economic Outlook*, Vol. 2012/2, OECD Publishing.



12. These three features are backed by panel regression results (Table 2). First, the pooled sample (see right panel in Figure 1) yields a positive but insignificant relationship between average growth and volatility. It is worth mentioning, however, that volatility does not necessarily reflect instability as the standard deviation is a symmetric measure and both periods of accelerating and decelerating growth, lead to increasing volatility. Indeed, squared growth rates turn out to be significantly positive, suggesting that outliers heighten volatility. In order to distinguish explicitly “good” from “bad” volatility, downside or semi-standard deviations will be added to the volatility analysis.

**Table 2. Link between growth and volatility**

	Pooled			Within (country fixed effects)			Between (cross-section)		
	I	II	III	I	II	III	I	II	III
Growth	0.0792 (0.125)		-0.0177 (0.124)	-0.475* (0.181)		-0.511** (0.153)	0.915*** (0.260)		1.185** (0.376)
Growth (-)		0.231 (0.231)			-1.085* (0.426)			1.254 (0.776)	
Growth (+)		0.0879 (0.126)			-0.634** (0.219)			1.057* (0.404)	
Growth (squared)			0.258*** (0.0702)			0.245** (0.0760)			-0.175 (0.176)
Observations	181	181	181	181	181	181	34	34	34

Note:

Standard errors in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

5-year window of quarterly growth rate of real GDP from 1980 through 2009. Growth (-) refers to below-average growth, Growth (+) to above-average growth and Growth (squared) to centred squared growth rates.

13. Second, the within estimates, that control for country-fixed effects,<sup>3</sup> point towards a negative link between growth and volatility. Note also, that the slope is steeper for below-average growth periods. This could hint at a negative feedback loop within a country between instability and negative or below-average growth.<sup>4</sup>

14. Finally, cross-country regressions, based on average 5-year windows for each country (left panel in Figure 1) indicate a positive linear link between growth and volatility. This, however, may simply result from scale effects of average growth on the standard deviation as evidenced by the presence of less-developed OECD countries in the upper-right part of the graph. Indeed, below average growth the relationship is not significant as shown in Table 2.

## 2. Which policy instruments affect macroeconomic stability?

15. Macroeconomic stability is not a well-defined concept and volatility, defined as the standard deviation of output growth rates, is not an exhaustive measure. Accordingly, additional indicators that account for asymmetry, rare events and business cycle characteristics are used in the two empirical exercises of this section. The first empirical exercise uses time series of quarterly real output series in order to assess volatility and growth distribution characteristics with respect to the policy regime (Box 1 illustrates the methodology for the case of product market regulation).

3. As an illustration, squares for the United States and triangles for the United Kingdom are highlighted in the right panel of Figure 1.

4. Granger-causality tests are not conclusive for most countries.

### Box 1. Volatility and downside risks of growth distributions

In order to assess volatility and growth distribution characteristics with respect to the policy regime non-overlapping 5-year windows are formed ending in 2012. Over each of these windows, based on quarterly data, the following measures of macroeconomic stability are calculated:

- Volatility: annualised standard deviation of log-differenced output.
- Downside-volatility: annualised standard deviation of log-differenced output below average growth.
- Amplitude: maximum minus minimum of the de-trended output (output-gap in the case of GDP),
- 10<sup>th</sup> percentile: 10<sup>th</sup> percentile of the distribution of log-differenced output.
- Shortfall probability: the frequency of quarters with negative log-differenced output.

At the beginning of each 5-year period a country's policy indicator is compared with the median policy indicator at that specific time across countries. In order to eliminate cyclical noise in some indicators (e.g. those expressed in percentage of GDP), hp-filtered policy indicators are used. Accordingly, 5-year periods are separated into low and high regimes (here: low and high regulated at time *t*). Average values of the above stability indicators, conditional on the policy regime, are presented for real GDP, consumption, investment, and exports and imports. Table 3 presents these stability indicators for OECD's overall PMR index.

**Table 3. Macroeconomic stability and product market regulation**

	GDP		Consumption		Investment		Exports		Imports	
	Low	High	Low	High	Low	High	Low	High	Low	High
Average growth	1.97	2.20	1.89	2.14	1.17	1.65	3.86	4.97	3.94	4.53
Growth volatility	2.18	1.90	1.87	1.89	<b>8.06</b>	<b>5.79</b>	6.27	6.65	6.43	7.20
Downside-volatility	1.55	1.79	1.35	1.44	<b>6.08</b>	<b>3.93</b>	4.53	5.14	5.48	5.77
Amplitude	5.90	5.83	5.53	4.91	20.94	16.59	<b>15.47</b>	<b>18.26</b>	18.02	20.01
10th percentile	-0.88	-0.57	-0.77	-0.58	-4.40	-3.25	-3.09	-3.06	-3.10	-3.41
Shortfall probability	25.11	20.00	25.54	22.50	42.39	38.04	30.87	27.61	29.02	29.78
Observations	151	145	151	145	151	145	151	145	151	145

Note: Numbers represent averages over 5-year windows conditional on the policy regime (low/high). Bold numbers indicate significant differences of these averages at the 5% level using t-tests.

Each indicator addresses a specific issue of macroeconomic stability. Downside volatility, for instance, allows distinguishing "good" and "bad" volatility. In the case of product market regulation, investment volatility, and especially downside volatility, is significantly higher in less regulated countries. The amplitude of the de-trended series complements information on volatility which may be a pure statistical artefact (affected by high or low autocorrelation, etc.). For instance, overregulation seems to increase the amplitudes of real exports. The 10<sup>th</sup> percentile provides the growth rate that economic output growth falls short of in 10% of the times and gives an idea about the prevalence of downside risks. Finally, shortfall probability indicates the chance of a quarterly drop in output which, *per se*, may be seen as a stability issue. While less regulation seems to exhibit lower 10<sup>th</sup> percentiles and higher shortfall probabilities than higher regulated regimes, none of the differences are significant.

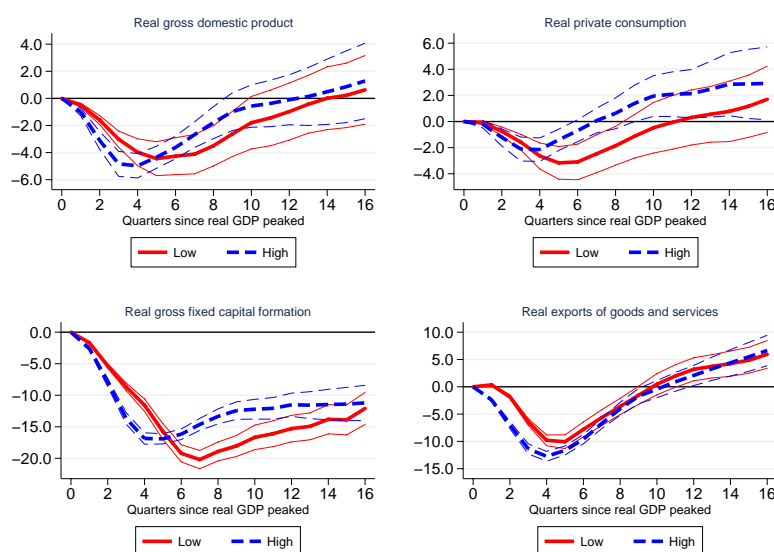
It should be noted that the results reflect correlation, not causality. It may, for instance, be the case that high investment volatility encourages policy makers to reduce regulatory barriers so as to enhance competition and the economy's adjustment capacity. On the other hand, the methodology partly controls for such reverse causality by introducing a lag between the observation of the policy regime and the measurement of subsequent stability.

16. The second exercise assesses resilience and persistence patterns during sharp downturns by splitting downturns in two groups according to the current regime of the different policy indicators (Box 2 illustrates the methodology for product market regulation).<sup>5</sup>

### Box 2. Resilience and persistence during significant downturns

In order to assess the instability and persistence patterns during downturns, turning points of classical business cycles of real GDP are identified, with the restriction that the peak-to-trough exceeds 1%. Business cycle downturns are then separated into low and high regimes with respect to the policy indicator at the peak compared to the median across countries at that time. Subsequently, average evolutions of real output (GDP, private consumption, total investment and exports) conditioning on the policy regime (low/high) are observed and presented graphically (Figure 2 produces this for the case of product market regulation).

Figure 2. Downturns by regime of product market regulation



The figure yields information on average peak-to-trough amplitudes, the duration of downturns and the pace of the recovery. These will be explored numerically in Section 3. The present example suggests, for instance, that high product market regulation is related to faster declines and more sluggish recoveries in investment during business cycle downturns. At the same time, for investment, both peak-to-trough and recovery from the trough are more pronounced when product market regulation is low in line with the above finding of higher volatility (Table 3).

17. For each policy indicator, the analysis in this section briefly reviews the literature on the link between structural policies and macroeconomic stability and provides empirical evidence using the approaches presented in Box 1 and Box 2.

5. Note, that throughout all exercises high/low policy regimes are defined with respect to the median. Robustness checks based on other quantiles, for instance, 1<sup>st</sup> quintile (low) versus 5<sup>th</sup> quintile (high), produce very similar results.

## 2.1. Product market regulation

18. The OECD's product market regulation (PMR) indicator reflects various aspects of the market structure: state control and barriers to entrepreneurship and barriers to trade and investment. The policy maker pursues various objectives that include efficiency, innovation and investment, distributional objectives or quality of service. Over the last decades, product market deregulation has been at the forefront of structural reform agendas, which have sought to foster productivity and potential growth. As such, liberalising product markets has been, and still is, one of the top priorities in OECD's *Going for Growth* recommendations.

19. While there is a large body of literature on the relationship between structural policies and productivity little is known about the link to macroeconomic stability. Bourlès *et al.* (2010), for instance, showed that overregulated upstream markets tend to reduce incentives to innovate which reduces total factor productivity. However, the link between competition and innovation is controversial and the sign of the correlation unclear (Cohen, 2010). Neo-Schumpeterian models following Aghion *et al.* (2005) suggest that the relationship between competition and innovation follows an inverted U-curve. Accordingly, beyond a certain threshold, intense competition compresses the expected rents of innovation to a level that renders such investments unprofitable. In terms of macroeconomic stability, competition may be beneficial as it may accelerate the relocation of factors of production towards the most viable sectors in response to shocks. On the other hand, innovative companies and industries are exposed to technology shocks that drive or exacerbate macroeconomic fluctuations (e.g. Alexopoulos, 2011).

20. OECD research has found that tighter product market regulation helps to mitigate exogenous shocks but also increases their persistence (see Duval *et al.*, 2007). While increased competition and a larger number of firms may yield diversification benefits, several authors argue that competition increases idiosyncratic volatility, for instance, through a reduction in consumers' loyalty in line with decreasing search and shift costs (see e.g. Irvine and Pontiff, 2009). Similarly, Comin and Philippon (2006) find that product market deregulation is positively correlated with higher firm-level volatility but also with higher R&D investment which in turn leads to lower correlations with the rest of the economy and may thus help explain the decline in aggregate volatility observed during the Great Moderation.

21. Empirical evidence suggests that high barriers to entrepreneurship are associated with higher real GDP volatility and amplitudes (Table 4). The results also underline the highly asymmetric pattern of volatility as downside-volatility is substantially lower than total volatility, especially in the low-regulated regime. Downside risks are higher in the case of high barriers to entrepreneurship while results on shortfall probabilities are mixed. However, differences between high and low barriers regimes are not significant for investment stability measures.

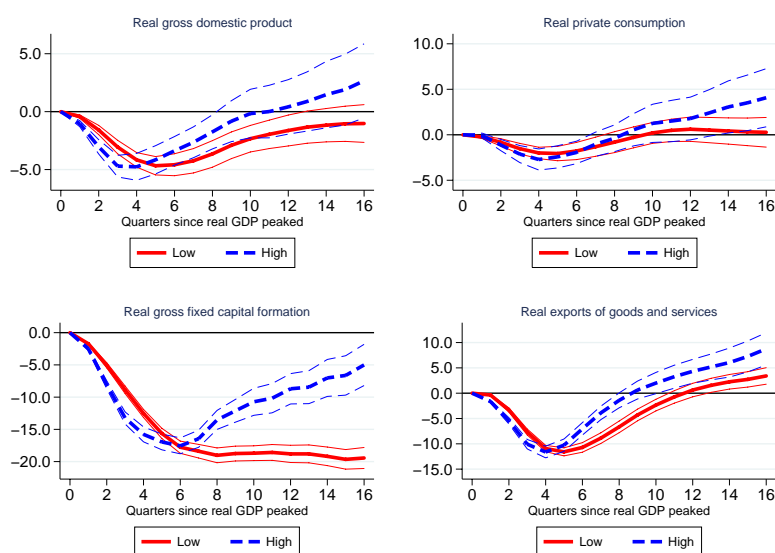
**Table 4. Barriers to entrepreneurship and macroeconomic stability**

	GDP		Consumption		Investment		Exports		Imports	
	Low	High	Low	High	Low	High	Low	High	Low	High
Average growth	1.96	2.21	2.10	1.94	1.10	1.72	<b>3.68</b>	<b>5.15</b>	3.86	4.60
Volatility	<b>1.81</b>	<b>2.27</b>	<b>1.56</b>	<b>2.20</b>	6.31	7.54	<b>5.31</b>	<b>7.60</b>	<b>5.68</b>	<b>7.95</b>
Downside-volatility	<b>1.30</b>	<b>2.03</b>	<b>1.07</b>	<b>1.72</b>	4.41	5.61	<b>4.09</b>	<b>5.59</b>	<b>4.67</b>	<b>6.58</b>
Amplitude	<b>5.09</b>	<b>6.64</b>	<b>4.43</b>	<b>6.01</b>	16.64	20.89	<b>14.41</b>	<b>19.32</b>	<b>16.16</b>	<b>21.87</b>
10th percentile	-0.64	-0.81	<b>-0.47</b>	<b>-0.88</b>	-3.51	-4.14	<b>-2.55</b>	<b>-3.59</b>	<b>-2.69</b>	<b>-3.82</b>
Shortfall probability	24.02	21.09	22.83	25.22	41.96	38.48	28.91	29.57	29.24	29.57
Observations	46	46	46	46	46	46	46	46	46	46

Note: See Box 1 for definitions and methodology. Numbers represent averages over 5-year windows conditional on the policy regime (low/high). Bold numbers indicate significant differences of these averages at the 5% level using t-tests.

22. Analysing downturns yields a mixed picture: real output, especially investment and exports decline slightly faster on average than in the low barriers to entrepreneurship regime (Figure 3). On the other hand, and more surprisingly, the recovery of investment and exports seems to be faster and stronger.

**Figure 3. Downturns by regime of barriers to entrepreneurship**



Note: Evolutions of real output (GDP, private consumption, total investment and exports) starting from the business cycle peak and conditioned on the policy regime (low/high) are drawn (see Box 2 for details). Thick lines refer to averages and thin lines represent 95% confidence interval limits.

23. By choosing the level of barriers to trade and investment such as tariffs, barriers to FDI or discriminatory administrative procedures, product market regulation also determines the extent of economic activity with the rest of the world. While the exposure to world trade represents an additional source of risk, it also allows exporters to diversify their markets. Vannoorenberghe (2012) finds that a larger share of exports tends to increase the volatility of domestic sales while it reduces the volatility of export sales. To some extent, this is reminiscent of German exporters' experience in the recent crisis: while export markets shrank substantially in Southern Europe, the scope and orientation of German exporters allowed them to shift sales towards Asia where demand was more robust. Further, di Giovanni and Levchenko (2012) argue that openness to trade increases the importance of large firms which reduces the diversification potential of the economy leading to increasing aggregate output volatility.

24. Empirically, countries with relatively high barriers to trade and foreign investment experience higher volatility (Table 5) although the difference is smaller than in the case of barriers to entrepreneurship and not significant except for trade. Lower barriers seem to lead to positive contributions of net exports and to less volatile trade. Investment volatility and amplitudes do not seem to be affected by the level of regulation on trade and investment, but shortfall probabilities are significantly higher in the lower barrier regime. This instability also appears to affect average growth of GDP, investment, consumption and imports.<sup>6</sup>

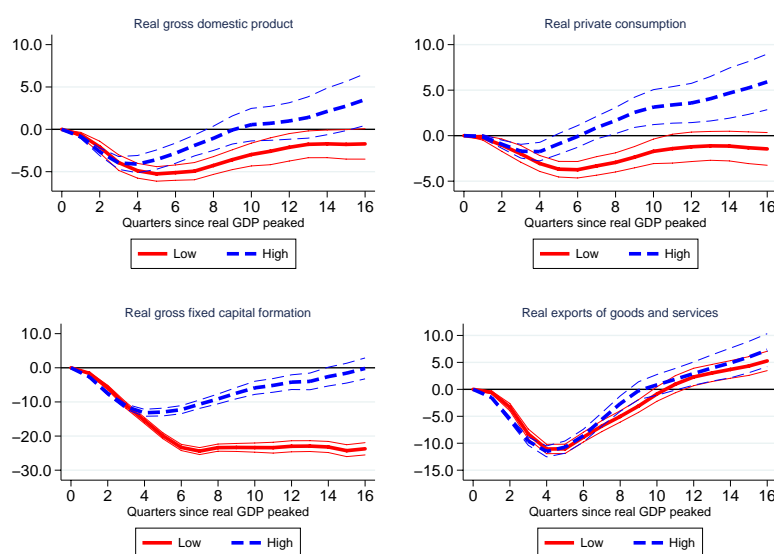
6. These findings are robust with respect to the great recession. Indeed, excluding the last 5-year window (2008-12) from the sample leads to similar though slightly less robust conclusions.

**Table 5. Barriers to trade and investment and macroeconomic stability**

	GDP		Consumption		Investment		Exports		Imports	
	Low	High	Low	High	Low	High	Low	High	Low	High
Average growth	<b>1.71</b>	<b>2.46</b>	<b>1.48</b>	<b>2.55</b>	<b>0.29</b>	<b>2.53</b>	3.95	4.88	<b>3.45</b>	<b>5.02</b>
Volatility	1.96	2.12	1.73	2.03	6.93	6.92	<b>5.81</b>	<b>7.10</b>	<b>6.03</b>	<b>7.60</b>
Downside-volatility	1.55	1.78	1.22	1.57	4.90	5.12	4.52	5.16	5.18	6.07
Amplitude	5.84	5.90	4.94	5.51	18.55	18.99	15.77	17.96	<b>17.06</b>	<b>20.97</b>
10th percentile	-0.80	-0.65	-0.78	-0.58	-4.11	-3.54	-2.83	-3.31	-2.94	-3.57
Shortfall probability	24.78	20.33	26.20	21.85	<b>44.46</b>	<b>35.98</b>	27.72	30.76	29.89	28.91
Observations	46	46	46	46	46	46	46	46	46	46

Note: See Box 1 for definitions and methodology. Numbers represent averages over 5-year windows conditional on the policy regime (low/high). Bold numbers indicate significant differences of these averages at the 5% level using t-tests.

25. The evolution of overall output during downturns is more favourable in the case of high regulation of barriers to trade and investment. The initial drop is less pronounced and the economy recovers significantly faster if barriers to trade and investment are high (Figure 4). This finding is most significant for real investment and the results hint at vulnerabilities associated with deregulation of trade and investment.

**Figure 4. Downturns by regime of barriers to trade and investment**

Note: Evolutions of real output (GDP, private consumption, total investment and exports) starting from the business cycle peak and conditioned on the policy regime (low/high) are drawn (see Box 2 for details). Thick lines refer to averages and thin lines represent 95% confidence interval limits.

26. Additionally, firm-level volatility may be influenced by the ownership structure as the level of risk-taking depends on it. Thesmar and Thoenig (2011) show that the financial volatility of firms depends on the level of ownership concentration which may explain why over the past decades the volatility of sales has increased for listed firms while it has decreased for private firms. On the other hand, Minetti et al. (2012) argue that ownership concentration affects the willingness to innovate and to diversify negatively, which might increase the persistence of shocks.

27. The inefficiency of state controlled companies due to a lack of commitment, limited control and non-benevolent, fragmented government and weak budget constraints has long been recognised in the regulatory and governance literature (see e.g. Martimort, 2006 or Shleifer and Vishny, 2012). At the same time, public ownership seems to be negatively correlated with corporate risk-taking (e.g. Boubakri et al., 2012). Empirical evidence for OECD countries confirms this view as both growth and volatility appear to be higher in low state control regimes (Table 6).

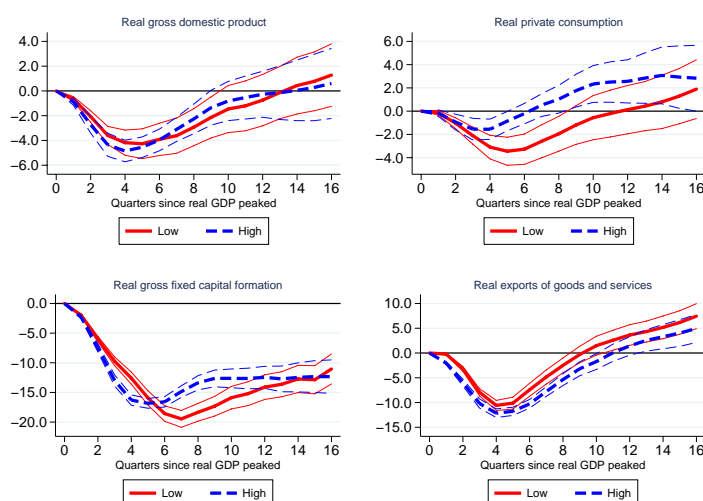
**Table 6. State control and macroeconomic stability**

	GDP		Consumption		Investment		Exports		Imports	
	Low	High	Low	High	Low	High	Low	High	Low	High
Average growth	2.27	1.97	2.17	1.92	1.40	1.54	4.30	4.61	4.36	4.19
Volatility	<b>2.34</b>	<b>1.78</b>	<b>2.16</b>	<b>1.65</b>	<b>8.26</b>	<b>5.94</b>	6.66	6.22	6.98	6.64
Downside-volatility	1.93	1.43	<b>1.77</b>	<b>1.04</b>	<b>6.37</b>	<b>3.87</b>	4.95	4.66	6.05	5.17
Amplitude	6.25	5.53	<b>6.04</b>	<b>4.44</b>	20.61	17.14	16.53	17.08	19.06	18.88
10th percentile	-0.81	-0.66	-0.75	-0.61	-4.48	-3.39	-3.17	-2.91	-3.18	-3.32
Shortfall probability	23.04	22.02	25.65	22.55	41.09	39.36	30.54	27.55	29.02	29.68
Observations	46	47	46	47	46	47	46	47	46	47

Note: See Box 1 for definitions and methodology. Numbers represent averages over 5-year windows conditional on the policy regime (low/high). Bold numbers indicate significant differences of these averages at the 5% level using t-tests.

28. The constrained risk-taking behaviour leads notably to higher resilience of domestic demand components, especially consumption (Figure 5). On the other hand, the investment recovery seems to be more sluggish, which may be the results of slow reallocation of labour and capital during the downturn.

**Figure 5. Downturns by regime of state control**



Note: Evolutions of real output (GDP, private consumption, total investment and exports) starting from the business cycle peak and conditioned on the policy regime (low/high) are drawn (see Box 2 for details). Thick lines refer to averages and thin lines represent 95% confidence interval limits.

29. Finally, the empirical work in Fiori et al. (2012) suggests that regulatory reforms in product markets have favourable impacts on employment by promoting labour market reforms. Indeed, they show that a higher level of competition can induce a shift from collective towards individual bargaining, thereby increasing flexibility. This potentially helps economies to attenuate shocks and reverse them more quickly.



## 2.2. Labour market policy

30. De Serres and Murtin (2013) provide fresh evidence for the trade-off between resilience and persistence of unemployment. They argue that the reduction of persistence of unemployment after reforms dominates the short-run labour-shedding effect which leads to a long-term decrease in unemployment volatility. While labour market institutions shape the response of unemployment to output shocks, reverse causality may also apply since inefficient labour markets affect supply and demand in the economy. Indeed, output volatility seems to be higher and more asymmetric in countries with a strict employment protection regime, which is merely driven by consumption volatility (Table 7).

**Table 7. Employment protection and macroeconomic stability**

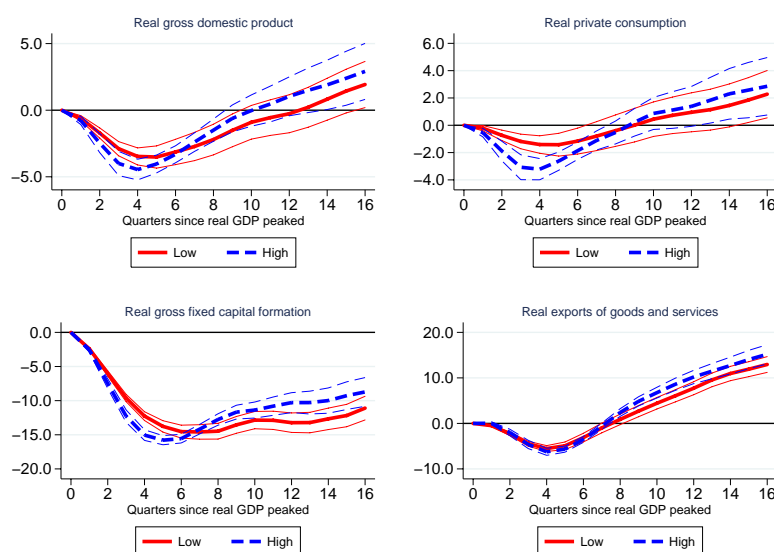
	GDP		Consumption		Investment		Exports		Imports	
	Low	High	Low	High	Low	High	Low	High	Low	High
Average growth	2.49	2.17	2.38	2.04	2.41	1.95	5.71	5.33	5.63	4.96
Volatility	1.69	1.83	<b>1.54</b>	<b>1.96</b>	5.68	5.94	5.96	5.52	5.82	6.06
Downside-volatility	1.23	1.58	<b>1.01</b>	<b>1.61</b>	3.85	4.22	4.30	4.03	4.22	4.81
Amplitude	4.82	5.18	4.11	4.73	14.97	15.90	14.76	14.13	15.24	16.08
10th percentile	-0.40	-0.56	<b>-0.34</b>	<b>-0.65</b>	-2.91	-3.18	-2.16	-2.41	-2.21	-2.57
Shortfall probability	19.33	22.69	20.67	24.46	36.05	39.77	25.52	26.31	26.22	25.85
Observations	65	65	65	65	65	65	65	65	65	65

Note: See Box 1 for definitions and methodology. Numbers represent averages over 5-year windows conditional on the policy regime (low/high). Bold numbers indicate significant differences of these averages at the 5% level using t-tests.

31. Real output seems to be less resilient but also less persistent during downturns when employment protection is high (Figure 6).<sup>7</sup> In particular, real consumption and real investment appear to suffer significantly more in the early stages of downturns consistent with the fact that labour market flexibility favours the reallocation of (human) resources towards the most viable sectors and companies, which attenuates the adverse effects of negative shocks.

7. Duval et al. (2007) found that employment protection increases persistence of a shock while it reduces its amplification. Their methodology, however, differs from the one used in this study as they considered all common innovations irrespective of their size and sign as opposed to considering common and idiosyncratic significant downturns (peak-to-trough of at least 1%) as is used here. Further, they use annual data of deviation cycles as opposed to quarterly data of classical business cycles to identify shocks.



**Figure 6. Downturns by regime of employment protection**

Note: Evolutions of real output (GDP, private consumption, total investment and exports) starting from the business cycle peak and conditioned on the policy regime (low/high) are drawn (see Box 2 for details). Thick lines refer to averages and thin lines represent 95% confidence interval limits.

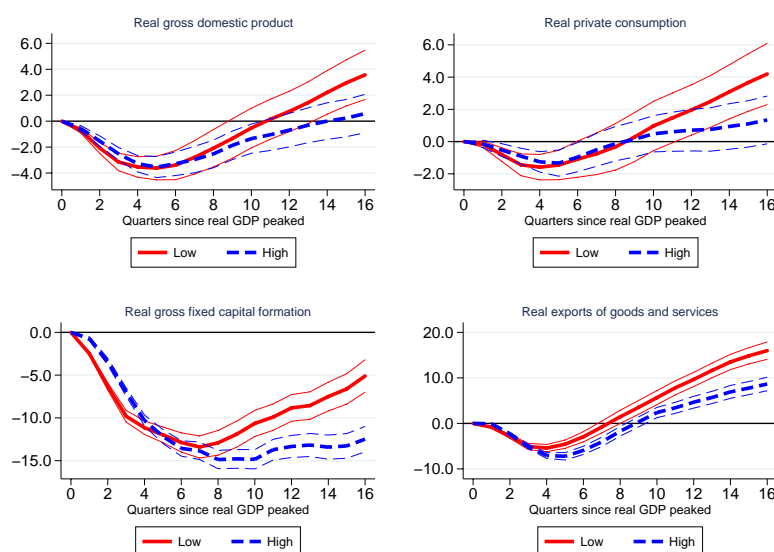
32. Other labour market institutions are expected to shape output responses to adverse shocks. Active labour market programmes (spending as a percentage of GDP), that include public employment services, training, recruitment and maintenance incentives, direct job creation and start-up incentives, seem to be related to higher shortfall probabilities of real GDP and investment (Table 8).

**Table 8. Active labour market programmes and macroeconomic stability**

	GDP		Consumption		Investment		Exports		Imports	
	Low	High	Low	High	Low	High	Low	High	Low	High
Average growth	2.48	2.12	2.32	1.92	2.44	1.67	<b>5.81</b>	<b>4.86</b>	<b>5.66</b>	<b>4.59</b>
Volatility	1.72	1.74	1.64	1.64	5.99	6.48	5.75	5.09	5.94	5.39
Downside-volatility	1.48	1.23	1.29	1.13	4.27	4.46	4.23	3.65	<b>4.84</b>	<b>3.96</b>
Amplitude	4.90	4.97	4.37	4.11	15.08	16.74	14.83	13.32	15.75	14.29
10th percentile	-0.45	-0.54	-0.44	-0.52	-3.08	-3.40	-2.14	-2.21	-2.30	-2.40
Shortfall probability	<b>18.06</b>	<b>23.55</b>	21.21	24.29	<b>36.28</b>	<b>41.39</b>	26.13	25.27	23.76	26.63
Observations	62	61	62	61	62	61	62	61	62	61

Note: See Box 1 for definitions and methodology. Numbers represent averages over 5-year windows conditional on the policy regime (low/high). Bold numbers indicate significant differences of these averages at the 5% level using t-tests.

33. Active labour market programmes do indeed appear to delay the propagation of shocks to the economy somewhat but they also prolong the downturn and increase the persistence of adverse shocks (Figure 7). These patterns apply to real output in general, but are more visible for investment. To some extent, this is counter-intuitive, since training and employment services should improve the matching efficiency on the job market.

**Figure 7. Downturns by regime of active labour market programme**

Note: Evolutions of real output (GDP, private consumption, total investment and exports) starting from the business cycle peak and conditioned on the policy regime (low/high) are drawn (see Box 2 for details). Thick lines refer to averages and thin lines represent 95% confidence interval limits.

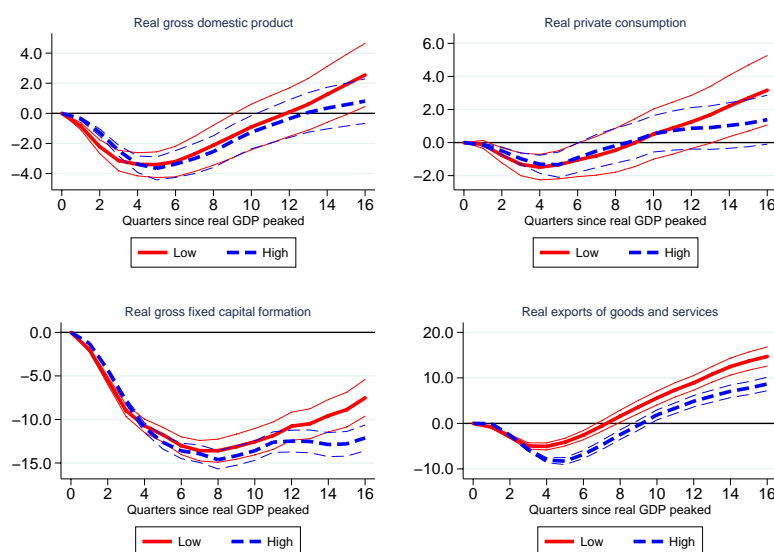
34. Passive labour market programmes comprise out-of-work income maintenance and support such as unemployment benefits, bankruptcy compensation and early retirement schemes and are generally found to be counter-productive in terms of economic performance. As far as consumption volatility is concerned, passive labour market programmes seem to dominate the impact of active labour market programmes (Table 9) as the volatility, downside-volatility and amplitude of consumption is significantly lower in the high policy regime.

**Table 9. Passive labour market programmes and macroeconomic stability**

	GDP		Consumption		Investment		Exports		Imports	
	Low	High	Low	High	Low	High	Low	High	Low	High
Average growth	2.29	2.23	2.22	1.99	1.89	2.22	5.16	5.30	4.99	5.13
Volatility	1.81	1.66	<b>1.82</b>	<b>1.52</b>	6.68	5.90	5.72	5.57	<b>6.34</b>	<b>5.29</b>
Downside-volatility	1.48	1.23	<b>1.32</b>	<b>1.04</b>	4.74	4.06	4.19	4.17	<b>5.09</b>	<b>3.94</b>
Amplitude	5.01	4.80	<b>4.65</b>	<b>3.88</b>	16.68	15.19	14.79	14.07	<b>16.45</b>	<b>14.04</b>
10th percentile	-0.54	-0.46	-0.56	-0.42	-3.53	-2.98	-2.32	-2.27	-2.76	-2.12
Shortfall probability	21.29	21.51	23.65	22.29	39.64	37.88	<b>27.45</b>	<b>24.31</b>	26.83	24.99
Observations	66	67	66	67	66	67	66	67	66	67

Note: See Box 1 for definitions and methodology. Numbers represent averages over 5-year windows conditional on the policy regime (low/high). Bold numbers indicate significant differences of these averages at the 5% level using t-tests.

35. Out-of-work income maintenance reduces the incentive to search for new job opportunities (Rogerson et al., 2005) and prolong the duration of unemployment leading to hysteresis effects (Pissarides, 1992) that may impede a vigorous recovery. Indeed, real investment declines seem to be somewhat more persistent when the level of public expenditure on passive labour market programmes is high although differences are not large.

**Figure 8. Downturns by regime of passive labour market programmes**

Note: Evolutions of real output (GDP, private consumption, total investment and exports) starting from the business cycle peak and conditioned on the policy regime (low/high) are drawn (see Box 2 for details). Thick lines refer to averages and thin lines represent 95% confidence interval limits.

36. The importance of labour unions in shaping the economy's response to macroeconomic shocks is widely recognised in the literature. Lindbeck and Snower (1986), for instance, show that labour unions seek to introduce a wedge between labour supply and demand so as to reduce the employers' ability to make adjustments when facing a shock. On the one hand, fewer adjustments on the extensive and intensive margin may reduce income and consumption volatility. On the other hand, it may impede reallocation, hamper growth and increase investment volatility. Empirical evidence partly confirms these views (Table 10). High bargaining coverage is related to lower amplitudes of real GDP around the trend.<sup>8</sup>

**Table 10. Wage bargaining coverage**

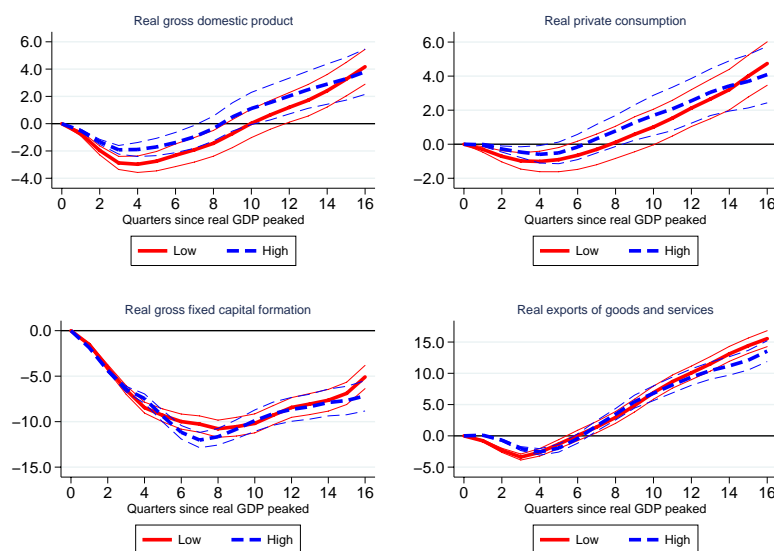
	GDP		Consumption		Investment		Exports		Imports	
	Low	High	Low	High	Low	High	Low	High	Low	High
Average growth	<b>3.13</b>	<b>2.49</b>	<b>2.93</b>	<b>2.33</b>	3.11	2.10	<b>5.96</b>	<b>5.06</b>	5.65	4.76
Volatility	2.05	1.84	1.89	1.77	6.24	6.02	5.97	5.49	6.21	5.82
Downside-volatility	1.49	1.25	1.28	1.27	4.05	4.23	4.17	3.68	4.29	4.12
Amplitude	<b>5.46</b>	<b>4.74</b>	5.00	4.49	15.70	15.07	<b>14.56</b>	<b>12.71</b>	16.37	14.91
10th percentile	-0.43	-0.55	-0.43	-0.50	-3.15	-2.85	-2.16	-2.30	-2.61	-2.47
Shortfall probability	17.99	21.24	19.79	21.66	36.21	37.79	24.46	25.19	26.96	27.68
Observations	118	114	118	114	118	114	118	114	118	114

Note: See Box 1 for definitions and methodology. Numbers represent averages over 5-year windows conditional on the policy regime (low/high). Bold numbers indicate significant differences of these averages at the 5% level using t-tests.

8. Note, however, that the approach does not allow to study potential U-shaped relationships between the policy indicator (here, wage bargaining coverage) and macroeconomic stability indicators.

37. Similarly, the evolution during business cycle downturns confirms the theoretical arguments as real GDP declines are significantly larger when wage bargaining coverage is low though the difference is small and quickly absorbed as the economy recovers (Figure 9).

**Figure 9. Downturns by regime of wage bargaining coverage**



Note: Evolutions of real output (GDP, private consumption, total investment and exports) starting from the business cycle peak and conditioned on the policy regime (low/high) are drawn (see Box 2 for details). Thick lines refer to averages and thin lines represent 95% confidence interval limits.

### 2.3. Tax and benefit system

38. The importance of automatic stabilisers in terms of resilience and persistence with respect to macroeconomic shocks has been widely assessed in the literature. Fatas and Mihov (2001) or Klomp and De Haan (2009), for instance, document that the size of government is negatively correlated with real GDP volatility because of the income smoothing effect of taxes, in particular direct taxes, and transfers.

39. Van der Noord et al. (2006) show that social spending is positively correlated with persistence of output gaps and further highlight the negative link between the standard deviation of real GDP and the persistence of output gaps. The level of social expenditure may express the preferences of a country regarding the trade-off between resilience and persistence with respect to adverse shocks to the economy. This is reminiscent of the trade-off between distortionary effects of taxes and the play of automatic stabilisers. However, Buti et al. (2002) argue that this holds only true up to a critical threshold of government size beyond which both, growth and stability, are negatively affected. The same non-linear relationship of the automatic stabilisers and volatility of real GDP is documented in Cuaresma et al. (2011).

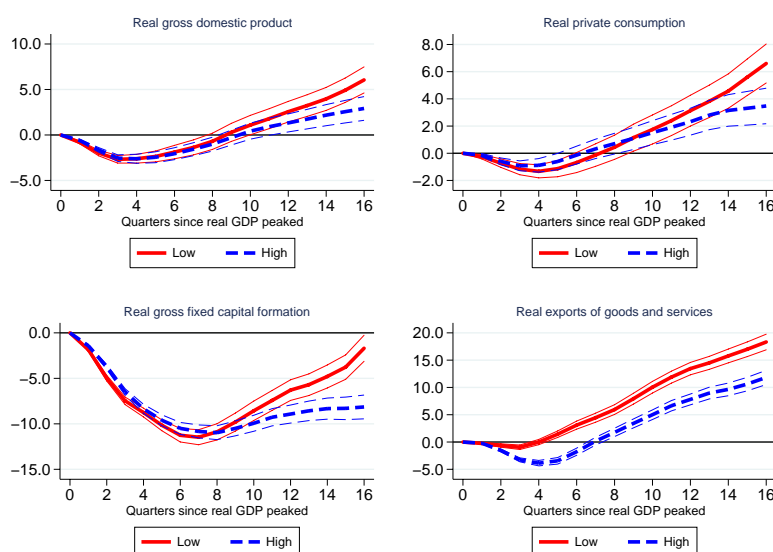
40. Using social security benefits as a proxy for the size of automatic stabilisers, empirical evidence confirms the claim that more transfers decrease the volatility of output while being a drag on long-term growth (Table 11). Similar results can be found for indirect and direct taxes on households (not reported).

**Table 11. Social security benefits and macroeconomic stability**

	GDP		Consumption		Investment		Exports		Imports	
	Low	High	Low	High	Low	High	Low	High	Low	High
Average growth	<b>3.32</b>	<b>2.52</b>	<b>3.20</b>	<b>2.38</b>	<b>3.59</b>	<b>2.21</b>	<b>6.08</b>	<b>5.29</b>	<b>5.85</b>	<b>4.81</b>
Volatility	<b>2.28</b>	<b>1.91</b>	2.01	1.83	<b>6.95</b>	<b>5.77</b>	<b>6.65</b>	<b>5.78</b>	<b>7.25</b>	<b>5.73</b>
Downside-volatility	1.58	1.41	1.45	1.27	<b>4.88</b>	<b>3.84</b>	<b>4.48</b>	<b>3.88</b>	<b>5.28</b>	<b>3.99</b>
Amplitude	<b>5.78</b>	<b>4.87</b>	<b>5.63</b>	<b>4.23</b>	<b>17.24</b>	<b>14.32</b>	<b>15.24</b>	<b>13.44</b>	<b>18.70</b>	<b>14.36</b>
10th percentile	-0.55	-0.46	-0.45	-0.51	<b>-3.36</b>	<b>-2.82</b>	-2.63	-2.41	<b>-3.05</b>	<b>-2.51</b>
Shortfall probability	18.51	20.54	<b>18.51</b>	<b>21.96</b>	<b>34.43</b>	<b>38.12</b>	26.65	25.06	28.79	27.13
Observations	127	121	127	121	127	121	127	121	127	121

Note: See Box 1 for definitions and methodology. Numbers represent averages over 5-year windows conditional on the policy regime (low/high). Bold numbers indicate significant differences of these averages at the 5% level using t-tests.

41. Business cycle downturns are slightly dampened in high social security benefit countries, especially when it comes to domestic demand components, while the recovery is much more sluggish (Figure 10). Also, exports seem to suffer from the higher weight of employers' social security contributions and the induced competitive disadvantage.

**Figure 10. Downturns by regime of social security benefits**

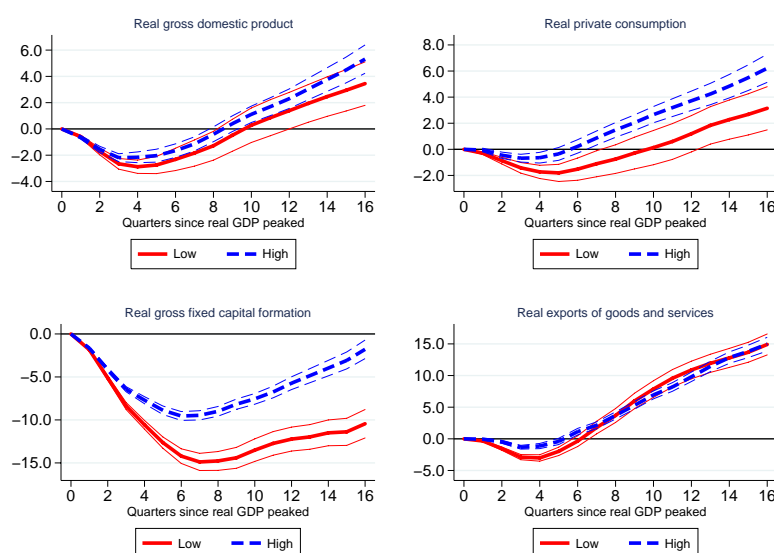
Note: Evolutions of real output (GDP, private consumption, total investment and exports) starting from the business cycle peak and conditioned on the policy regime (low/high) are drawn (see Box 2 for details). Thick lines refer to averages and thin lines represent 95% confidence interval limits.

42. In contrast, financing public expenditure more through direct taxes on business seems to be neutral in terms of output volatility (Table 12) and even stabilising in terms of resilience and persistence during downturns (Figure 11), probably reflecting the higher elasticity of income taxes with respect to output gaps (Girouard and André, 2005) inducing a more counter-cyclical fiscal policy response.

**Table 12. Taxes on business and macroeconomic stability**

	GDP		Consumption		Investment		Exports		Imports	
	Low	High	Low	High	Low	High	Low	High	Low	High
Average growth	2.83	2.87	2.67	2.84	2.44	2.87	5.79	5.33	5.26	5.21
Volatility	1.92	1.90	1.89	1.75	5.93	6.34	5.82	6.35	6.27	6.47
Downside-volatility	1.42	1.24	1.38	1.17	4.20	4.27	3.98	4.24	4.66	4.52
Amplitude	5.26	4.96	5.15	4.38	15.72	15.19	14.15	14.27	16.75	15.90
10th percentile	-0.45	-0.45	-0.49	-0.37	-2.88	-3.02	-2.23	-2.67	-2.57	-2.86
Shortfall probability	18.91	20.46	20.67	20.17	36.19	37.44	<b>24.02</b>	<b>28.51</b>	27.60	29.25
Observations	127	121	127	121	127	121	127	121	127	121

Note: See Box 1 for definitions and methodology. Numbers represent averages over 5-year windows conditional on the policy regime (low/high). Bold numbers indicate significant differences of these averages at the 5% level using t-tests.

**Figure 11. Downturns by regime of taxes on business**

Note: Evolutions of real output (GDP, private consumption, total investment and exports) starting from the business cycle peak and conditioned on the policy regime (low/high) are drawn (see Box 2 for details). Thick lines refer to averages and thin lines represent 95% confidence interval limits.

### 3. Measuring the impact of structural policies on macroeconomic stability

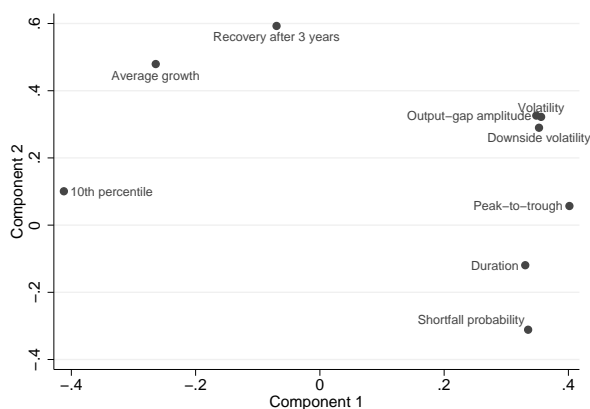
43. The previous section introduced two different concepts of assessing macroeconomic stability. The first draws on time-series characteristics (average growth, volatility, downside-volatility, output-gap amplitudes, significant shortfalls and shortfall probability of real GDP). The second approach of the previous section showed, graphically, the average behaviour of real output and other variables during business cycle downturns and recoveries. In order to take this aspect into account numerically, peak-to-troughs of output during downturns, durations of these downturns and the strengths of recoveries (growth during the three years following the trough) are calculated. For the purpose of illustration, the set of stability indicators for the last decade (2003-12), which corresponds roughly to a full business cycle for most countries, is reported in Annex Table A.1.

### Box 3. Defining instability and persistence

This box outlines the methodology used to define instability and persistence indicators. Similar to the empirical exercises presented in Section 2, stability indicators are computed over 5-year windows. In addition to the six time-series indicators (see Box 1), three business cycle indicators are computed, namely peak-to-trough and duration (in quarters) of significant downturns, 3-year recoveries of real GDP (in %) after troughs (see Box 2) and averaged over the same 5-year windows. If no downturn has occurred, peak-to-trough and duration are set to 0 and 3-year recovery equal to 3 times the annual average growth over the 5-year period.

Based on these nine stability indicators, a principal component analysis is performed. The first two principal components account for more than 86%. Therefore, only these two components are retained. Figure 12 shows the respective loadings.

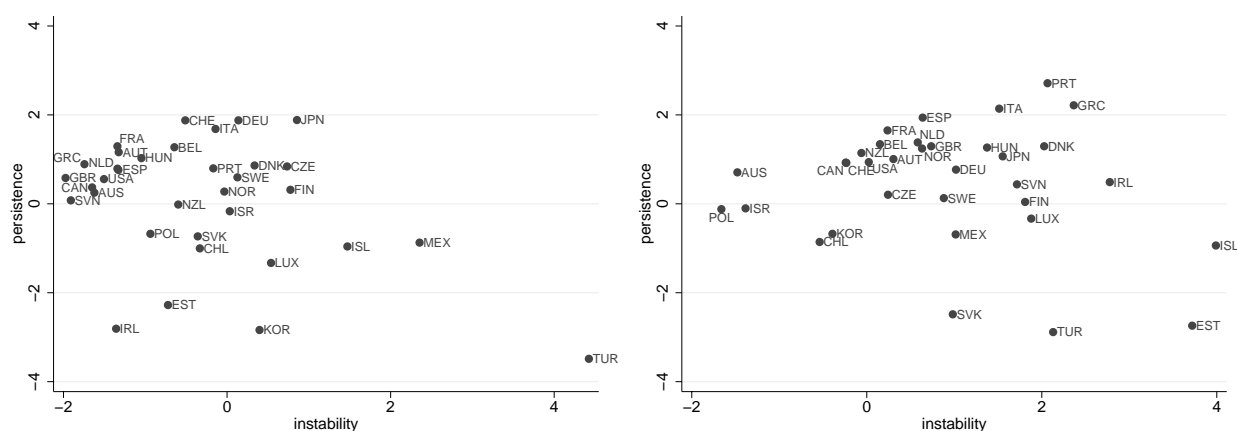
**Figure 12. Principal component loadings**



Note: Principal component analysis based on correlation matrix. The first 2 principal components account for more than 86% of the variation.

The first principal component defines the measure of instability consistent with the high weights for volatility, output-gap amplitudes and severity of the downturn (peak-to-trough and duration). The inverse of the second principal component defines the persistence measure in line with the high weights for shortfall probability and duration of the downturn as well as low 3-year recoveries. Note that average growth is negatively correlated with both, instability and persistence.

44. Based on these nine stability indicators, a principal component analysis is performed and measures for instability and persistence are derived as weighted averages (see Box 3). Figure 13 illustrates where OECD countries are located in the instability-persistence space for the period 1993-2012. The sample is split into two sub-periods in order to highlight the impact of the recent crisis. Several comments are in order: First, instability has generally been higher over the last decade. Second, while some countries' characteristics in terms of macroeconomic stability did not evolve, other countries experienced a clear shift towards more instability and also more persistence, most notably Ireland, Greece and Spain. Low income countries seem to be exposed to greater instability but also to less persistence. Indeed, emerging countries typically exhibit higher volatility, but also stronger recoveries driven by stronger median term growth in line with the convergence process (Didier et al., 2012).

**Figure 13. Instability and persistence of OECD countries**

Note: Scores on the first two principal components are represented. Instability is the 1<sup>st</sup> principal component while persistence refers to the inverse of the 2<sup>nd</sup> principal component. Based on 5-year windows from 1993 through 2002 (left panel) and from 2003 through 2012 (right panel).

45. In order to explore the impact of structural policy indicators on instability and persistence across countries and time, panel regressions are run. Box 4 outlines the methodology and regression results. Employment protection increases instability and persistence, and this, independently of the great recession. Product market regulation generally increases persistence although the inclusion of the great recession only confirms this result for the state control indicator. The finding that instability is reduced by tighter product market regulation is exclusively driven by the great recession, probably affected by other characteristics such as financial deregulation and housing market deregulation that are correlated with barriers to trade, investment and entrepreneurship.

46. Labour market programmes, active and passive, generally increase persistence and instability, although the latter does not hold if one includes the great recession, suggesting that some of the measures stabilised economies that faced substantial increases in unemployment. Results on wage bargaining are mixed but a wide coverage of collective agreements seems to increase persistence. Tax systems that rely primarily on direct taxes on households and social security contributions are related to higher persistence while direct taxes on business seem to reduce persistence.



#### Box 4. Measuring the impact of structural policies on instability and persistence

Synthetic indicators for instability and persistence are computed for 5-year windows according to the methodology detailed in Box 3. These measures are regressed on policy indicators with time and country-fixed effects included and GDP per capita, financial openness and trade openness are added as control variables. Policy indicators reflect hp-filtered values at the beginning of the respective 5-year window. The measure of financial openness is taken from Chinn and Ito (2008) while trade openness is the sum of nominal exports and imports divided by twice the GDP.

Two-step GMM estimation is used in order to address the issue of potential joint endogeneity of the explanatory variables and robust standard errors are computed. The following table presents results. For the sake of readability, the coefficients for control variables and fixed effects are not reported but may be obtained from the author upon request.

**Table 13. Policies' impact on instability and persistence**

	Through 2012		Through 2007	
	Instability	Persistence	Instability	Persistence
State control	-1.086*** (0.247)	0.296** (0.126)	0.0670 (0.119)	0.459*** (0.0697)
Barriers to entrepreneurship	-1.901*** (0.168)	-0.290 (0.221)	1.095*** (0.257)	0.719*** (0.164)
Barriers to trade and investment	-2.305*** (0.471)	-0.212 (0.262)	-0.336 (0.280)	0.865*** (0.192)
EPL (regular)	0.280* (0.151)	0.260*** (0.0882)	0.136 (0.0911)	0.242*** (0.0702)
EPL (temporary)	0.225** (0.0999)	0.242*** (0.0583)	0.189*** (0.0652)	0.224*** (0.0507)
LMP - Active measures	0.0232 (0.325)	0.575*** (0.158)	0.520*** (0.159)	0.837*** (0.111)
LMP - Passive measures	-0.164 (0.153)	0.331*** (0.0872)	0.145* (0.0756)	0.361*** (0.0619)
Bargaining coverage	-0.00845* (0.00466)	0.0135*** (0.00243)	-0.00150 (0.00374)	0.0142*** (0.00263)
Centralisation of wage bargaining	0.193 (0.611)	-0.317 (0.289)	0.910** (0.460)	-0.0211 (0.301)
Coordination of wage bargaining	0.125 (0.0994)	0.115** (0.0534)	0.288*** (0.0718)	0.0766 (0.0535)
Taxes on production and imports (% GDP)	-0.0332 (0.0382)	0.0322 (0.0223)	0.0176 (0.0277)	0.0245 (0.0241)
Direct taxes on business (% GDP)	-0.155 (0.104)	-0.292*** (0.0457)	-0.0359 (0.0855)	-0.324*** (0.0507)
Direct taxes on households (% GDP)	0.0303 (0.0220)	0.0365*** (0.0117)	0.0646*** (0.0165)	0.0448*** (0.0122)
Social security contributions (% GDP)	-0.0260 (0.0185)	0.0618*** (0.00982)	-0.0267* (0.0141)	0.0661*** (0.0105)
Social security benefits (% GDP)	-0.00494 (0.0270)	0.137*** (0.0138)	0.00428 (0.0213)	0.145*** (0.0145)

Note: All results refer to regressions that control for per capita GDP, financial openness and trade openness as well as time- and country fixed effects. For the sake of readability, the corresponding coefficients are not reported but may be obtained from the author upon request. Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

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## ANNEXES

Table A1. Macroeconomic stability by country

Country	Date of trough	Great recession							Time-series statistics (2003-12)					
		Peak-to-trough	Duration of downturn	Time-to-recovery	Relative recovery	Recovery after 1 year	Recovery after 2 years	Recovery after 3 years	Average growth	10 <sup>th</sup> percentile	Downside volatility	Volatility	Shortfall probability	Amplitude (Output gap)
AUS	-								3.0	0.1	0.7	1.0	5.1	3.0
AUT	2009q2	5.1	4	7	0.4	2.0	5.4	6.3	1.6	-0.7	1.4	1.5	17.9	6.5
BEL	2009q2	4.3	4	7	0.6	2.8	4.9	4.7	1.3	-0.5	1.4	1.4	15.4	5.1
CAN	2009q2	4.0	3	5	0.7	3.4	5.8	8.2	1.8	-0.2	1.5	1.4	12.8	5.1
CHE	2009q1	3.3	3	6	0.4	2.2	5.2	6.2	2.0	-0.1	1.4	1.3	12.8	4.9
CHL	2009q1	3.0	2	3	0.8	4.0	11.7	16.5	4.6	-0.1	1.9	2.4	10.3	7.5
CZE	2009q2	6.0	3		0.3	2.8	5.1	4.1	2.7	-0.6	2.0	2.2	23.1	7.5
DEU	2009q2	6.9	4	7	0.6	4.5	7.9	8.8	1.3	-0.4	2.3	2.0	23.1	7.9
DNK	2009q3	7.9	6		0.4	2.9	3.4	3.6	0.6	-1.8	1.6	2.6	35.9	7.7
ESP	2009q4	6.3	7		0.1	0.3	0.4	-1.3	1.1	-0.8	1.0	1.4	35.9	5.0
EST	2009q3	21.6	8		0.6	6.0	13.7	15.9	3.0	-2.6	5.8	5.0	20.5	20.9
FIN	2009q2	10.6	5		0.5	3.4	6.6	7.2	1.7	-1.0	3.6	3.2	28.2	11.3
FRA	2009q2	4.4	5		0.5	1.7	3.6	3.7	1.0	-0.5	1.2	1.1	17.9	4.8
GBR	2009q2	6.6	6		0.4	2.2	3.1	2.4	1.1	-0.9	1.5	1.6	25.6	6.5
GRC	2009q2	4.4	4		-0.6	-2.8	-9.9	-17.0	-0.8	-2.2	2.7	3.5	51.3	8.2
HUN	2009q3	8.8	5		0.3	2.0	3.5	1.8	0.9	-1.0	2.0	2.2	30.8	7.8
IRL	2009q4	9.8	8		0.3	0.5	2.5	2.5	1.6	-1.6	1.9	3.8	46.2	10.5
ISL	2010q2	14.3	11			2.1	4.7	6.7	2.2	-4.5	5.0	6.9	35.9	13.8
ISR	-								4.2	0.1	0.9	1.2	7.7	5.6
ITA	2009q2	7.4	6		0.4	2.0	3.0	0.5	-0.1	-0.8	1.8	1.7	38.5	6.4
JPN	2009q2	8.6	5		0.7	5.3	4.1	6.7	0.7	-1.3	2.5	2.5	35.9	9.4
KOR	2009q1	5.0	3	2	1.4	8.1	12.1	15.0	3.6	0.2	2.3	2.4	2.6	7.4
LUX	2009q1	8.1	3		0.3	2.8	5.9	6.1	2.5	-1.1	3.0	3.3	25.6	9.7
MEX	2009q2	8.6	4	6	0.8	6.8	10.7	14.7	2.5	-0.2	3.7	2.9	15.4	10.4
NLD	2009q2	4.7	5		0.5	1.8	3.5	2.9	1.2	-0.6	1.4	1.5	23.1	6.2
NOR	2009q3	2.9	7	9	0.6	0.7	2.8	5.7	1.7	-1.1	1.4	2.2	30.8	5.9
NZL	2008q4	2.6	4	12	0.5	1.4	1.0	2.8	1.6	-0.4	1.1	1.5	25.6	3.9
POL	-								4.2	0.4	0.6	1.2	2.6	5.1
PRT	2009q2	4.0	5		0.5	1.9	0.6	-2.5	-0.3	-1.2	1.2	1.7	56.4	4.7
SVK	2009q2	8.1	3	8	0.6	5.5	8.7	11.5	4.3	0.3	4.8	4.0	5.1	12.5
SVN	2009q2	10.1	4		0.1	1.3	2.7	0.4	1.5	-1.1	2.9	2.9	25.6	10.3
SWE	2009q2	7.4	6	5	1.2	5.9	10.7	11.7	2.1	-1.1	2.5	2.3	17.9	9.8
TUR	2009q1	11.5	3	6	0.7	9.6	19.6	22.7	4.7	-1.4	4.0	4.6	15.4	17.1
USA	2009q2	4.8	5	9	0.7	2.6	4.3	6.6	1.7	-0.4	1.6	1.4	12.8	5.6

Source: OECD (2013), *OECD Economic Outlook*, Vol. 2012/2, OECD Publishing.

**A2. Mean policy indicators by country in the 2000s**

	PMR_pmr	PMR_stc	PMR_bte	PMR_bti	EPL	EPL_r	EPL_t	LMP_100	LMP_110	LMP_120	cov	cent	wcoord	tind_gdp	tyb_gdp	tyh_gdp	ssrg_gdp	sspg_gdp
AUS	1.2	1.9	1.3	0.5	1.2	1.5	0.9	1.0	0.3	0.6	46.1	0.4	1.8	12.2	5.0	12.1	0.0	8.1
AUT	1.7	2.6	1.6	0.8	2.0	2.6	1.5	1.9	0.6	1.3	98.9	0.9	4.0	14.5	2.5	11.0	16.3	18.8
BEL	1.6	2.7	1.8	0.2	2.2	1.7	2.6	3.4	1.1	2.2	96.0	0.5	4.2	12.7	3.3	13.3	16.1	15.8
CAN	1.1	1.6	1.2	0.5	0.8	1.3	0.3	1.1	0.4	0.7	31.9		1.0	11.8	3.9	11.9	4.7	10.1
CHE	1.6	2.4	1.8	0.5	1.1	1.2	1.1	1.4	0.6	0.8	47.9	0.3	3.0	6.9	3.5	11.0	6.9	10.9
CHL	1.6	2.7	1.7	0.4	2.7	2.7	2.6	0.3	0.2	0.1	23.6			4.1	1.6	1.8		4.7
CZE	1.9	2.8	1.9	1.1	2.0	3.3	0.7	0.5	0.2	0.3	44.0	0.3	2.0	10.7	4.1	4.4	15.4	12.6
DEU	1.5	2.2	1.7	0.6	2.2	2.8	1.5	2.9	1.0	1.9	64.7	0.5	4.0	10.8	2.5	9.0	17.7	18.0
DNK	1.1	1.5	1.4	0.5	1.5	1.6	1.4	3.8	1.7	2.1	82.0	0.5	3.3	17.3	3.4	26.5	2.1	16.1
ESP	1.5	2.5	1.6	0.4	3.0	2.5	3.5	2.4	0.8	1.6	88.2	0.4	3.7	11.2	3.5	7.3	13.0	12.1
EST	1.2	2.0	1.4	0.3	2.1			0.4	0.1	0.3	25.2		1.0	12.8	1.3	6.3	11.0	9.6
FIN	1.3	2.1	1.5	0.3	2.0	2.2	1.9	2.8	0.9	1.9	90.4	0.4	3.6	13.5	4.0	14.0	12.2	16.3
FRA	1.7	2.9	1.8	0.4	3.0	2.5	3.6	2.5	1.0	1.5	90.0	0.2	2.0	15.1	2.6	8.8	18.2	17.8
GBR	0.8	1.4	1.0	0.1	0.7	1.1	0.4	0.6	0.3	0.2	34.8	0.1	1.0	12.6	3.4	12.7	8.0	13.0
GRC	2.5	4.0	2.3	1.1	3.0	2.3	3.7			0.4	65.0	0.3	4.0	12.5	3.3	5.1	13.1	17.0
HUN	1.7	2.6	1.8	0.6	1.5	1.9	1.0	0.8	0.4	0.4	37.8	0.2	2.0	15.8	2.1	7.7	13.1	14.4
IRL	1.2	2.1	1.3	0.2	1.0	1.6	0.5	1.7	0.7	1.0	50.5	0.5	4.8	12.6	3.6	8.5	6.1	9.3
ISL	1.3	1.2	2.1	0.5	1.2	1.7	0.6				87.9			17.1	2.5	14.9	3.0	6.3
ISR	2.6	3.4	2.5	1.7	1.4	1.9	0.9	0.9	0.2	0.7	56.1		2.0	16.2	5.1	8.6	6.9	6.6
ITA	1.7	3.0	1.6	0.6	2.0	1.8	2.2	1.3	0.5	0.7	80.0	0.4	4.0	14.2	2.9	11.3	12.8	17.0
JPN	1.4	2.3	1.6	0.5	1.4	1.9	1.0	0.6	0.2	0.4	17.3	0.3	3.0	8.4	3.2	5.3	10.7	11.4
KOR	1.8	2.2	1.7	1.5	2.0	2.4	1.7	0.4	0.2	0.2	10.3		3.0	12.0	3.6	4.0	5.3	2.4
LUX	1.4	2.4	1.6	0.3	3.3	2.8	3.8	1.0	0.4	0.6	58.3	0.3	2.2	12.8	7.4	6.4	11.5	14.3
MEX	1.9	2.2	2.3	1.3	3.1	2.3	4.0	0.0	0.0	0.0	8.5			9.9			1.7	1.6
NLD	1.2	1.9	1.5	0.2	2.1	3.0	1.2	3.1	1.3	1.8	84.9	0.6	4.0	12.2	3.5	7.9	14.8	11.0
NOR	1.4	2.2	1.3	0.6	2.6	2.3	3.0	1.2	0.7	0.4	72.9	0.5	4.0	12.6	10.1	10.7	9.3	13.5
NZL	1.2	1.6	1.6	0.5	1.4	1.7	1.2	1.1	0.4	0.7	18.7	0.3	1.5	12.7	5.4	15.3	1.2	10.4
POL	2.7	3.6	2.9	1.6	1.7	2.1	1.3	1.2	0.4	0.8	38.9	0.2	1.0	13.3	2.4	4.9	12.4	15.7
PRT	1.6	2.9	1.5	0.3	3.5	4.2	2.8	1.7	0.6	1.1	61.8	0.3	2.6	13.8	3.3	5.6	11.5	13.8
SVK	1.7	1.8	1.7	1.5	1.5	2.4	0.7	0.8	0.3	0.5	44.6	0.5	2.5	11.5	3.0	3.5	13.2	12.6
SVN	1.4	2.7	1.1	0.4	2.5	3.2	1.9	0.6	0.3	0.4	97.7	0.4	4.0	15.2	2.0	6.3	14.5	15.6
SWE	1.4	2.6	1.2	0.4	2.2	2.9	1.6	2.4	1.3	1.1	93.3	0.5	3.0	16.7	3.0	17.8	10.8	15.7
TUR	2.5	4.1	2.7	0.5	3.7	2.6	4.9				25.0							
USA	1.0	1.2	1.6	0.3	0.2	0.2	0.3	0.6	0.2	0.4	14.0	0.2	1.0	7.3	2.5	10.1	7.0	12.1
OECD	1.6	2.4	1.7	0.6	2.0	2.1	1.8	1.5	0.6	0.9	58.1	0.4	2.8	12.8	3.5	9.6	9.8	12.4

Note: All indicators reflect average values from 2000 through 2009. For abbreviations and variable description see Table A3.

## A3. Description of policy indicators

Variable	Description	Source
PMR_pmr	Overall PMR index	OECD (PMR index)
PMR_bte	Barriers to entrepreneurship	OECD (PMR index)
PMR_bti	Barriers to trade and investment	OECD (PMR index)
PMR_stc	State control	OECD (PMR index)
EPL	Employment protection index (overall)	OECD (Employment Outlook)
EPL_r	Employment protection index (regular contracts)	OECD (Employment Outlook)
EPL_t	Employment protection index (temporary contracts)	OECD (Employment Outlook)
LMP_100	Total labour market programmes (% of GDP)	OECD (Employment Outlook)
LMP_110	Active labour market programmes (% of GDP)	OECD (Employment Outlook)
LMP_120	Passive labour market programmes (% of GDP)	OECD (Employment Outlook)
cov	Share of employees covered by wage bargaining agreements	ICTWSS database
cent	Level of centralisation of wage bargaining	ICTWSS database
wcoord	Level of coordination of wage bargaining	ICTWSS database
sspg_gdp	Social security benefits (% GDP)	OECD (Economic Outlook)
ssrg_gdp	Social security contributions (% GDP)	OECD (Economic Outlook)
tyb_gdp	Direct taxes on business (% GDP)	OECD (Economic Outlook)
tyh_gdp	Direct taxes on households (% GDP)	OECD (Economic Outlook)
tind_gdp	Taxes on production and imports (% GDP)	OECD (Economic Outlook)

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