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MORE JOBS BUT LESS PRODUCTIVE?
THE IMPACT OF LABOUR MARKET POLICIES ON PRODUCTIVITY

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TABLE OF CONTENTS

MORE JOBS BUT LESS PRODUCTIVE? THE IMPACT OF LABOUR MARKET POLICIES ON PRODUCTIVITY

Introduction

1. Achieving higher GDP per capita is one of the primary economic policy objectives of OECD countries. Higher GDP per capita brings in its train better living standards through higher consumption levels and also creates more room for investing in other factors that improve the quality of life, such as health, education and the environment.

2. Growth in GDP per capita can be decomposed into the growth of two components: labour utilisation and labour productivity. The OECD Growth Study found that labour productivity growth is particularly important in promoting GDP per capita growth. During the 1990s, labour productivity growth accounted for at least half of GDP per capita growth in most OECD countries, and a considerably higher proportion in many of them (OECD, 2003a). As the populations of OECD countries age and the proportion of the population of working age falls, continued growth in productivity, along with increased labour force participation among currently underrepresented groups, will be crucial to improve living standards.

3. Both labour utilisation and labour productivity depend to some extent on labour market policies. The effect of such policies on labour utilisation is well established. Thus, the Restated OECD Jobs Strategy (OECD, 2006a, 2006b) identifies policy packages that reduce unemployment and increase employment, potentially raising GDP per capita. It has been argued, however, that certain labour market reforms that increase labour utilisation may at the same time reduce productivity and therefore have ambiguous overall effects on living standards. For instance, Heckman, Ljunge and Ragan (2006) argue that some of the employment-enhancing policy packages that were praised in the Restated OECD Jobs Strategy are productivity-depressing, and that only rigorously market-oriented economies have managed to sustain employment <u>and</u> productivity growth simultaneously.

4. In order to improve our understanding of this issue, this chapter examines the impact of various labour market policies on the level and growth rate of labour productivity and multi-factor productivity. Key channels through which labour market policies affect productivity are identified and assessed empirically.

5. Section 1 examines the productivity performance of OECD countries over the past decade and briefly discusses the main determinants of productivity growth. Section 2 looks at the possible linkages between labour market policies and productivity and estimates the direct impact of selected policies on productivity. The chapter concludes with a discussion of the overall productivity impact of the recommendations put forward in the Restated Jobs Strategy and provides some suggestions for further research.

Main findings

- *Higher employment tends to be associated with lower levels of measured aggregate labour productivity.* This is because, other things equal, policy reforms which increase employment promote job opportunities for low-skilled workers, generate diminishing returns to labour input and expand labour-intensive activities, thereby exerting downward pressure on average labour productivity. However, this does not mean that policies that raise employment are necessarily associated with lower average productivity. Indeed, pro-employment policies may exert a direct effect on productivity – which may either offset the negative productivity effect due to employment growth or aggravate it, depending on the policy. As a consequence, *when evaluating the impact of labour market reforms on GDP per capita, it is crucial to examine both the employment and labour productivity effects of reforms.*

- It has been claimed by some that only countries which emphasise market-oriented policies (limited welfare, light regulation) may enjoy both successful employment performance and strong labour productivity growth simultaneously, unambiguously improving GDP per capita. This claim is not supported by the evidence in this chapter, however. Indeed it finds that *other successful employment performers* (which combine strong work incentives with generous welfare protection and well-designed regulation) *had, on average over the past decade, similar GDP per capita growth to that recorded in more market-reliant countries*. However, within-group differences in GDP per capita trends are larger than between-group differences.

- Over and above effects due to their influence on employment, *labour market reforms can have a sizeable impact on productivity levels and growth rates through multiple channels, including* by creating incentives for employers or workers to invest in *training* (a 10% increase in the stock of human capital accumulated through job-related training is found to be associated with an increase of 1.5 percentage points in the level of productivity); by facilitating *reallocation of resources* into activities where productivity is above-average or grows more rapidly; *and* by generating or maintaining high-quality *job matches*. More specifically, the chapter examines the productivity impact of four types of policy, for which data needed to perform empirical analysis exist.

- *Stringent employment protection for regular contracts has a small negative impact on productivity growth*, most likely by restricting the movement of labour into emerging, high-productivity activities, firms or industries. The estimated impact is small but statistically significant. Conservative estimates suggest that if OECD countries liberalised provisions for regular contracts to reflect those of the United States, average annual labour productivity growth would increase by about 0.04 percentage points.

- *Increases in the ratio of minimum to median wages appear to have a positive impact on productivity*. In the long-run, increasing this ratio by ten percentage points could increase the level of labour productivity by almost two percentage points. The favourable effect of the minimum wage on productivity may be due to improved incentives for investment in training or come as a result of substitution of high-skilled labour for low-skilled-labour. The relative importance of the two interpretations could not be assessed in the chapter.

- *Reforms that reduce the generosity of unemployment benefits are likely to reduce the level of productivity*. There are three reasons for this. First, reducing the generosity of unemployment benefits can adversely affect productivity by reducing the time and/or resources available to the unemployed to find a well-matched job vacancy. Second, by discouraging workers from searching for high-risk, high-productivity jobs, lower benefits may dissuade firms from creating such jobs. Third, lower benefits improve work incentives among job seekers, who are disproportionately low-skilled. If these jobseekers move to employment, the skill composition of the workforce will be altered and average measured productivity reduced. *However, the overall impact* of lowering unemployment benefits *on GDP per capita* (incorporating both the positive employment effect and the negative productivity effect) *appears to be negligible*.

- *Family-friendly policies appear to increase productivity by allowing workers with family responsibilities to maintain their links to the workforce* and capitalise on prior investments in firm- or industry-specific human capital. The magnitude of this effect is, however, small and somewhat sensitive to the sample. While the results reported in this chapter focus on parental leave, it is likely that other policies that encourage sustained workforce participation by parents will have a similar impact on productivity.

1. Economic growth in OECD countries

1.1. Decomposing GDP per capita growth

OECD countries grew at different rates over the past decade

6. OECD countries grew at very different rates over the past decade.[1] Figure 2.1 shows that trend annual growth rates ranged from above 5% a year for Ireland to below 1% a year for Switzerland, with a cross-country average of 2.4% a year (see OECD, 2007, for a more detailed overview of broad trends in growth performance).

Labour productivity performance over the past decade has been mixed

7. GDP per capita growth can be decomposed in the growth of labour productivity and the growth of labour utilisation. Figure 2.1 shows that growth of labour productivity (GDP per hour worked) was particularly important in driving economic growth over the past decade. It is therefore not surprising that the wide cross-country variation in GDP per capita growth is mirrored by a similar variation in labour productivity growth. In fact, trend growth of labour productivity ranged from over 4% per year in Ireland, Korea, Poland and the Slovak Republic to less than 1% per year in Mexico, the Netherlands and Spain.[2]

8. Decomposition of labour productivity growth by industry highlights the disparate patterns of growth across OECD countries. In the United States, productivity growth during the 1990s was concentrated in high- and medium-high-technology manufacturing industries and in low-skilled service industries such as retail, hotels and restaurants. In contrast, productivity growth in Europe and Japan was concentrated in medium- and low-technology manufacturing industries and high-skilled service industries such as communication and financial services (Nicoletti and Scarpetta, 2003). Productivity growth within existing firms and industries contributes more to overall growth than inter-industry or inter-firm movement of resources. Entry of new, highly productive firms was an important driver of growth in European countries in the 1990s, but exit of older, less productive firms played a larger role in the United States (OECD, 2003a).

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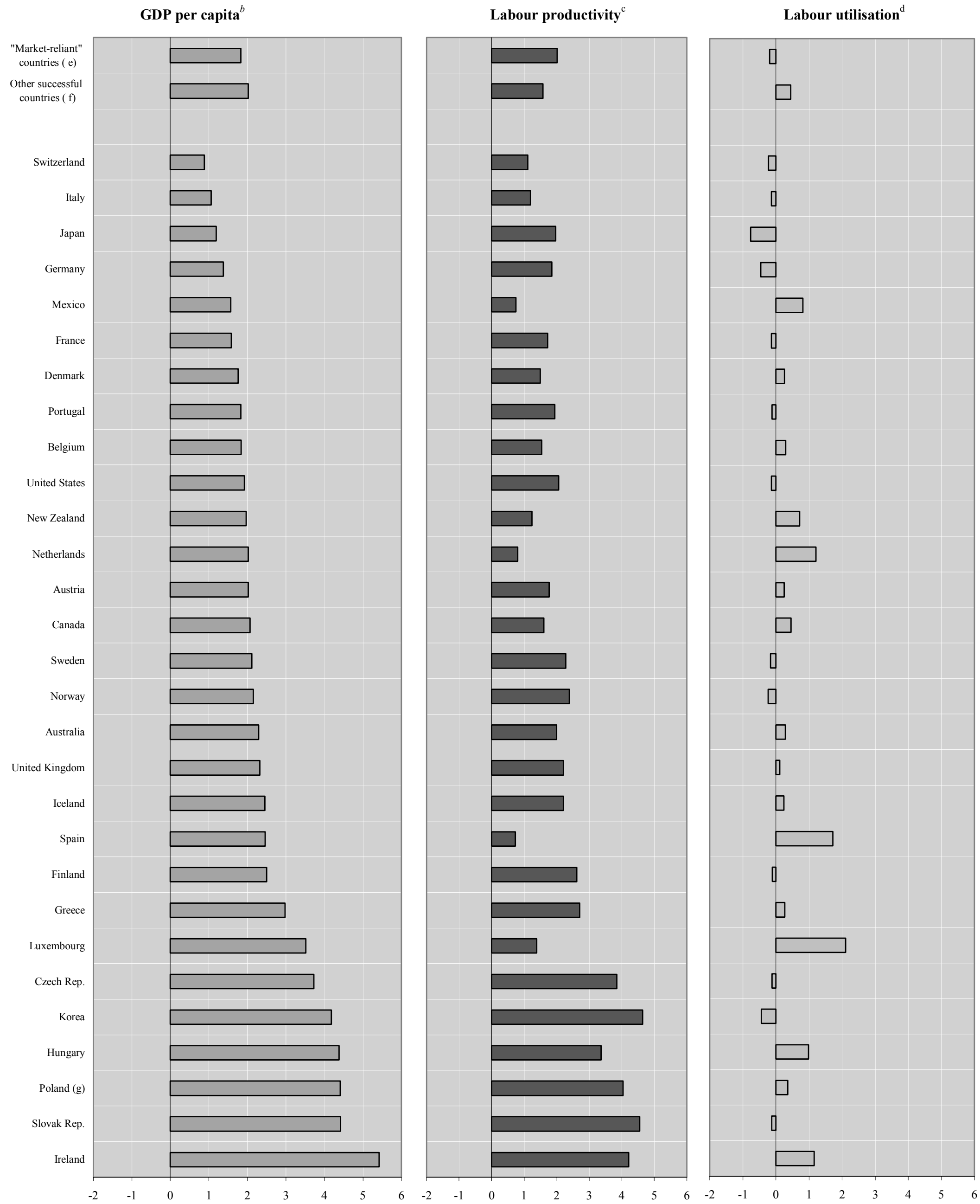
1. The period 1995-2005 is the longest for which data for certain components of GDP per capita are available for almost all OECD countries.

2. Low labour productivity growth in the Netherlands and Spain could reflect progress in these countries in increasing labour utilisation, whereby less productive workers have entered the workforce, reducing the average level of measured labour productivity (see below).

Figure 2.1. **Cross-country differences in economic growth were large in the past decade**

Average annual trend growth rate of GDP per capita and its components in percentage, 1995 to 2005[a]



a) Countries ordered from top to bottom by increasing average annual growth rate of GDP per capita.
b) GDP divided by total population.
c) GDP per hour worked.
d) Total hours worked divided by total population.
e) GDP-weighted average for Australia, Canada, Japan, New Zealand, Switzerland, the United Kingdom and the United States.
f) GDP-weighted average for Austria, Denmark, the Netherlands, Norway and Sweden.
g) 2000-2005.
While Korea was included in the “market-reliant countries” grouping in OECD (2006a, 2006b) and Ireland in the “other successful countries” group, they were excluded here because GDP per capita growth in these countries were extreme values and possibly the result of very specific national experiences that are unlikely to be exportable to other OECD countries.

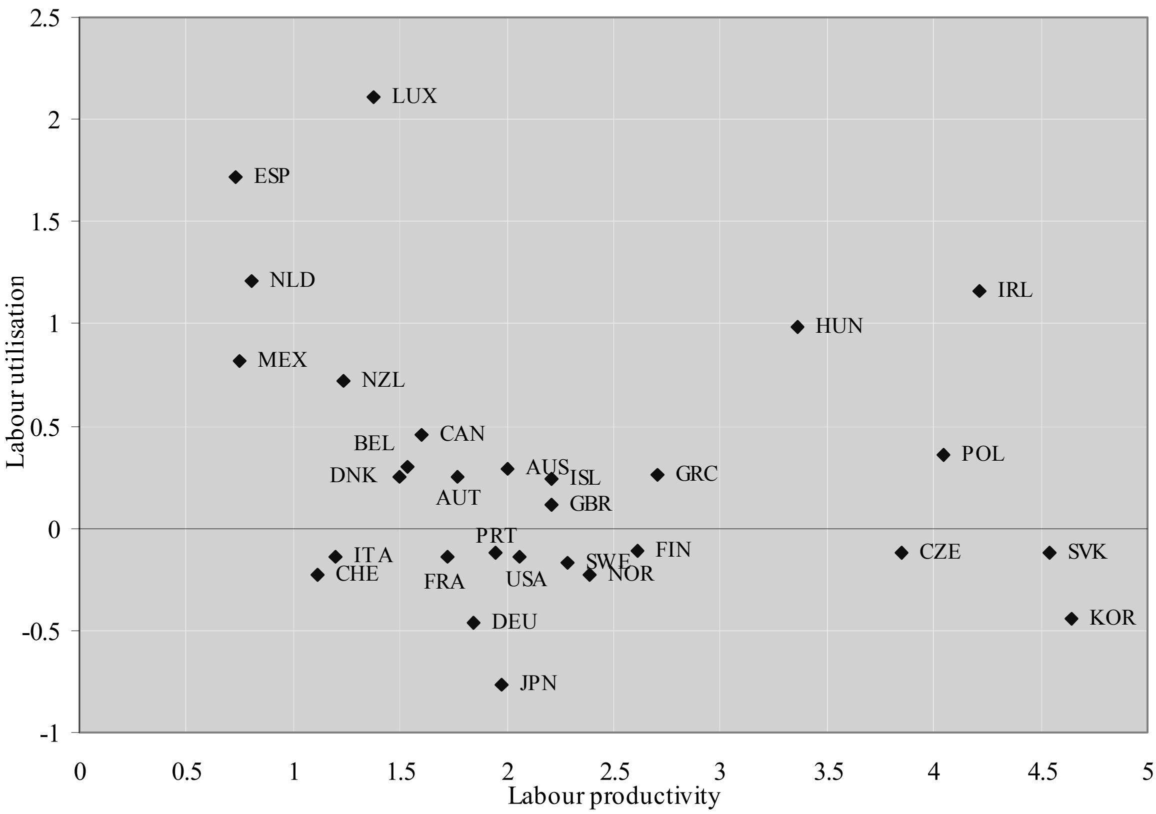
Source: OECD (2007).

Employment and labour productivity growth are negatively correlated…

9. Perhaps of greater consequence when examining the impact of labour market policies, Figure 2.2 shows that there is a negative correlation between the growth rates of labour utilisation and measured labour productivity. Over the period 1995-2005, the cross-country correlation coefficient between growth of hours per capita and labour productivity growth, excluding countries with average annual trend GDP per capita growth of more than 3% (whose experience is perhaps unlikely to be exportable to any other OECD country), was -0.61 (statistically significant at the 1% level).[3]

Figure 2.2. **Labour utilisation[a] and labour productivity[b] are negatively correlated**

Average annual trend growth rates in percentage, 1995-2005[c]



a) Total hours worked divided by total population.
b) GDP per hour worked.
c) Data for Poland are for 2000-2005.

Source: OECD calculations using data from Figure 2.1.

10. The negative relationship between employment growth and measured average labour productivity growth has been highlighted in previous studies (see *e.g*. OECD, 2007) and has a number of explanations. First, it arises, in part, because measured average labour productivity does not adequately control for

3. The correlation coefficient for the whole sample included in Figure 2.2 is only -0.28. Using actual rather than trend data, however, this correlation is much stronger (with a coefficient of -0.55). Furthermore, using a smaller sample of 18 countries, for which trend data are available over the period 1970-2005, the correlation coefficient was -0.56, significant at the 5% level.

changes in the quality of labour.[4] Aggregate employment growth is usually associated with faster employment growth for the low-educated than for the highly-educated, so compresses the average level of skills and productivity among the employed (see *e.g.* Nickell and Bell, 1996). Thus an increase in employment with no change in the average productivity per unit of skilled labour and/or individual productivity for those already in employment would lead to a reduction in measured average labour productivity. Second, if employment increases as a result of greater labour supply, labour-intensive (low-productivity) activities, are likely to expand. While the productivity of individual firms or industries could remain unchanged, an expansion of low-productivity production will depress aggregate productivity levels (McGuckin and van Ark, 2004; Dew-Becker and Gordon, 2006). Finally, other things equal, diminishing returns to labour inputs imply that the marginal impact of higher employment rates (or longer hours of work per employee) on output will be smaller (see *e.g.* Bourles and Cette, 2005).

11. In other words, if no other link existed between structural reforms and productivity, a policy reform that increased employment would have a less-than-proportionate impact on GDP per capita because of its dampening effect on conventionally measured aggregate labour productivity. A number of authors have argued that this dampening effect can be large. For instance, Dew-Becker and Gordon (2006) estimate that, other things equal, an increase in total hours per capita by 1% will reduce labour productivity by 0.7% and result in an overall increase in GDP per capita of only 0.3%. Similar results are found by Bourles and Cette (2005) and McGuckin and van Ark (2004), although the latter argue that employment growth has a productivity-depressing effect only in the short-run. The impact of labour market policies on productivity resulting solely from their effect on employment is referred to in the remainder of this chapter as a "composition effect".

…therefore evaluating the success of structural reforms by measuring labour productivity can be misleading

12. Although more research is needed on this issue, the negative correlation between employment and measured labour productivity suggests that evaluating the success of employment-enhancing structural reforms by measuring labour productivity can be misleading. Policy reforms that boost employment but do not have an independent impact on technological change or efficiency could have a negative impact on average measured labour productivity simply by increasing the proportion of low-skilled workers employed (thereby reducing the average quality of the labour input), creating opportunities for labour-intensive activities and generating decreasing returns to labour input (for a given capital stock).

13. A comparison of the growth and productivity performance of so-called "market-reliant countries" and "other countries with successful employment performance" (the two country groups with successful labour market packages as identified in the Restated OECD Jobs Strategies, see OECD 2006a, OECD 2006b) shows how misleading an assessment based only on productivity might be. Trend annual labour productivity growth was 0.4 percentage points faster in market-reliant countries than in other successful performers over the past decade (Figure 2.1). But, labour utilisation growth was 0.6 percentage points lower in market-reliant countries. As a result, average GDP per capita growth in market-reliant countries was 0.2 percentage points slower than in the other successful countries.[5] This comparison must, however,

4. Schwerdt and Turunen (2005) estimate that around one third of traditionally-measured euro-area labour productivity growth over the period 1984-2004 was due to improvements in labour quality.

5. Although Korea and Ireland were classified in the former and latter group, respectively, in OECD (2006a, 2006b) they were excluded from the groups in Figure 2.1 because GDP per capita growth rates in these countries between 1995 and 2005 were extreme values among the sample of countries considered, possibly dependent on very specific national experiences that are unlikely to be exportable elsewhere. If Korea and Ireland are included in their respective groups, the market-reliant countries had trend average annual labour productivity growth 0.3 percentage points higher, labour utilisation growth 0.7 percentage points lower and GDP per capita growth 0.4 percentage points lower than the other successful countries.

be made with great caution: Figure 2.1 also shows that there is much more variation in GDP per capita growth within groups than between groups, thereby making it difficult to draw general inferences about policy packages.

1.2. Sources of labour productivity growth in OECD countries

14. Over and above composition effects due to changes in labour utilisation, cross-country differences in labour productivity growth are the result of a range of factors, including among others labour market policies and institutions. A full analysis of these factors goes beyond the scope of this chapter. However, a brief summary of the main sources of labour productivity growth, other than labour market policies, is presented below, drawing heavily on the results from previous OECD research on economic growth (OECD, 2003a, 2007). The potential influence of labour market policies on these factors, and subsequently on productivity growth, is examined in more detail in Section 2.

Capital deepening

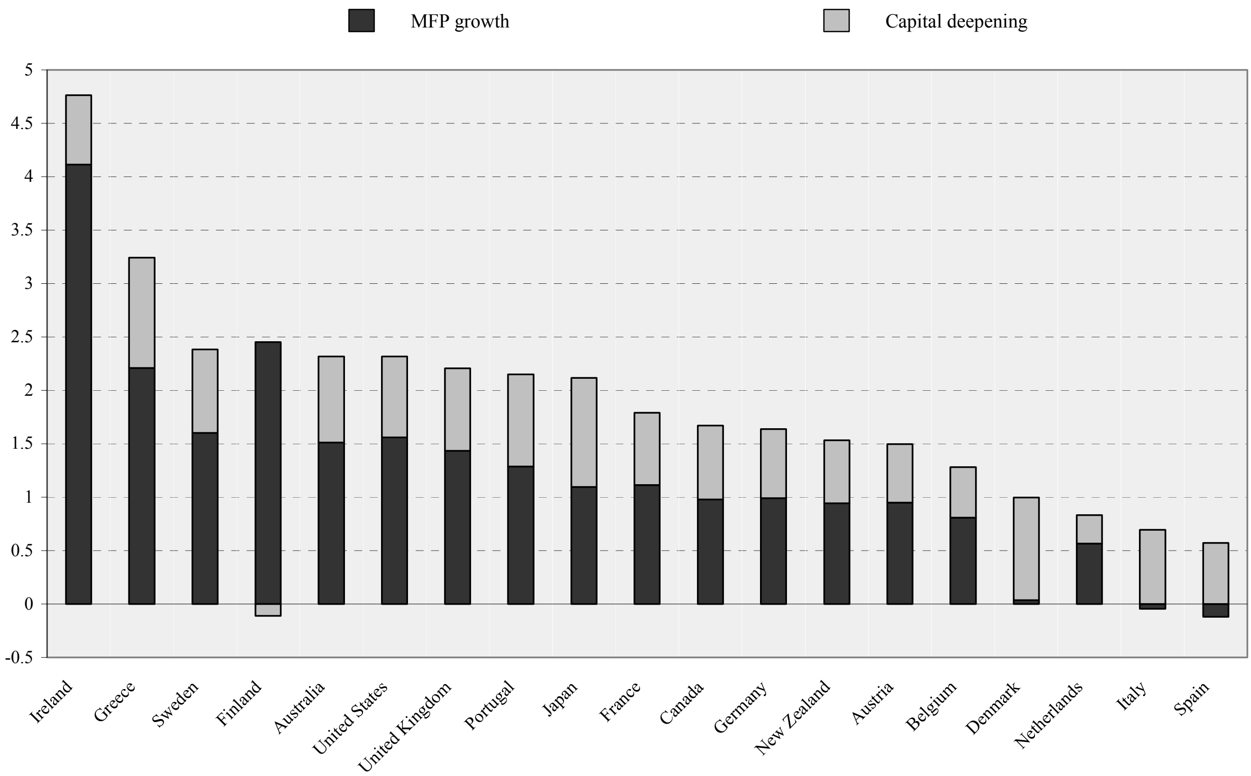
15. Historically, capital deepening (or growth of the capital-to-labour ratio) is the major determinant of labour productivity growth. Reliable estimates attribute about half of aggregate output growth in the last forty years of the twentieth century to physical capital accumulation (de la Fuente and Ciccone, 2002). Figure 2.3 shows that, with the exception of Finland, most OECD countries experienced capital deepening since 1995. Capital deepening accounted for, on average, 45% of labour productivity growth in the past decade, with the remainder explained by multi-factor productivity (MFP) growth.[6] Yet, cross-country differences in labour productivity growth were essentially due to cross-country differences in MFP growth.[7] MFP growth was particularly high in Finland, Greece and Ireland, close to zero in Denmark and negative in Italy and Spain.

6. MFP measures the components of output and labour productivity that are not accounted for by factor inputs.

7. The cross-country coefficient of variation of MFP growth over the period was 0.78, against 0.40 for capital deepening and 0.52 for labour productivity.

Figure 2.3. **Cross-country differences in labour productivity growth are mainly due to MFP growth patterns**

Decomposition of average annual growth rate of GDP per hours worked into average annual growth rate of MFP and annual average growth rate of capital input, 1995 to 2005[a]



a) Calculated using 1995-2004 data for Australia, Japan and Spain, 1995-2003 for Austria, Belgium, Denmark, Finland, Greece, Ireland, Italy, the Netherlands, Portugal, Sweden and the United Kingdom.
b) Countries ordered from left to right by decreasing average annual growth rate of labour productivity.

Source: OECD Productivity Database.

Human capital

16. There is broad consensus that human capital is a key determinant of GDP per capita growth. Recent macroeconomic estimates suggest that one additional year of schooling may raise GDP per capita in OECD countries by over 5% (Bassanini and Scarpetta, 2002a; OECD, 2003a; de la Fuente and Domenech, 2006), which is broadly consistent with estimates from microeconomic studies (Temple, 2001; Krueger and Lindahl, 2001). Less than half of this effect can be attributed to the fact that better skills support labour market participation and employment, thereby enhancing the growth potential (OECD, 2004). Better skills also help to speed up the pace of technological change, thus contributing directly to economic growth.[8] Some researchers estimate that one additional year of education can increase the annual growth rate of MFP by as much as 0.9 percentage points through this channel (de la Fuente and Ciccone, 2002).

8. Up-to-date international measures of productivity do not control for labour "quality". Indeed, existing human-capital-adjusted measures of aggregate MFP growth that can be compared across countries are available only until the late 1990s (Bassanini and Scarpetta, 2002b). For this reason, they are not used here.

Box 2.1. **Estimates of the impact of workplace training on productivity**

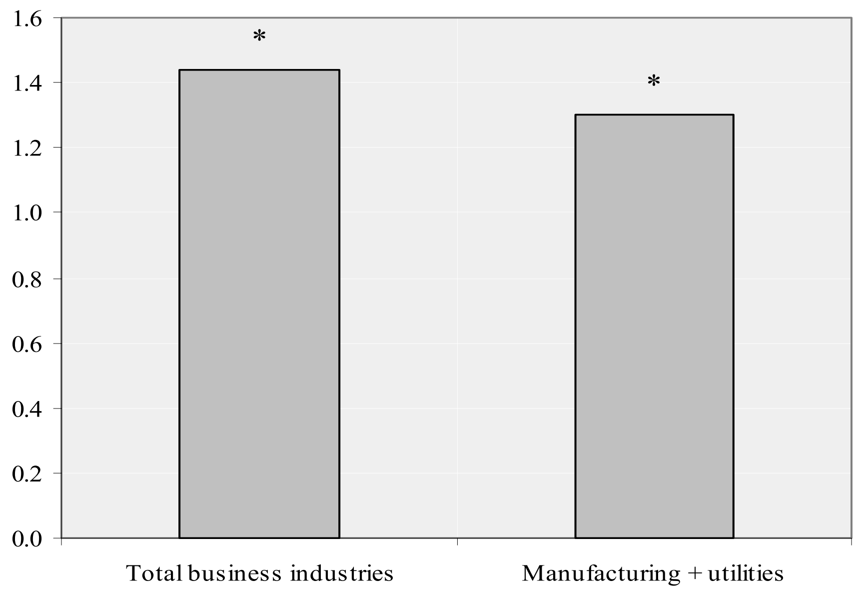
There are two main types of quantitative studies of the effect of training on productivity: survey-based studies; and case studies - sometimes company-sponsored. Survey-based studies have the advantage that the findings can be generalised to other firms if the survey is sufficiently representative. However, they typically lack information on the cost of training, so it is generally not possible to estimate rates of return to training using survey data. Case studies have the advantage that they more often have information on costs, but their results are difficult to generalise and often suffer from selectivity bias (see Bartel, 2000).

Most survey-based studies of the link between training and productivity estimate production functions at the industry or firm-level using data from a single country. They typically find elasticities of MFP with respect to training between 0.05 and 0.15. The comparison of results across different studies is, however, hampered by differences in training definitions and methodologies. For example, Dearden, Reed and van Reenen (2006) find an elasticity of 0.14 for the United Kingdom at the sample average. Ballot, Fakhfakh and Taymaz (2006) find elasticities of 0.18 for France and 0.07 for Sweden. Conti (2005) finds an elasticity between 0.03 and 0.09 for Italy, depending on the estimation method, while Brunello (2004) find an elasticity of 0.13 for the same country. Barrett and O'Connell (2001) find an elasticity of 0.04 for Ireland. Kurosawa *et al.* (2007) find an elasticity between 0.06 and 0.34, depending on the estimation method, for off-the-job training in Japan but no effect for on-the-job training. By contrast, a few studies for the United States, such as Black and Lynch (2001), find no significant effect of training on productivity. Yet, one should be cautious before drawing conclusions from US studies because they typically lack the time dimension for the training variables.

Consistent with this literature, the figure below presents estimates obtained for the purpose of this chapter from pooled, cross-country comparable data from selected European countries suggesting that increasing the stock of human capital accumulated through workplace training by 10% would yield 1.4% higher MFP in the long-run (see Annexes 2.A1 and 2.A2 for a full description of data and methods).

Workplace training has a positive impact on productivity

Percentage impact on MFP level of a 10% increase in the stock of human capital accumulated through workplace training



* significant at 10%.
Derived from GMM estimates. See Annex 2.A2 for more details.
Source: OECD estimates (see Table 2.A3.1 for full results)

17. Macroeconomic studies of the impact of human capital on productivity typically focus on the impact of initial education (see Sianesi and van Reenen, 2003, for a survey). However, continuous job-related training also affects the overall level of human capital in the workforce, and could therefore influence productivity. Due to measurement problems, however, there are relatively few studies on the productivity effects of training.[9] Available studies typically estimate production functions using industry- or firm-level data and find that a 10% increase in the stock of human capital due to job-related training leads to an increase in MFP of between 0.5% and 1.5% (Box 2.1). While smaller than estimates of the impact of initial education on productivity, these results indicate that job-related training, and policies that affect its provision, are likely to be an important driver of productivity.

Catching up

18. At least some of the observed cross-country variation in labour and MFP productivity growth is likely to be the result of low-productivity countries 'catching up' to countries that are closer to the technology frontier. Catching up played a major role in OECD growth patterns until the end of the 1970s, but its importance has decreased since then. Nonetheless, during the past ten years catch-up continued to be important for a number of countries, such as the Czech Republic, Korea, Hungary and the Slovak Republic, which experienced relatively fast growth of labour productivity from a low base. By contrast, Mexico began at a low level and also experienced below-average labour productivity growth (OECD, 2003a).

Innovation and adoption of new technologies

19. Innovation is a major determinant of MFP growth. For instance, a 1% increase in domestic business research and development (R&D) is estimated to increase MFP growth by 0.13 percentage points (Guellec and van Pottelsberghe de la Potterie, 2001). The elasticity of MFP growth to R&D has increased over the past few decades with the emergence of new technologies. Similarly, adoption of new technologies, particularly information and communications technologies (ICT), over the past few decades has had a major impact on productivity growth.[10]

Institutions and policies

20. Institutions and policies are likely to have an impact on labour productivity either by influencing capital deepening and human capital accumulation or by directly affecting efficiency and technological change. In particular, the impact of macroeconomic and fiscal policies and financial development on growth has been widely studied, with results generally showing that macroeconomic volatility and tax pressure reduce growth, although indirect taxes tend to have a less negative impact than direct taxes (OECD, 2003a). Anti-competitive product market regulation also appears to hinder MFP growth (see

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9. A number of studies try to proxy productivity with wages (see Leuven, 2005, for a survey). However, to the extent that labour markets are not perfectly competitive, estimates of training wage premia cannot fully capture the effect of training on productivity (see Bassanini *et al.*, 2007).

10. Oliner and Sichel (2000) estimate that two-thirds of the acceleration in labour productivity growth in the United States between the early 1990s and late 1990s can be attributed to ICT. It increased productivity growth through a number of channels. Innovation in ICT-producing industries increased MFP growth in those industries. Accompanying rapid price declines for ICT goods spurred investment in ICT goods by ICT-using industries. Capital-deepening increased labour productivity growth, but not MFP growth, in these industries. In some cases, investments in ICT goods have been accompanied by changes in work processes or organisational structures that have also led to MFP improvements in ICT-using industries (OECD, 2003a; van Ark, Inklaar and McGuckin, 2003; Jorgenson and Stiroh, 2000; Oliner and Sichel, 2000).

Nicoletti and Scarpetta, 2003, and references cited therein). By contrast, the empirical literature linking labour and social policies and growth is surprisingly small and usually focuses only on overall social expenditure, with controversial results (see Arjona, Ladaique and Pearson, 2002, and references cited therein). In an attempt to bridge this gap, the remainder of this chapter is devoted to shedding some light on this issue.

2. What role for labour market policies?

2.1. Main channels through which labour market policies may influence productivity

21. The discussion in Section 1.1 highlights the negative correlation between employment and productivity: labour market policies that increase the employment rate or hours worked will tend to depress average measured productivity due to diminishing returns to labour inputs or by increasing the proportion of low-skilled workers or labour-intensive industries (referred to above as the composition effect). In addition, labour market policies can have an independent impact on productivity through several channels. First, policies that influence incentives for workers or firms to invest in training or education can affect productivity by altering the stock of human capital. Second, policies that encourage (discourage) the movement of resources between declining and emerging firms, industries or activities can enhance (depress) productivity by helping firms respond quickly to changes in technology or product demand. Third, policies that improve the quality of job matches or maintain high-quality job matches for longer might increase the efficiency of labour resource allocation, increasing the level of productivity. Fourth, policies that make labour more (less) expensive might affect the direction, and therefore the pace, of technological change. Finally, policies that reduce (increase) social conflicts might condition workers' effort and their willingness to align their behaviours with their employer's objectives. Table 2.1 outlines the possible relationships between various labour market policies and productivity as proposed in the existing theoretical literature.[11]

11. In addition, pro-employment policy reforms may reduce social spending and make room for more spending on education, R&D or other productivity-enhancing activities.

Table 2.1. **Possible links between labour market policies and productivity, over and above composition effects**

Possible positive impact on productivity	Possible negative impact on productivity
Strict statutory or contractual employment protection	
▪ acts as a signalling device to workers about firm commitment, increasing worker effort and incentives to invest in firm-specific human capital and to cooperate with the implementation of productivity-enhancing work practices or new technologies	▪ increases the costs of firing and therefore increases the cost of adapting quickly to the emergence of new technologies (particularly in times of diffusion of new general-purpose technologies and/or low-technology industries where adoption often translates into downsizing) ▪ impedes flexibility and slows the movement of labour resources into emerging high-productivity firms, industries and activities
Training programs for the unemployed	
▪ assist the unemployed to get higher skilled (higher productivity) jobs that have longer duration than otherwise ▪ directly increase stock of human capital	▪ crowd out other training programs, reducing incentives for workers and firms to invest in skills
Subsidised employment and work experience programs	
▪ increase job duration and therefore the stock of human capital acquired on-the-job	▪ reduce the wage differential between low and high-skilled jobs, reducing incentives for workers to invest in skills
Employment placement programs and public employment services	
▪ increase the quality of matches between unemployed and job vacancies, resulting in a more efficient allocation of labour resources	
Generous unemployment benefits	
▪ increase the time spent looking for work and improve the quality of matches, increasing the efficiency of resource allocation ▪ encourage workers to look for higher productivity jobs in more volatile industries, and encourage firms to create such jobs	▪ encourage shirking by existing employees as there is a lower cost of being fired, reducing productivity ▪ increase the length of unemployment spells, leading to depreciation of human capital
Centralised wage-setting arrangements	
▪ compress wage relativities and reduce poaching, giving employers incentives to invest in training ▪ speed the process of structural adjustment by making declining industries relatively less profitable and emerging industries relatively more profitable than under decentralised wage-fixing arrangements	▪ discourage workers from investing in skills because they may be unable to capitalise on their investments through higher wages ▪ weaken the links between productivity gains and wage growth, reducing incentives for workers to implement productivity-enhancing work practices
High minimum wages	
▪ compress wage relativities and reduce poaching, giving employers incentives to invest in training ▪ substitute high for low-productivity jobs, increasing aggregate productivity levels ▪ reduce demand for low-skilled jobs, giving employees incentives to invest in skills	▪ lead to downward wage rigidity, increasing separations, and reducing incentives for firms to invest in training ▪ compress wage relativities, thereby reducing the returns to education and incentives to invest in skills ▪ increase the shadow price of labour, leading firms to over-invest in labour-saving innovation at the cost of productivity-enhancing innovation
Family-friendly policies	
▪ assist workers with family responsibilities to maintain high-quality job matches, increasing incentives to invest in training	▪ induce gender discrimination in hiring processes, leading to sub-optimal allocation of labour resources (for example, concentration of highly skilled women in low-skilled jobs)
An expansion in atypical or temporary employment	
▪ increases firms’ ability to adapt quickly to changes in technology or product demand by moving labour resources into emerging, higher productivity activities ▪ increases workers' incentives to invest in general human capital to escape job insecurity	▪ reduces the average level of training by reducing incentives for firms that hire atypical workers to invest in their training, and reducing incentives for workers to invest in firm-specific human capital

Sources: Acemoglu and Pischke (1999a, 1999b); Acemoglu and Shimer (1999, 2000); Agell (1999); Arulampalam, Booth and Bryan (2004); Bartelsman *et al.* (2004); Belot, Boone and van Ours (2002); Bertola (1994); Boone and van Ours (2004); Boone (2000); Buchele and Christiansen (1999); Cahuc and Michel (1996); Calmfors, Forslund and Hemstrom (2001); Dowrick (1993); Draca and Green (2004); Hopenhayn and Rogerson (1993); Marimon and Zilibotti (1999); Moene and Wallerstein (1997); Saint-Paul (1997, 2002); Shapiro and Stiglitz (1984); Soskice (1997).

22. From a policy perspective, it is important to be able to estimate both the independent impact of labour market policies on productivity and, whenever productivity effects due to changes in employment (composition effects) are likely to be large, the overall impact on GDP per capita. In this section, the productivity effects of four specific labour market policies (employment protection legislation, minimum wages, unemployment benefits and family-friendly policies) will be analysed in detail, their selection being dictated by data availability and feasibility of the implementation of the empirical methodology, outlined in Box 2.2.

Box 2.2. **Model specification**

Estimating the impact of policies on GDP per capita

The overall impact of labour market policies on GDP per capita can be estimated by fitting structural convergence equations of GDP per capita, as done in OECD (2003a), based on augmented-Solow or Lucas models. Assume that the aggregate technology can be described by the production function:

$$y_{it} = A_{it} k_{it}^{\alpha} h_{it}^{\beta}$$

where i and t index country and time, respectively, y, k and h are output, physical capital, human capital per capita (or unit of labour), respectively, α and β are the partial elasticities of output with respect to physical and human capital, respectively, and A is the level of technological and economic efficiency, which in turn is the product of two components: economic efficiency dependent on institutions and economic policy and the level of technological progress that grows at an exogenous rate. As economies are not in the steady-state, structural estimation of this model implies modelling appropriately adjustment to the steady-state. It can be shown that, independently of whether the underlying model implies diminishing or constant returns to variable factors (α + β less than or equal to 1), this leads to an error-correction model of the following type (Bassanini and Scarpetta, 2002a, Arnold, Bassanini and Scarpetta, 2004):

$$\Delta \ln y_{it} = -\phi_i \left(\ln y_{it-1} - \theta_1 \ln s_{it}^K - \theta_2 \ln h_{it} + \theta_3 n_{it} - \sum_{j=1}^{m} \gamma_j \ln V_{it}^j - \chi_{it} \right)$$
$$+ b_{1i} \Delta \ln s_{it}^K + b_{2i} \Delta \ln h_{it} + b_{3i} \Delta n_{it} + \sum_{j=1}^{m} c_{ji} \Delta \ln V_{it}^j + \varepsilon_{it}$$

where s^K is the investment rate, *n* is the growth rate of the working-age population, *V*s denote policies affecting efficiency, χ_{it} are country-by-period (say: 5-year) dummies, ϕ_i are country-specific convergence parameters and γ_j and θ_j capture the long-run effects of policies and other factors on GDP per capita. This model can be consistently estimated by maximum likelihood through PMG estimators, provided that the time dimension is sufficiently greater than the number of countries (Pesaran, Shin and Smith, 1999). As a result, long time series are necessary to estimate this type of model. Unfortunately, long time series were not available for most of the policy variables examined in this chapter. As a result, it was only possible to use this estimation technique to examine the impact of unemployment benefits on GDP per capita.

Estimating the impact of policies on productivity

Alternatively, one can try to estimate directly the impact of policies on labour productivity. However, labour market policies may exert conflicting effects on labour productivity. For instance, they may raise employment and thereby reduce labour productivity through composition effects discussed in Section 1.1. But they may also stimulate economic efficiency and thus exert upward pressure on labour productivity (so-called “independent” effects). Identifying independent effects is crucial for policy purposes.

As shown in Annex 2.A4, however, within-industry composition effects, if any, appear to be negligible. Therefore, one way to isolate the "independent" effects of policies on productivity is to look at the within-industry variation of productivity while, at the same time, controlling for aggregate effects through time-by-country dummies. Therefore, analyses of within-industry productivity developments can meaningfully shed light on the independent impact of selected labour market policies on productivity. However, the presence of country-by-time dummies makes the identification of the productivity effect of labour market policy variables more complex, insofar as they are typically defined only at the aggregate level.

For the purposes of this chapter, the effects of EPL, minimum wages and parental leave on productivity have been estimated at an industry-level using a reduced-form difference-in-difference model.[1] This approach is based on the assumption that the effect of particular policies on productivity is greater in industries where the policy is more likely to be binding – hereafter called "policy-binding industries". For example, EPL is likely to be binding in industries where layoff rates are high. If firms need to lay off workers to restructure their operations in response to changes in technologies or product demand, high firing costs are likely to slow the pace of reallocation of resources. By contrast, in industries where firms can restructure through internal adjustments or by relying on natural attrition of staff, changes in EPL can be expected to have little impact on labour reallocation, and subsequently productivity.

Other factors and policies that influence productivity are assumed to have the same effect in policy-binding industries as in other industries, thereby being controlled for by country-by-time dummies. Assuming that a particular policy only affects the growth of productivity, the impact of the policy on MFP growth in policy-binding industries can be estimated using the following specification:

$$\log y_{ijt} = \delta \log k_{ijt} + \gamma I_{bj} \sum_{\tau=0}^{t} POL_{i\tau} + \mu_{ij} + \chi_{it} + \varsigma_{jt} + \varepsilon_{ijt}$$

where i indicates countries, j indicates industries, t indicates years, y is labour productivity (Y/L), k is the capital-to-labour ratio (K/L), I is an indicator equal to one for policy-binding industries and zero otherwise, POL is a country-level measure of the policy in question, and Greek letters represent coefficients or disturbances (see Annex 2.A2 for a more detailed derivation of the specification). The same classification of policy-binding industries is used for all countries to prevent problems of endogeneity between the policy variable and the policy-binding indicator (further details on the indicators used for each of the difference-in-difference experiments and the sensitivity of the baseline results to their use are in Annex 2.A2). The impact of the policy on labour productivity can be estimated using the same specification but omitting the capital-to-labour ratio. If the policy is assumed to affect only the level of productivity, the empirical specification is:

$$\log y_{ijt} = \delta \log k_{ijt} + \beta I_{bj} POL_{it} + \mu_{ij} + \chi_{it} + \varsigma_{jt} + \varepsilon_{ijt}$$

As a sensitivity test, the baseline specification can be augmented to include controls for other factors and policies that might affect productivity, including possible interactions between *POL* and other relevant policy variables. Since a number of policies are likely to influence both the level of productivity (efficiency) and its growth rate, one would ideally like to estimate a productivity growth model where both level and growth effects are accommodated. However, there are technical problems associated with estimating a structural or dynamic model incorporating these effects jointly.[2] For this reason, in the difference-in-difference specifications used in this chapter, labour market policies are assumed to permanently affect either the level of productivity or its growth rate, but not both. However, in some cases both level and growth effects were included in the same equation for model selection purposes only, where the theoretical literature was unable to provide clear guidance on this issue.

The aggregate impact of the policy on productivity growth is calculated by multiplying the estimated effect in policy-binding industries by the share of these industries in total GDP. This assumes that there is zero impact of the policy in other industries (and in all industries that are not included in the sample used in the analysis). As such, the estimates represent a lower bound of the aggregate impact of the policy on productivity.

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1. Estimating a structural model of productivity at the industry (or firm) level implies including a distant-to-frontier term – that is the gap from the industry productivity leader (Griffith, Redding and van Reenen, 2004). In turn, this would imply computing MFP levels in a cross-country comparable fashion. Although this was done in previous OECD work (Scarpetta and Tressel, 2002, Nicoletti and Scarpetta, 2003), cross-country comparable time series of MFP are available only until the mid-1990s, and their update proved to be unfeasible given the time and available resources.

2. Incorporating both growth and level effects would require estimating a dynamic model, in which minor specification errors would lead to serious inconsistency problems. It is therefore not recommendable in reduced-form models.

23. A number of labour market policies that could be expected to have an impact on productivity were not assessed in this chapter, primarily due to data limitations. As outlined in Table 2.1, policies and institutions such as active labour market programmes (ALMPs) and wage-bargaining arrangements could have both negative and positive impacts on productivity and GDP per capita, with the overall effect unclear. Unfortunately, data series for both policies are either too short or not sufficiently detailed to enable accurate estimation of their impact on GDP per capita, as described in Box 2.2. Neither are there clear reasons to believe that such policies would have a greater impact on productivity in some industries than others, making it difficult to justify using a difference-in-difference specification of the type described in Box 2.2. It is possible that the operation of these policies could also influence the degree to which the policies examined in the following sections affect productivity. Where data availability allows, interactions between policies have been examined to paint a fuller picture of the complex relationship between policies and productivity. However, the simplified models with interaction terms considered here pose the risk of misspecification due to omitted interactions, so the results of the interaction experiments should be interpreted with caution (see Bassanini and Duval, 2006).

2.2. Employment protection legislation

Employment protection legislation could affect production efficiency and productivity growth through multiple channels…

24. Stringent layoff regulations increase the cost of firing workers making firms reluctant to hire new workers, particularly if they expect to make significant employment changes in the future. As such, EPL could impede flexibility, making it more difficult for firms to react quickly to changes in technology or product demand that require reallocation of staff or downsizing, and slowing the flow of labour resources into emerging high-productivity firms, industries or activities (Hopenhayn and Rogerson, 1993; Saint-Paul, 1997, 2002). In addition, stringent EPL might discourage firms from experimenting with new technologies, characterised by potentially higher returns but also greater risk (Bartelsman *et al.*, 2004). Layoff protection might also reduce worker effort (thus productivity) because there is less threat of layoff in the event of poor work performance (Ichino and Riphahn, 2001).

25. Alternatively, layoff regulations could provide additional job security for workers, increasing job tenure and work commitment and making firms and workers more likely to invest in firm- or job-specific human capital (Soskice, 1997; Belot, Boone and van Ours, 2002).[12] Stringent layoff regulations might also spur productivity-enhancing investments by incumbent firms in order to avoid downsizing (Koeniger, 2005).

…but available literature is inconclusive about the direction of the overall effect

26. The existing cross-country evidence on the relationship between EPL and productivity growth is inconclusive. DeFreitas and Marshall (1998) find that strict EPL has a negative impact on labour productivity growth in the manufacturing industries of a sample of Latin American and Asian countries. Nickell and Layard (1999) and Koeniger (2005) find a weak positive relationship between EPL strictness and both MFP and labour productivity growth for samples of OECD countries.[13] Autor, Kerr and Kugler

12. Yet, stringent EPL might induce substitution of specific for general skills. As the former are of little or no use if workers need to change industry or occupation in the aftermath of major shocks, this might also produce a negative effect on productivity, particularly in times of diffusion of radically new technological paradigms (Wasmer, 2006).

13. In Nickell and Layard (1999), the relationship between labour productivity and EPL strictness is not statistically significant once the productivity gap to the United States is included in regressions, but the relationship between MFP growth and EPL strictness continues to hold.

(2007) study the impact of exceptions to the employment-at-will doctrine in the United States on several performance variables by using cross-state differences in the date of their adoption and find that some of them have a positive effect on capital deepening, a negative effect on MFP and no effect on labour productivity. Using a difference-in-difference estimator on industry-level data for several OECD and non-OECD countries, Micco and Pages (2006) find a negative relationship between layoff costs and the level of labour productivity. Yet, this effect appears to depend entirely on the presence of Nigeria in the sample. By contrast, Ichino and Riphahn (2001) and Riphahn (2004) find that EPL in Germany significantly increases absenteeism, probably reducing productivity.

27. There is some support for the argument that strict EPL slows the speed at which displaced workers find new jobs in expanding industries. Burgess, Knetter and Michelacci (2000) find that countries with stricter EPL have slower rates of adjustment of productivity to long-run levels, although they point out that the direction of causality could run from productivity growth to EPL strictness.[14] More recent evidence suggests that strict layoff regulations reduce job turnover and, particularly, job destruction (Boeri and Jimeno, 2005; Micco and Pages, 2006; Haltiwanger, Scarpetta and Schweiger, 2006). Messina and Vallanti (2007) find that the negative impact of EPL on job turnover, job creation and job destruction is greater in industries where total employment is contracting and where firms cannot achieve substantial reductions in employment levels by purely relying on voluntary quits. However, the impact of EPL on firm growth appears to be, at best, small (Boeri and Jimeno, 2005; Schivardi and Torrini, 2003).

Firing restrictions are estimated to have a small negative impact on productivity growth…

28. For the purpose of this chapter, the impact of EPL for regular contracts on productivity growth is estimated using the difference-in-difference procedure described in Box 2.2, for a sample of 18 OECD countries over the period 1982-2003. Following previous OECD research (see *e.g.* OECD, 2004), EPL is measured here using a cardinal index varying from 0 to 6 from least to most stringent. The estimation procedure is based on the assumption that the effect of EPL on productivity is stronger in industries with greater layoff propensity. In order to reduce bias due to the possible relationship between EPL stringency and the cross-industry distribution of layoffs, EPL-binding industries are identified based on layoff rates by industry in the United States, that is the least regulated country (see Annexes 2.A1 and 2.A2 for more details on data and methods).[15]

29. Figure 2.4 shows that EPL on regular contracts is estimated to have a small but statistically significant negative effect on aggregate productivity growth.[16] Following the lower bound approach described in Box 2.2, a one point increase in the index of EPL stringency – roughly corresponding to half of the difference between the OECD average and the country with the lowest value of the EPL index (United States)[17] – appears to reduce the annual growth rate of labour productivity by at least

14. For example, countries that have a comparative advantage in volatile, high-productivity industries might implement stricter EPL in response to political pressure to ease the social costs of labour adjustment.

15. However, the fact that, in the United States, the unemployment insurance system is experience-rated with premia dependent, at least in part, on the risk of layoff, might distort the structure of layoffs in this country. For this reason, turnover rates are also used in a sensitivity analysis since, while being quite variable across industries, they have been shown to be extremely stable across countries (Haltiwanger, Scarpetta and Schweiger, 2006).

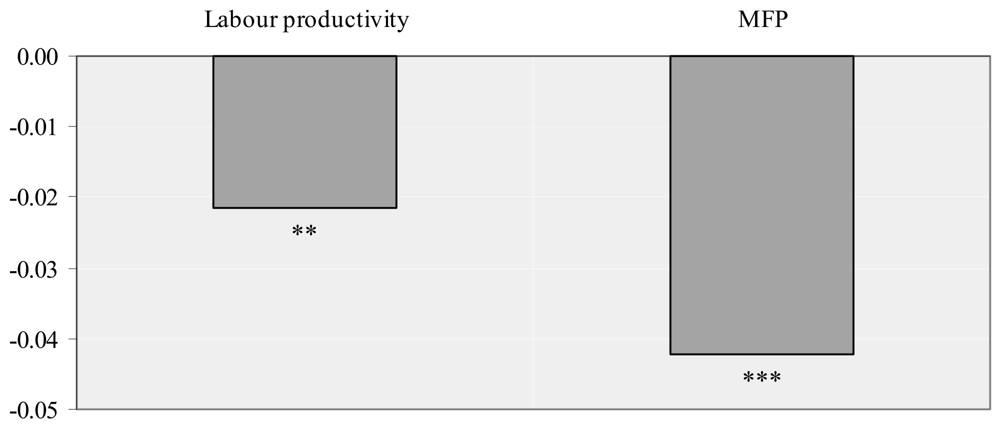
16. Theory does not unambiguously predict whether EPL is more likely to affect productivity levels or growth rates. A model selection exercise (see Table 2.A3.3), however, suggests that EPL for regular contracts is more likely to have a growth effect than an efficiency effect as the estimated level effect of EPL on productivity is not statistically significant once a growth effect is included in the specification.

17. One point corresponds also to one standard deviation in the cross-country distribution of the EPL index for regular contracts.

0.02 percentage points and the annual growth rate of MFP by at least 0.04 percentage points.[18] The result is remarkably robust to various robustness checks for the inclusion of possible confounding factors and changes in the sample of countries used in the estimation (see Table 2.A3.4 and Figure 2.A3.1).

Figure 2.4. **EPL has a negative effect on productivity growth**

Percentage-point impact on labour productivity growth and MFP growth of a one point increase in the EPL index for regular contracts



Derived from difference-in-difference OLS estimates. The estimates in this figure are calculated by multiplying the estimated effect of EPL in EPL-binding industries (see Table 2.A3.3) by the share of EPL-binding industries in total GDP. This assumes that there is zero impact of the policy in other industries (and in all industries that are not included in the sample used in the analysis). Therefore, the estimates represent a lower bound of the aggregate impact of EPL on productivity growth.
MFP: multi-factor productivity; EPL: employment protection legislation.
** significant at 5%; *** significant at 1%.

Source: OECD estimates.

30. Although this estimated effect is small, it is not negligible from a policy perspective, since it cumulates over time. For instance, if in the mid-1980s Portugal, the country in the sample with the highest value of the EPL index, had liberalised provisions for regular contracts to reflect those of the United States, its labour productivity would be more than 1.5 percentage points higher than is presently the case.

31. If stringent EPL slows productivity growth by impeding the flow of resources into high productivity activities, it can be expected that this constraining effect of EPL and its impact on productivity are smaller where institutions depress firm incentives to improve productivity. Insofar as lack of product market competition can dampen these incentives (see *e.g.* Nicoletti and Scarpetta, 2003 and references therein), one can expect the effect of EPL on productivity to be smaller when product market regulation is strongly anti-competitive. However, no evidence could be found that the negative impact of EPL on productivity is less important in countries with strongly anti-competitive product market regulation.

…but no clear conclusion can be drawn about the impact of EPL for temporary contracts

32. Partial EPL reforms, whereby regulations on temporary contracts are weakened while maintaining strict EPL on regular contracts, have been shown to be associated with increasing labour market duality in OECD countries (OECD, 2004). An expansion in temporary work could have opposing effects on productivity. On the one hand, temporary contracts could increase flexibility so that firms can

18. The fact that EPL appears to have a stronger effect on MFP growth than labour productivity might reflect a positive impact on capital deepening.

adapt quickly to changes in technology or product demand and move resources easily into emerging, high productivity activities. Temporary workers might also display greater work effort than other workers if they perceive that good performance could lead to contract renewal or a permanent job offer (Engellandt and Riphahn, 2004). On the other hand, there is some evidence that temporary workers are less likely to participate in job-related training (OECD, 2002; Albert, Garcia-Serrano and Hernanz, 2005; Bassanini *et al.*, 2007; Draca and Green, 2005), or even are more prone to workplace accidents (Guadalupe, 2003).

33. The analysis undertaken for this chapter does not shed further light on the productivity effects of partial EPL reform. While a decrease in the level of the overall EPL index (incorporating measures of both EPL on regular and temporary contracts) is associated with an increase in productivity growth, the results are unclear on whether relaxing rules on temporary contracts while leaving EPL on regular contracts unchanged would have any impact on productivity.[19]

2.3. Minimum wages

Minimum wages can affect average productivity through the substitution of skilled for unskilled workers…

34. While there is no clear-cut evidence that minimum wages affect aggregate unemployment (see OECD, 2006a for a survey of recent literature), available evidence suggests that high minimum wages can reduce demand for unskilled labour, relative to skilled labour, thereby leading to substitution of skilled for unskilled workers, without any overall change in the employment level (Neumark and Wascher, 2006; Aaronson and French, 2007). If more skilled labour is employed and more unskilled labour is excluded from employment, the aggregate skill level of the workforce will increase, thereby raising average productivity.[20]

…or by influencing training or innovation decisions

35. Minimum wages also compress the lower tail of the wage distribution without necessarily affecting individual productivity, thereby increasing employers' incentive to pay for training as they can reap the difference between productivity and wage growth after training (see *e.g.* Acemoglu and Pischke, 1999b; Acemoglu and Pischke, 2003). Moreover, low-skilled workers could have a greater incentive to invest in human capital to avoid unemployment (Cahuc and Michel 1996; Agell and Lommerud, 1997; Agell 1999). On the other hand, by compressing wage relativities between skilled and unskilled jobs, minimum wages could reduce incentives for the low-skilled to invest in training. More importantly, high minimum wages prevent low-wage workers from accepting wage cuts to finance training (Rosen, 1972).

36. Minimum wages may also influence firms' innovation decisions. Boone (2000) argues that a level of the minimum wage above productivity induces firms to over-invest in labour-saving innovation. This reduces investment in innovations that improve the quality of products and enhance long-run growth.

37. There is very little existing empirical evidence on the impact of minimum wages on productivity. Kahn (2006) finds that the ratio of the minimum to median wage is negatively related to MFP growth in French manufacturing industries. But when the unemployment benefit replacement rate is taken into account, the coefficients on both variables become statistically insignificant. Research is more abundant on

19. When indices for both temporary and permanent contracts are included in the empirical specification, the coefficient on the index for temporary contracts is sometimes insignificant and never significantly greater than the coefficient on the index for permanent contracts (see Table 2.A3.5).

20. This effect should be distinguished from the composition effect discussed in Section 1.1 because the substitution of skilled for unskilled labour is not necessarily accompanied by a change in the overall level of employment or hours.

the effect of minimum wages on training, but no consensus emerges as to the overall effect of minimum wages.[21]

Minimum wages are estimated to have a positive effect on average productivity…

38. The impact of statutory minimum wages on productivity was estimated using the difference-in-difference technique described in Box 2.2 for a sample of 11 OECD countries over the period 1979-2003. The estimation is based on the assumption that changes in minimum wages have a greater impact on productivity in industries that are more heavily reliant on low-wage labour. In order to reduce bias due to the possible relationship between minimum wages and the distribution of low-wage employment, low-wage industries are identified based on the incidence of low-wage workers by industry in the United Kingdom prior to the introduction of statutory minimum wages in that country in 1999. Minimum wages are measured as the economy-wide ratio of the gross statutory minimum wage to the median wage (see Annexes 2.A1 and 2.A2 for more details on data and methods).[22,23]

39. Figure 2.5 shows that an increase of ten percentage points in the ratio of the statutory minimum wage to median wages (approximately equal to the cross-country standard deviation in minimum wages) is associated with an increase of between 1.7 and 2.0 percentage points in the long-run level of both labour productivity and MFP.[24] The estimated effects are relatively robust to changes in the sample of countries used in the estimation (see Figure 2.A3.2).

21. See Grossberg and Sicilian (1998), Neumark and Wascher (2001), and Acemoglu and Pischke (2003) for the United States, and Arulampalam, Booth and Bryan (2004) for the United Kingdom. There are several possible reasons why this strand of research is inconclusive. For instance, in countries where the minimum wage is high, it might be difficult to find a group which is not directly or indirectly affected by the minimum wage and qualifies as a genuine control. Conversely, in countries where the minimum wage is particularly low, the incidence of training in the treatment group is likely to be extremely small, since the incidence of training is relatively infrequent at the bottom of the wage distribution. By contrast, indirect evidence suggesting a positive impact of minimum wages on training is provided by empirical studies of the relationship between wage compression and training that seem to lead to less ambiguous conclusions (Almeida-Santos and Mumford, 2005; Bassanini and Brunello, 2007).

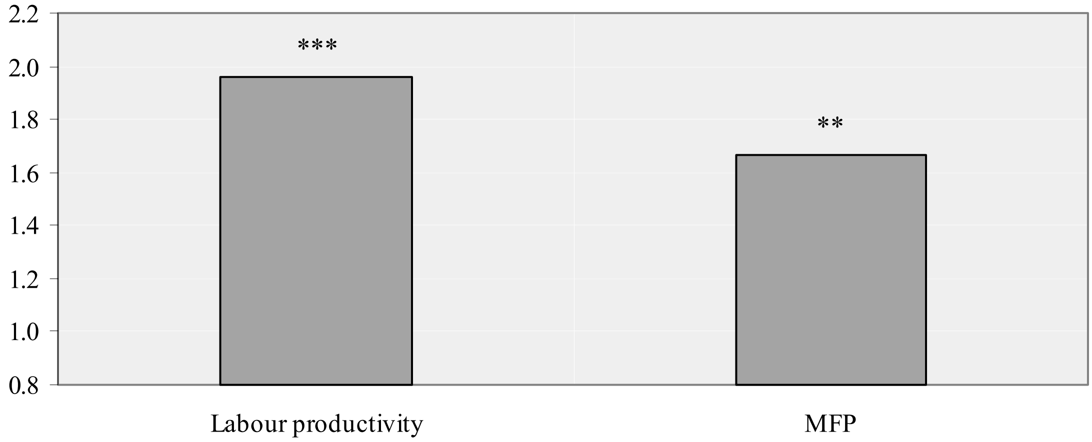
22. To the extent that changes in minimum wages affect productivity through their impact on firms' decisions, statutory minimum labour costs might be a more appropriate measure of minimum wages. However, compiling the data require the use of detailed tax models for each country and year and is available only since 2000 (Immervöll, 2007).

23. The ratio of the minimum wage to median earnings used in the analysis could be endogenous, due to the correlation between productivity and median wages. The baseline specification was initially estimated using both OLS and instrumental variables (IV) approaches, using the logarithm of the real minimum wage in 2000 US dollars PPP as an instrument for the ratio of the minimum wage to median earnings (see Table 2.A3.8 for results). For the baseline specification, a Hausman test for endogeneity (see *e.g.* Wooldridge, 2002) rejected the hypothesis that the ratio of the minimum wage to median earnings is exogenous, so IV estimation is used throughout to control for endogeneity.

24. As explained in Box 2.2, the estimates represent a lower bound of the effect of minimum wages on productivity. Yet, to the extent that the value added attributable to low-wage industries included in the sample accounts for over one quarter of total GDP, estimates in Figure 2.5 are less likely to heavily underestimate the aggregate impact of minimum wages on productivity than for other labour market policies examined in this chapter. While minimum wages appear to have a greater impact on labour productivity than MFP, the difference between the effects is not statistically significant.

Figure 2.5. **An increase in the minimum wage has a positive effect on measured average productivity**

Percentage-point impact on labour productivity and MFP levels of a ten percentage-point increase in the ratio of the minimum wage to median earnings



Derived from difference-in-difference IV estimates where the logarithm of the real minimum wage in 2000 US dollars PPP is used as an instrument for the ratio of the minimum wage to median earnings. The estimates in this figure are calculated by multiplying the estimated effect of minimum wages in low-wage industries (see Table 2.A3.9) by the share of low-wage industries in total GDP. This assumes that there is zero impact of the policy in other industries (and in all industries that are not included in the sample used in the analysis). Therefore, the estimates represent a lower bound of the aggregate impact of minimum wages on productivity growth.
MFP: multi-factor productivity.
** significant at 5%; *** significant at 1%.

Source: OECD estimates.

40. From a long-run perspective, the estimated effect of changes in the minimum wage on productivity is limited. If Spain – the country with the lowest ratio of minimum to median wages (30% in 2002) – had the same policy as France – the country with the highest ratio of minimum to median wages (61% in 2002) – its measured average labour productivity would be, other things equal, about six percentage points greater than it actually is.

…but this might simply reflect substitution of high- for low-skilled workers

41. It is not clear, however, to what extent the positive impact of minimum wages on productivity is simply due to substitution of high-skilled for low-skilled workers, increasing the aggregate level of skills and productivity, rather than as the result of improved incentives to invest in training. Although the specification provides no conclusive way of disentangling these effects, further analysis with alternative specifications suggests that minimum wages have a more significant impact on the level of productivity than on its growth rate (see Table 2.A3.8). Insofar as the training channel would likely affect the growth rate as well as the level of productivity, this result provides some, albeit weak, evidence that substitution of high- for low-skilled workers is effectively part of the story. The possibility that a large proportion of the productivity effect of minimum wages is due to reduced demand for low-skilled workers should be kept in mind when drawing policy implications from these results, insofar as distributional consequences must be assessed.

42. The effect of minimum wages on productivity reported in Figure 2.5 is estimated assuming that factors other than minimum wages have the same impact on productivity in both low-wage and other industries. Overall, the baseline results are robust to the inclusion of control variables (see Table 2.A3.10). A number of interactions between minimum wages and other policy variables were also tested to determine whether the impact of minimum wages on productivity depends, at least in part, on the broader policy

setting in operation in a particular country. Previous OECD research (see OECD, 2006a) shows that minimum wages can influence the way in which the tax wedge affects unemployment. The explanation for this may be that higher minimum wages make it more difficult for employers to pass on tax increases to workers, reducing demand for labour. If minimum wages intensify the negative effect of taxes on employment, the lower employment rates that result could induce higher levels of productivity through a composition effect. In this way, the estimated positive impact of minimum wages on productivity could simply be a result of their amplifying the effect of taxes on employment. However, controlling for an interaction between the tax wedge and the minimum wage had little impact on the baseline results, indicating that minimum wages have an effect on productivity, independent of any interaction with taxes.

Generous unemployment benefits may reduce the impact of minimum wages on productivity

43. The higher the minimum wage relative to the unemployment benefit replacement rate, the greater the opportunity cost of remaining unemployed. If minimum wages increase productivity by reducing demand for unskilled labour and providing incentives for low-skilled workers to invest in training to avoid unemployment, high replacement rates could dull this effect by reducing the opportunity cost of remaining unemployed. To test this hypothesis, the average unemployment benefit replacement rate was included as a control variable both individually and interacted with minimum wages (see Table 2.A3.10). The results are sensitive to the estimation sample used, but provide some qualified evidence that generous unemployment benefits may reduce the positive impact of minimum wages on productivity in low-wage industries.[25]

2.4. Unemployment benefits

Unemployment benefits may increase measured aggregate productivity through their impact on employment,…

44. There are a number of channels through which unemployment benefits could affect productivity. First, given the magnitude of the estimated impact of unemployment benefits on unemployment,[26] unemployment benefits are likely to affect productivity purely through their impact on employment (the so-called composition effect discussed in Section 1.1). In particular, by increasing the reservation wage, generous unemployment benefits tend to price low-productivity workers out of jobs in imperfect labour markets (Lagos, 2006), increasing the proportion of high-skilled workers employed and therefore the average productivity level of the workforce.

…by providing a buffer for the unemployed to find a suitable job,…

45. Second, generous unemployment benefits (in terms of either duration or replacement rate or both) may provide a buffer of time and resources to allow the unemployed to find a job that suits their skills and

25. Alternatively, the result could indicate that in low-wage industries, higher minimum wages reduce the positive impact of unemployment benefits on productivity (see Section 2.4 for a full discussion of the possible effects of unemployment benefits on productivity). In short, if unemployment benefits increase productivity by giving the unemployed a buffer of time or resources to find a well-matched job, higher minimum wages will dampen this effect by increasing the opportunity cost for low-skilled workers of remaining unemployed and creating an incentive for the unemployed to move quickly into any available job vacancy.

26. For instance OECD (2006a), using estimates from Bassanini and Duval (2006), report that a 10% increase in average benefit replacement rates would, on average, reduce employment rates by 1%, that is an elasticity of -0.1. Bigger elasticities are typically found in the microeconomic literature, but they are calculated using different measures of the generosity of unemployment benefits to the measure used in this chapter.

experience, resulting in higher quality matches between the unemployed and available job vacancies (Marimon and Zilibotti, 1999).[27]

46. Higher quality job matches should increase productivity levels as resources are used more efficiently. If higher quality job matches last longer, there could also be an impact on human capital accumulation. For example, workers with longer tenure might be more likely to receive training from their employer, or have greater incentives to themselves invest in training.

…or by encouraging firms to create risky, high-productivity jobs

47. Furthermore, it is possible that the provision of generous unemployment benefits also encourages the creation of higher productivity jobs (Acemoglu and Shimer, 1999, 2000). Higher productivity jobs might carry with them a higher risk of layoff to the extent that they are located in more volatile, innovative activities or require workers with more specific skills and have greater risk of job mismatch. For example, there is some evidence that there are higher rates of involuntary turnover in high-technology industries (as proxied by technology use, R&D investment or use of skilled labour – Givord and Maurin, 2004; Zavodny, 2004). If this is the case, in the absence of unemployment benefits, the unemployed will have an incentive to apply for low-productivity jobs with a corresponding low risk of future layoff and firms will find it more difficult to fill higher-productivity positions. In this context, generous unemployment benefits could allow the unemployed to risk future layoff by taking a higher productivity job (and also increase the quality of matches), knowing that, if they were laid off in the future, they would be supported by a safety net. Firms might be therefore more likely to offer such jobs, increasing the share of high-productivity jobs and the overall level of productivity.

Unemployment benefits can also have some negative effects on productivity,…

48. Unemployment benefits may also have some adverse effects on productivity. It is well-established that generous unemployment benefits can increase the duration of unemployment spells and the overall level of unemployment (see OECD, 2006a, for a survey of recent literature). This could have a negative impact on productivity through inefficient use of resources and depreciation of human capital during long spells of unemployment. In addition, by reducing the opportunity cost of unemployment, generous unemployment benefits may lead existing employees to reduce their work effort, thereby lowering productivity (see *e.g.* Shapiro and Stiglitz, 1984; Albrecht and Vroman, 1996).

…therefore their net effect on GDP per capita is a priori *ambiguous*

49. Given the range of possible impacts of unemployment benefits on productivity and their unambiguous negative effect on labour utilisation, the net effect on GDP per capita is, *a priori*, ambiguous. In contrast with the cases of EPL and minimum wages discussed above, the existence of a long time-series of data on unemployment benefits replacement rates allows for the impact of unemployment benefits on

27. Active labour market programmes (ALMPs), such as job-search assistance, training and work experience programmes, can also improve match quality by improving information about skills and vacancies, adapting the skills of jobseekers to the available vacancies or reducing the uncertainty associated with hiring for firms (see Calmfors, 1994; Martin and Grubb, 2001; Boone and van Ours, 2004; and OECD, 2005 for an overview). However, the lack of a long time-series of data on ALMPs precludes a rigorous examination of their impact on GDP per capita. In addition, it is hard to conceive of a reason that ALMPs would affect productivity more in some industries than others, so the difference-in-difference methodology described in Box 2.2 cannot be applied to estimate the impact of ALMPs on productivity. For this reason, this impact is not estimated in this chapter.

GDP per capita to be estimated using the structural model discussed in Box 2.2.[28] Since more generous unemployment benefits are associated with lower aggregate employment rates, the overall effect of higher unemployment benefits on GDP per capita will be negative unless a positive productivity effect compensates fully for the negative employment effect.

Empirical evidence shows no overall impact on GDP per capita of unemployment benefits, suggesting the possibility of a positive productivity impact…

50. Figure 2.6 shows that the generosity of unemployment benefits (as measured by an average of gross replacement rates across various earnings levels, family situations and durations of unemployment) appears to have no significant overall impact on the level of GDP per capita.[29] Moreover, a robustness exercise shows no significant differences in the magnitude of this effect between countries characterised by high and low ALMP spending.[30] These results suggest that any negative impact of unemployment benefits on employment is offset fully by a net positive impact of unemployment benefits on average productivity. Furthermore, although point estimates are negative, the long-run elasticity of GDP per capita to changes in benefit generosity appears to be much smaller than the corresponding elasticity of the employment rate.[31] This cautiously suggests that the generosity of unemployment benefits is likely to have a positive effect on productivity over and above composition effects.[32]

28. This aggregate approach cannot be used in the analysis of parental leave (Section 2.5) either, because of the lack of availability of long time-series.

29. These estimates are obtained by fitting the aggregate structural model described in Box 2.2, which was made possible by the availability of long time series for average gross replacement rates. The sample covers 18 OECD countries over the period 1970-2002. The countries included in the sample are Australia, Austria, Belgium, Canada, Denmark, France, Greece, Ireland, Italy, Japan, the Netherlands, Norway, New Zealand, Portugal, Spain, Switzerland, the United Kingdom and the United States. See Annex 2.A1 for more details on data.

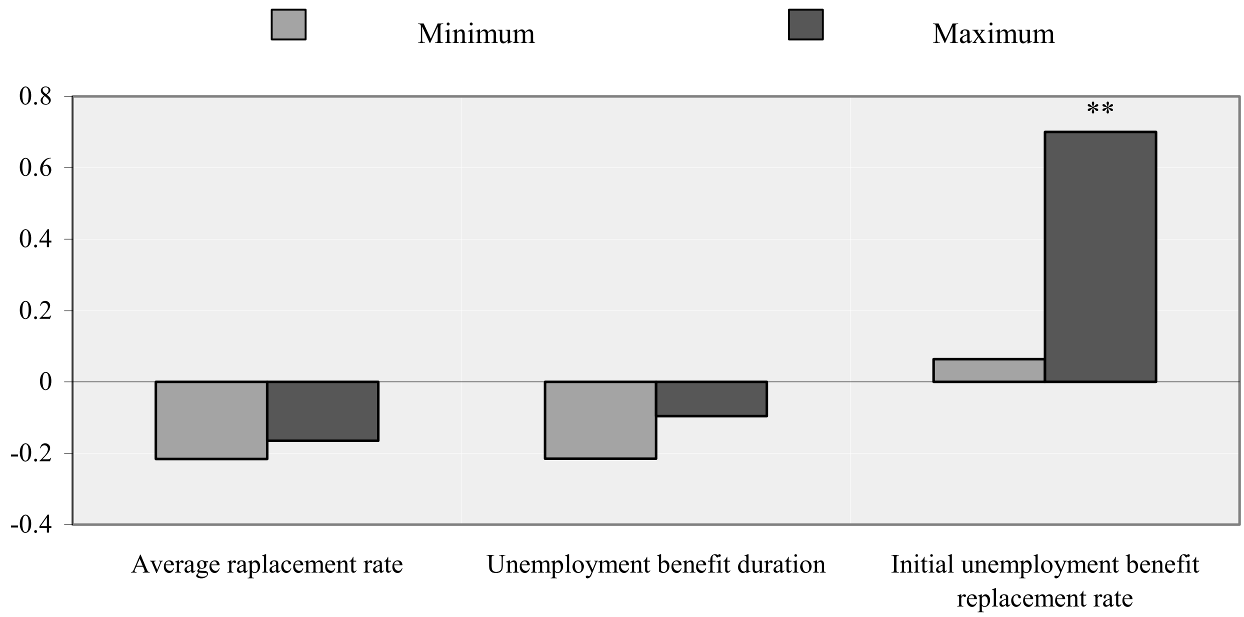
30. Results from this robustness exercise are not shown in Figure 2.6 but are available upon request. For the purposes of this exercise, high-spending countries are Denmark, Ireland, and the Netherlands. According to the estimates presented in Bassanini and Duval (2006), in these countries, ALMP spending is sufficiently high to make statistically insignificant the impact of unemployment benefit generosity on the unemployment rate (see 2006a, Figure 7.4).

31. As shown in Figure 2.6, at the sample average, a 10% increase in average replacement rates would imply a fall in GDP per capita of about 0.15-0.2 percent, implying an elasticity no greater than -0.02. Such a low elasticity cannot be entirely explained through composition effects (see Section 1.1). However, the size and significance of the estimated coefficients is somewhat sensitive to changes in the sample of countries used in the estimation.

32. This interpretation is reinforced by the fact that the initial level of the replacement rate appears to have a positive effect in certain specifications.

Figure 2.6. **Unemployment benefits have little overall impact on the level of GDP per capita**

Percentage-point impact on the steady-state level of GDP per capita of a 10% increase in average replacement rate, unemployment benefit duration and initial unemployment benefit replacement rate



Derived from Pooled Mean Group (PMG) estimates. For each policy, minimum and maximum indicate the smallest and greatest estimate obtained in the specifications reported in Table 2.A3.12.
** significant at 5%.

Source: OECD estimates. See Table 2.A3.12 for full results.

51. A more detailed examination of the two channels through which unemployment benefits can potentially have a positive influence on productivity over and above composition effects (by improving job-match quality and by encouraging the creation of high-productivity, high-risk jobs) shows that both seem to receive some support from the empirical evidence.

…possibly as a result of higher quality job matches…

52. Generous unemployment benefits appear to be associated with higher quality job matches, although the effects are relatively small. In an attempt to directly examine job matches, Pollmann-Schult and Buchel (2005) find that receipt of unemployment benefits delays exits from unemployment into mismatched jobs (*i.e.* jobs for which the worker is over-educated), but not exits from unemployment into matched jobs (*i.e.* where the education level of the worker matches that of the position). A number of studies use post-unemployment job duration as a measure of job-match quality, on the assumption that better quality matches last longer. An increase in either the replacement rate (Centeno, 2004) or the duration of unemployment benefits (Belzil, 2001) is associated with a small, but statistically significant, increase in post-unemployment job duration. An alternative way of measuring job-match quality is to examine post-unemployment wages: better quality matches should result in higher productivity, and therefore be rewarded with higher wages. The limited recent evidence on the wage effects of unemployment benefits suggests, again, that there is a weak positive relationship between unemployment benefits (as measured by the replacement rate or expenditure on unemployment benefits as a percentage of GDP) and post-unemployment wages (Addison and Blackburn, 2000; Polachek and Xiang, 2005).

Box 2.3. **Analysing the role of unemployment benefits in encouraging the creation of high-productivity jobs**

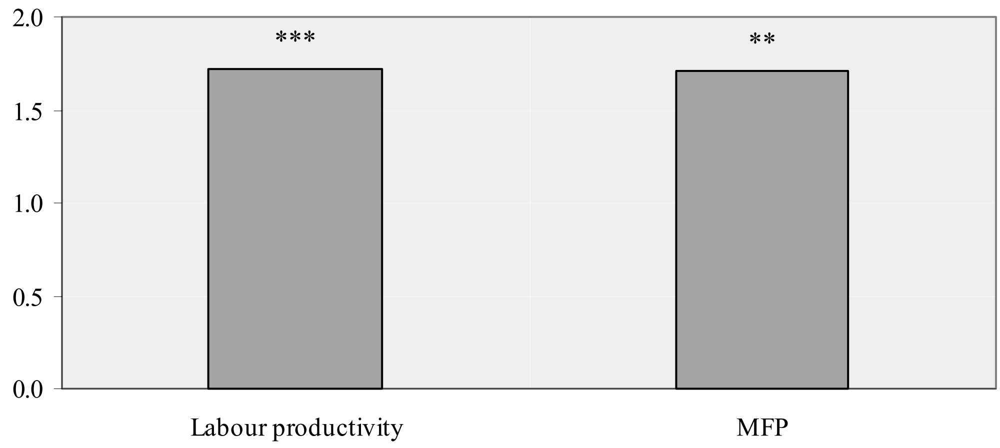
One of the channels through which unemployment benefits could affect productivity is by providing security for workers to search for, and accept, high-productivity jobs that have a high risk of future layoff, in turn increasing the number of high-productivity jobs offered by employers. Under somewhat restrictive assumptions, a difference-in-difference experiment of the type discussed in Box 2.2 has been carried out for the purposes of this chapter. If high-risk/high-productive jobs are more likely to be created in risky industries and effects of unemployment benefits through other channels are assumed to affect both risky and non-risky industries equally, the difference between changes in productivity in risky industries and changes in productivity in non-risky industries can be modelled as a function of unemployment benefits. Risky industries are defined as those where the employment share of entering firms surviving for one year or more is below the average for all industries. Yet, the identification assumptions are very restrictive; therefore this analysis must be viewed as somewhat tentative.

The estimation uses a sample of 18 OECD countries over the period 1979-2003. Risky industries are identified based on the likelihood of new firms surviving for more than one year. The same classification of risky industries is used for all countries in the sample (see Annexes 2.A1 and 2.A2 for details of data and methods).[1]

Higher average replacement rates are found to be associated with significantly higher MFP and labour productivity levels in risky industries compared with non-risky industries. The figure below shows that a 10% increase in the average replacement rate is associated with a 1.7% larger increase in both MFP and labour productivity in risky industries than in non-risky industries. The results are relatively robust to the inclusion of control variables (see Table 2.A3.14). Of course, all or part of this increase could be offset by any negative impacts of lower employment rates on productivity. In addition, the estimated effect might be in part due to substitution of high- for low-skilled workers.

Unemployment benefits have a positive effect on productivity in risky industries

Percentage-point impact on labour productivity and MFP levels of a 10% increase in the average replacement rate from the sample mean



Derived from difference-in-difference OLS estimates. MFP: multi-factor productivity.
** significant at 5%; *** significant at 1%.
Source: OECD estimates. See Table 2.A3.13 for detailed results.

1. In the United States, the unemployment insurance system is experience-rated with premia dependent, at least in part, on the risk of layoff. However, removing the United States from the estimation sample has almost no effect on the baseline results.

…or through the creation of risky, higher productivity jobs

53. Evidence on the relationship between unemployment benefits and the creation of high-productivity/high-risk jobs is less clear. Acemoglu (1997) looks at US state-level replacement rates between 1983 and 1993 and finds that an increase of ten percentage points induces an increase in the number of high-wage occupations by 1.3%, despite the decline in overall employment. A number of studies suggest that unemployment benefits increase the desirability of high-risk jobs. Topel (1984) uses US data and shows that high-risk jobs pay higher wages but this compensating differential is dampened by generous unemployment benefits. Similarly, Barlevy (2001) shows that even though workers who change jobs during booms tend to be hired in high-risk industries where they receive higher wages, unemployment benefits reduce the pro-cyclicality of their wages. From a cross-country perspective, there is some evidence that the generosity of unemployment benefits has a positive effect on relative levels of MFP and labour productivity of high-risk industries compared to low-risk industries (see Box 2.3).

54. Overall, the net impact of unemployment benefits on productivity appears to be positive. How much of this positive effect is due to changes in the composition of the labour force as a result of the impact of unemployment benefits on employment remains unclear. Unemployment benefits seem to have some independent positive impact on productivity, by supporting higher quality job matches and by facilitating the creation of riskier, higher productivity jobs (associated with the fact that unemployment benefits provide insurance against future job loss). Yet, the net impact on GDP per capita appears to be small.

2.5. Parental leave

55. Family-friendly policies, such as parental leave, employer provision of child-care, flexible working hours or leave to care for sick family members, may help improve parents' morale and work commitment. This, in turn, may have a positive impact on productivity by making it easier for parents to balance paid work with family responsibilities. In the absence of family-friendly working arrangements, working parents, particularly women, might leave the workforce completely for extended periods of time, reducing their total work experience and accumulated job-specific human capital. Firms and workers who are assured of an ongoing employment relationship might also be more likely to invest in training. Alternatively, policies such as leave or part-time work that reduce the amount of time parents spend working could impede productivity by reducing access to training and leading to human capital depreciation. Policies that increase the cost to employers of employing parents could lead to discriminatory and inefficient hiring outcomes, whereby highly-skilled women are concentrated in low-skilled jobs.

56. Existing studies of the impact of family-friendly working arrangements on productivity tend to be based on relatively small-scale surveys of managers' perceptions of productivity or turnover. The results are mixed and difficult to generalise (Baughman, Holtz-Eakin and DiNardi, 2003; Gray, 2002; Bloom and Van Reenen, 2006). One of the reasons for the lack of cross-country comparisons of the productivity effects of family-friendly working arrangements is that cross-country data on the use or provision of family-friendly working arrangements are scarce. Some family-friendly working arrangements are mandated by national or regional governments, but in many cases, responsibility for the provision of family-friendly working arrangements is left to employers, making it difficult to determine levels of coverage. A notable exception is parental leave. Most OECD countries have mandated parental leave arrangements, with compulsory maternity leave around the time of the birth of a child, and additional (paid or unpaid) leave after the birth. Because of the availability of comparable cross-country data over a reasonably long period of time, parental leave will be the focus of the analysis in this section.

Parental leave can reduce the negative effect of child-rearing breaks on women's wages…

57. There is very little existing empirical evidence on the direct productivity impact of parental leave. Gray (2002) finds that the provision of paid parental leave has no significant impact on manager-reported measures of labour productivity, financial performance, turnover or absenteeism. But paid parental leave increases significantly employee-reported satisfaction with pay.

58. To the extent that higher productivity is reflected in higher wages, the literature examining the impact of parental leave on wages provides more evidence on the expected relationship between parental leave and productivity.[33] Time spent out of the workforce after the birth of a child can have a negative impact on subsequent wages for women. Much of this negative impact is due to human capital depreciation or loss of opportunities to accumulate human capital while on leave or out of the workforce (see *e.g.* Datta Gupta and Smith, 2002). However, a number of studies have shown that the availability and use of parental leave mitigates the negative effects of children on women's wages. There are two reasons for this.

…by reducing the length of breaks and increasing the chances that women return to their pre-birth job…

59. First, access to parental leave seems to reduce the length of career breaks following the birth of a child. For example, Ronsen and Sundstrom (1996) find that women in Sweden and Norway who have access to paid maternity leave are more likely to return to work after child birth and return two to three times faster than other women. Similar results are found for women in the United States (Berger and Waldfogel, 2004) and the United Kingdom (Dex *et al.*, 1998; Burgess *et al.*, 2007). The negative impact of career breaks on wages tends to increase with the length of the break. Joshi, Paci and Waldfogel (1999) find that women who took a break of less than one year after childbirth had similar wages to women who had never had children, and significantly higher wages than women who took a longer break.

60. Second, women with access to parental leave are more likely to return to the job they held before the birth of their child (Baker and Milligan, 2005; Waldfogel 1998; Waldfogel, Higuchi and Abe, 1999). Returning to the pre-birth job has a positive impact on wages compared with returning to a new job, so that the overall negative effect of taking a birth-related career break on wages is small or eliminated altogether (Waldfogel, 1995, 1998; Baum, 2002; Phipps, Burton and Lethbridge, 2001). Returning to the pre-birth job appears to allow women to capitalise on the benefits of accumulated tenure with their existing employer, such as seniority, training and access to internal labour markets.

…but very long periods of leave could result in human capital depreciation

61. Most existing studies of the wage impact of parental leave use an indicator variable for access to or use of parental leave, rather than examining differences in the length of leave available. They suggest that the availability of leave can play a role in helping women remain attached to the labour force and their previous job. However, the effect of the length of leave available is not clear. It is possible that the positive impact of parental leave on productivity occurs only for relatively short periods of leave, whereas long periods of leave lead to substantial depreciation of human capital, even if women eventually return to their pre-birth job. Ruhm (1998) finds some evidence of a non-linear relationship between the length of parental leave and wages in nine European countries. Rights to short periods of paid leave (three months) have little effect on wages, while long periods of paid leave (nine months) are associated with a decrease in hourly earnings by around 3%.

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33. Almost all of the research in this area focuses on women's wages, primarily because women are far more likely than men to take parental leave. An exception is Albrecht *et al.* (1999), who find that the wage penalty for taking parental leave is much higher for men than women.

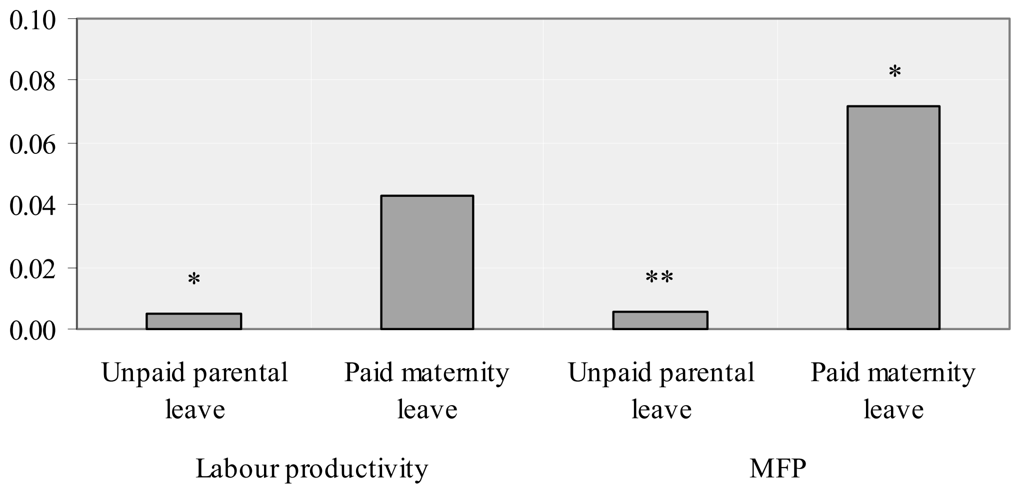
Unpaid parental leave has a small, positive impact on productivity

62. The impact of parental leave on productivity has been estimated using the difference-in-difference technique described in Box 2.2 for a sample of 18 OECD countries over the period 1980-1999. The estimation is based on the assumption that the availability of parental leave has a greater impact on productivity in industries where employment is female-dominated. Two variables for parental leave are used in this analysis: total weeks of legislated unpaid parental leave, including child-care leave; and total weeks of legislated paid maternity leave, estimated at average manufacturing worker wages (see Annexes 2.A1 and 2.A2 for details of data and methods).

63. Results suggest that longer unpaid parental leave is associated with somewhat higher productivity levels. Assuming that there is no impact of unpaid parental leave on productivity in non-female-dominated industries, Figure 2.7 shows that a one-week increase in the length of available leave is associated with an increase in aggregate labour productivity and MFP of between 0.005 and 0.01 percentage points. The statistical significance of the results is sensitive, however, to changes in the sample of countries included in the analysis.[34]

Figure 2.7. **Parental leave has a positive effect on productivity**

Percentage-point impact on labour productivity and MFP levels of a one-week increase in unpaid parental leave or paid maternity leave from the sample means



Derived from difference-in-difference OLS estimates. The estimates in this figure are calculated by multiplying the estimated effect of parental leave in female-dominated industries (see Table 2.A3.17) by the share of female-dominated industries in total GDP. This assumes that there is zero impact of the policy in other industries (and in all industries that are not included in the sample used in the analysis) and as such, represents a lower bound of the aggregate impact of parental leave on productivity growth.
MFP: multi-factor productivity.
* significant at 10%; ** significant at 5%.

Source: OECD estimates.

34. The statistical significance of the results is quite sensitive to the countries used in the sample. However, the point estimates are always positive, indicating that parental leave has either no impact or a positive impact on productivity. Thus, it can be concluded that there is no evidence that parental leave has a negative impact on productivity. The difference-in-difference specification involves using a complete system of two-dimensional dummy variables, so the results are identified by changes in policy variables within a particular country over time. In some countries there is very little across-time variation in parental leave variables, making it difficult to identify a result.

Paid maternity leave has a somewhat larger positive impact on productivity than unpaid parental leave

64. The results for paid maternity leave are less conclusive: longer periods of available paid maternity leave are associated with higher productivity, but the effects are only statistically significant for MFP.[35] Nevertheless, the estimates suggest that the productivity effect of additional paid maternity leave is larger than that for unpaid parental leave. These results suggest that if countries with no paid maternity leave (such as the United States) introduced it at the average OECD level (16 weeks), they could increase their MFP by about 1.2% in the long-run.

65. A number of alternative specifications were tested to determine whether the positive productivity impact of parental leave declines with very long periods of leave (see Table 2.A3.17 and discussion in Annex 2.A2). The results are inconclusive, but suggest that the impact of additional weeks of leave on productivity is greater in countries with relatively short periods of leave than in countries that already have generous leave entitlements.

66. The results presented in Figure 2.7 are based on the assumption that parental leave is the only factor that affects productivity in female-dominated industries more than in non-female-dominated industries. In reality, a range of other policy and demographic factors that influence women's labour force participation could have a similar impact on productivity as parental leave if they promote continuous labour force participation and preserve high-quality job matches. Including controls for tax incentives (labour tax wedge, tax incentives for part-time work and the relative marginal tax rate for second earners), women's education level, public expenditures on childcare and other policies that are known to affect women's employment rates (product market regulation and the average unemployment benefit replacement rate) had little effect on the size or significance of the estimated effect of unpaid parental leave on productivity (see Tables 2.A3.19 and 2.A3.20).[36] The impact of paid maternity leave on productivity was somewhat more sensitive to the inclusion of control variables. Including controls increased the size and significance of the estimated effect of paid maternity leave on labour productivity, but, in some specifications, reduced the impact on MFP. It is possible that at least part of the productivity impact of paid maternity leave on productivity operates through its effect on incentives for capital accumulation. Increases in paid maternity leave entitlements might prompt employers to invest in capital as a means of replacing workers on maternity leave, increasing the capital-to-labour ratio and labour productivity without affecting MFP.[37]

67. The finding that parental leave has a positive impact on productivity suggests that there could be a business case for firms in countries with little or no legislated parental leave to introduce parental leave at the firm-level. However, there are a number of reasons why such an interpretation should be made with caution. First, higher productivity does not necessarily translate into higher profits for firms – for example, higher productivity could result in higher wages for parents returning from leave, leaving profits

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35. The same model was estimated for a more disaggregated sample of industries for labour productivity only (due to a lack of disaggregated data on capital stock) and the results showed a positive and significant effect of paid maternity leave on labour productivity, of a similar magnitude to that shown in Figure 2.6 (see Table 2.A3.18).

36. There are also other unobservable factors that could affect productivity in female-dominated industries more than in non-female-dominated industries, such as employer provision of family-friendly working arrangements. There is some evidence that employer provision of family-friendly working arrangements is likely to be more prevalent in female-dominated industries (Bardoel *et al.*, 1999). Therefore, its omission from the empirical specification might bias estimates of the impact of parental leave on productivity in these industries.

37. However, it should be stressed that in all specifications tested, there was a positive impact of parental leave on both MFP and labour productivity.

unchanged. Second, even if parental leave was found to increase firm profits, it is unclear whether the benefits accruing to firms would exceed the cost of providing firm-level parental leave. Third, there are likely to be external benefits to society as a whole from helping parents maintain their links to the workforce, such as higher tax revenues, reduced dependence on welfare and lower rates of child poverty. This would suggest that there is a role for government in financing at least part of the cost of providing parental leave.

Conclusions

68. The Restated OECD Jobs Strategy advocates a range of labour market policies, assembled into coherent policy packages, with the aim of improving labour market outcomes, primarily reducing unemployment and increasing employment. Assessing the impact of such policies on productivity is important to the extent that policy reforms that boost labour utilisation but reduce productivity could have a negligible or even negative overall impact on living standards. Moreover, as populations age and labour force participation rates increase towards capacity, fostering productivity growth appears to be the only way of maintaining and improving living standards in OECD countries.

69. The likely existence of sizeable composition effects, however, means that evaluating the success of labour market reforms by measuring aggregate productivity can be misleading. Policy reforms that boost employment will likely have a negative impact on measured productivity simply by increasing the proportion of low-skilled workers employed, generating decreasing returns to labour input and creating opportunities for labour-intensive activities. Yet, this effect occurs in part because of shortcomings in the measurement of productivity, and any actual slowdown in productivity growth resulting from composition effects will be temporary, coming to a halt when the employment rate reaches post-reform equilibrium level. Furthermore, permanently lower productivity levels arising from this channel are likely to be outweighed by higher labour utilisation, leading to a small but positive increase in GDP per capita.

70. Some policy reforms can also have a direct impact on productivity in addition to this composition effect. However, while there is somewhat of a consensus that tax reforms and pro-competitive product market deregulation can enhance productivity and GDP per capita growth, evidence on the growth effects of labour market reforms does not loom large in the existing empirical literature. The results of the industry-level analysis presented in this chapter partially fill this gap. In particular, stringent statutory employment protection for regular contracts appears to dampen productivity growth, most likely by restricting the movement of labour into emerging, high-productivity activities, firms or industries.

71. Results for other policies are more tentative: higher minimum wages, for example, appear to be associated with higher productivity, but it is unclear to what extent this occurs as the result of improved provision of employer-sponsored training or whether it is due to simple substitution of high-skilled for low-skilled workers, the latter channel having important distributional consequences whose desirability must be assessed. Clearly, more research is needed on the channels through which minimum wages affect productivity. Family-friendly policies that encourage sustained workforce participation by parents appear also to increase productivity by allowing workers with family responsibilities to maintain their links to the workforce in general, and to their existing jobs in particular, although these results are somewhat sensitive to the empirical specification used. There is also some scattered evidence that reforms that reduce the generosity of the unemployment benefits tend to depress productivity, by reducing the time and/or resources available to the unemployed to find a well-matched job vacancy and by discouraging firms from creating high-risk, high-productivity jobs. Yet, the overall long-run impact of lowering unemployment benefits on GDP per capita (incorporating positive employment effects and negative productivity effects) appears to be negligible.

72. Overall, the econometric analysis presented in this chapter suggests that many of the reforms advocated in the OECD Jobs Strategy are likely to have beneficial effects on GDP per capita. In some cases, compensation of employment and productivity effects can yield negligible impacts on GDP per capita. More important, there is no evidence that these policy reforms might lead to a permanent productivity growth slowdown. Of course, looking at the impact of the OECD Jobs Strategy on GDP per capita is only one of a number of ways to evaluate its success. Policies that encourage people to move into the labour force are likely to have social benefits in excess of their impact on GDP per capita, particularly in the longer term.

73. Several possible policy reforms considered in the OECD Jobs Strategy could not be analysed within the context of this chapter due to insufficient cross-country comparable data. These include notably wage-bargaining arrangements, activation policies and efficiency of public employment services as well as training policies and policies to facilitate the school-to-work transition. More research on the productivity effects of these policies is needed.

ANNEX 2.A1. DATA SOURCES

General notes on country coverage

Following Bassanini and Duval (2006), data for Finland and Sweden in 1991 and 1992 were removed from the sample, and different country fixed effects used for both countries over the two sub-periods 1970-1990 and 1993-2003. Data for Germany are only included for the period from 1993 to 2003. This is to control for highly country-specific factors – including the collapse of the Soviet Union for Finland, unification of Germany and the Swedish banking crises – that are likely to have had an impact on productivity in the early 1990s and that cannot be captured using the policy control variables or other controls included in the analyses. Insofar as long time-series are necessary for reliable pooled mean group (PMG) estimates, Finland, Germany and Sweden, were excluded from the country sample whenever PMG estimators are used.

Aggregate composition effect analysis

Labour productivity

Definition: GDP in volume terms divided by total hours worked.

Source: OECD Productivity Database.

Hours per capita

Definition: Total hours per capita, equal to the employment rate of the population aged 15 to 64 years multiplied by average hours per person employed.

Source: OECD Productivity Database.

Aggregate analysis of the effect of unemployment benefits on GDP per capita

GDP per capita

Definition: GDP in volume terms.

Source: OECD Productivity Database.

Average unemployment benefit replacement rate

Definition: average unemployment benefit replacement rate across two income situations (100% and 67% of APW earnings), three family situations (single, with dependent spouse, with spouse in work) and three different unemployment durations (first year, second and third years, and fourth and fifth years of unemployment).

Source: OECD Benefits and Wages database.

Data adjustments: original data are available only for odd years. Data for even years are obtained by linear interpolation.

Initial (first year) unemployment benefit replacement rate

Definition: average unemployment benefit replacement rate during the first year of unemployment across two income situations (100% and 67% of APW earnings) and three family situations (single, with dependent spouse, with spouse in work).

Source: OECD Benefits and Wages Database.

Data adjustments: original data are available only for odd years. Data for even years are obtained by linear interpolation.

Unemployment benefit duration

Definition: ratio of average to initial unemployment benefit replacement rate (see above).

Source: OECD Benefits and Wages Database.

Data adjustments: data are multiplied by five in order to provide a measure in term of years.

Human capital

Definition: average years of education of the population aged between 25 and 64 years.

Source: Conway *et al.* (2006).

Population growth

Definition: Growth rate of the population aged between 15 and years.

Source: OECD Economic Outlook Database.

Investment rate

Definition: Ratio of gross fixed capital formation to GDP.

Source: OECD Economic Outlook Database.

Product market regulation

Definition: OECD summary indicator of regulatory impediments to product market competition in seven non-manufacturing industries. The data used in this paper cover regulations and market conditions in seven energy and service industries: gas, electricity, post, telecommunications (mobile and fixed services), passenger air transport, railways (passenger and freight services) and road freight.

Source: Conway *et al.* (2006).

Data adjustments: Following Bassanini and Duval (2006), data are assumed to be constant between 1970 and 1974.

Tax revenue to GDP

Definition: Tax revenue as a percentage of GDP.

Source: OECD Revenue Statistics.

Industry-level analysis

The main sources of data for all the industry-level analyses is the 60-Industry Database of the Groningen Growth and Development Centre (http://www.ggdc.net) and the OECD STAN Database. These two databases are based on similar construction principles and are, therefore, roughly comparable. The 60-Industry Groningen Database contains balanced country samples for value added, deflators, employment and hours and is therefore preferred to STAN for these variables. Data are included for the industries listed in Table 2.A1.1. Industries excluded from the analysis are agriculture, hunting, forestry and fishing, mining and quarrying, business services, public administration and defence, education, health and social work and other community, social and personal services. These industries were excluded because they include sizeable public sector employment or because it is difficult to measure their productivity accurately. The impact on the results of excluding these sectors is unknown. Such an approach, common in empirical research using industry-level data to analyse productivity, is likely to have an increasing bias on results as the share of output produced in service industries such as health and community services increases. However, at this time, updated national accounts data that accurately measure productivity in these sectors over a long time period are not available.

Table 2.A1.1. **Industries used for industry-level analysis**

International Standard Industry Classification (ISIC) (Revision 3) 2-digit code

ISIC Rev. 3	Description
15-16	Food products, beverages and tobacco manufacturing
17-19	Textiles, textile products, leather and footwear manufacturing
20	Wood and wood/cork products manufacturing
21-22	Pulp, paper and paper products manufacturing, printing and publishing
23-25	Chemical, rubber, plastics and fuel products manufacturing
26	Other non-metallic minerals manufacturing
27-28	Basic metals and fabricated metal products manufacturing
29-33	Machinery and equipment manufacturing
34-35	Transport equipment manufacturing
36-37	Manufacturing not elsewhere classified
40-41	Electricity, gas and water supply
45	Construction
50-52	Wholesale and retail trade and repairs
55	Hotels and restaurants
60-64	Transport, storage and communications services
65-67	Financial intermediation

Labour productivity

Definition: value added in volume terms (base 100 in 2000) divided by the product of average hours worked and total persons engaged.

Source: OECD calculation using Groningen Growth and Development Centre 60-Industry Database.

Employment

Definition: total persons engaged.

Source: OECD calculation using Groningen Growth and Development Centre 60-Industry Database.

Total hours worked

Definition: product of average hours worked and total persons engaged.

Source: OECD calculation using Groningen Growth and Development Centre 60-Industry Database.

Gross fixed capital formation

Definition: gross fixed capital formation in volume terms.

Source: OECD STAN Database (current and previous editions).

Capital stock

Definition: gross capital stock in volume terms.

Source: OECD STAN Database (current and previous editions).

Data adjustments: For countries, for which the capital stock was not available or industry coverage was insufficient, capital stocks were reconstructed from gross fixed capital formation using a perpetual inventory method. The iterative process is described below.

STEP 1: For each industry-by-country combination (including countries with non-missing data) it is assumed that $K_t = I_t + (1-d)K_{t-1}$, where *K* is the estimate of capital stock to be constructed, *I* is gross fixed capital formation and *d* is depreciation. This assumption implies that the capital-to-labour ratio *k* can be written as a function of the investment-to-labour ratio *i*, the growth rate of employment g_E, the depreciation rate, and the lagged value of the capital-to-labour ratio, that is: $k_t = i_t + ((1-d)/(1+g_{Et}))k_{t-1}$. In the first year, the capital-labour ratio and the investment-to-labour ratio are assumed to be in the steady state and growing at the same rate. Therefore, the capital-to-labour ratio in the first year can be written as $k_0 = (1+g_E^*)i_1/((1+g_E^*)g_I^* + d)$, where g_I, is the growth rate of the investment-to-labour ratio and * stands for steady-state values. Steady-state growth rates of the investment-to-labour ratio and employment are computed from country-by-industry averages of investment-to-labour ratio and employment growth over the sample period. Five-year moving averages are used for start and end values in order to smooth the weight of possible outliers in start and end dates. As depreciation rates are unknown, for each industry, a grid of depreciation rates is considered (covering all possible depreciation rates from 0.5% to 10%, with an increment of 0.5%). This step produces therefore 20 possible series of the capital-to-labour ratio.

STEP 2: For countries with non-missing data for capital stock, the growth rate of the observed values was regressed on the growth rate of the step 1 measures without the constant.

STEP 3: The “best” step 1 measure for each industry is selected as the one whose step 2 estimated coefficient is closest to 1, thereby more closely resembling observed series of the capital-to-labour ratio. The distance between each estimated coefficient and 1 is measure by the sum of the absolute values of the minimum and maximum of its 5% confidence interval.

STEP 4: The capital-to-labour ratios in the first year are divided by the step 2 estimated coefficient of the selected best measure, thereby increasing all initial values if the coefficient is smaller than one and increasing them if it is greater than one.

STEP 5: New series of capital-to-labour ratios are obtained from new starting values using the formula $k_t = i_t + ((1-d)/(1+g_{Et}))k_{t-1}$ and the same grid as before for depreciation rates.

Steps from 2 to 5 are then repeated until the estimated error on growth rates for the best measures becomes smaller than 0.1% – after 50 iterations, convergence is not attained only in the case of one industry (hotels and restaurants); no measure was therefore constructed for that industry. At that point the best measure of the capital-to-labour ratio is retained for countries for which the capital stock was not available or industry coverage was insufficient. However, its first five years are dropped, in order to reduce sensitivity to potential errors in starting values. Additionally, gross fixed capital formation in the Energy industry was set to missing before 1984 to reduce the influence of the second oil shock.

As a check on the quality of the procedure one can look at derived depreciation rates by industry, which indeed look plausible (Table 2.A1.2).

Table 2.A1.2. **Estimated capital stock depreciation rates**

Estimates of depreciation rates by industry obtained through
the iterative procedure used to reconstruct missing capital stocks

ISIC Rev. 3	Description	Depreciation (%)
15-16	Food products, beverages and tobacco manufacturing	4.5
17-19	Textiles, textile products, leather and footwear manufacturing	5
20	Wood and wood/cork products manufacturing	2.5
21-22	Pulp, paper and paper products manufacturing, printing and publishing	4
23-25	Chemical, rubber, plastics and fuel products manufacturing	2.5
26	Other non-metallic minerals manufacturing	3.5
27-28	Basic metals and fabricated metal products manufacturing	2.5
29-33	Machinery and equipment manufacturing	2.5
34-35	Transport equipment manufacturing	3
36-37	Manufacturing not elsewhere classified	2.5
40-41	Electricity, gas and water supply	1
45	Construction	3.5
50-52	Wholesale and retail trade and repairs	7.5
55	Hotels and restaurants	n.a.[a]
60-64	Transport, storage and communications services	3
65-67	Financial intermediation	7.5

a) not available.

Source: OECD estimates.

Employment growth

Definition: Difference between log of total employment in current year and log of total employment in previous year.

Source: OECD calculation using Groningen Growth and Development Centre 60-industry Database.

Public expenditures on active labour market policies

Definition: Public expenditures on active labour market programmes per unemployed worker as a share of GDP per capita.

Source: Bassanini and Duval (2006).

Tax wedge

Definition: tax wedge between the labour cost to the employment and the corresponding net take-home pay of the employee for a single-earner couple with two children earning 100% of average production workers earnings. The tax wedge expressed 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 include 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 no longer have to contribute to the national health insurance plan (private medical insurance is typically provided instead), thereby inducing a temporary decline in tax wedge; this issue is addressed by replacing the 2002 and 2003 observations by data obtained by linear interpolation between the 2001 and 2004 observations.

Output gap

Definition: OECD measure of the gap between actual and potential output as a percentage of potential output.

Source: OECD Economic Outlook Database.

Training

Training stock

Definition: stock of human capital per worker accumulated through training taken by full-time employees aged between 25 and 60 years.

Source: OECD calculations based on data from the European Union Labour Force Survey from 1992 to 2002.

Data adjustments: Data are reconstructed from participation rates in training in the four weeks preceding the survey using a perpetual inventory method. Training participation rates are computed only for individuals with at least 1 month of tenure at the moment of the survey to ensure that reported training was taken while working for the same employer. For each country and industry, following Dearden, Reed and Van Reenen (2006), training investments in the first year for which data are available are assumed to be in the steady state. A steady-steady annual growth rate of the training stock of 2% and a depreciation rate of 15% is also assumed. Missing data between two observations were reconstructed by assuming that training stocks grew at the steady-state rate in those years. Training stocks were calculated for Austria, Belgium, Denmark, Finland, France, Germany, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom for all available industries. Greece and Portugal were excluded from the estimation because the incidence of training participation rates equal to 0 in the sample was deemed to be abnormally high. The assumption of average growth of the training stock equal to 2% could not be rejected within this sample.

Employment protection legislation

EPL for regular contracts

Definition: OECD summary indicator of the stringency of employment protection legislation on regular contracts.

Source: OECD, Employment Outlook 2004.

EPL for temporary contracts

Definition: OECD summary indicator of restrictions on the use of temporary contracts by firms.

Source: OECD, Employment Outlook 2004.

EPL total

Definition: OECD summary indicator of the stringency of employment protection legislation incorporating both regular contracts and temporary work.

Source: OECD, Employment Outlook 2004.

Industry layoff rate

Definition: employed persons laid off as a result of the plant or company closing down or moving, insufficient work or their position or shift being abolished as a proportion of total employment in each industry. Data refer to the United States, from 2001 to 2003.

Source: OECD calculations based on January 2004 US Current Population Survey and Displaced Worker Supplement and OECD STAN global database.

Data adjustments: layoffs calculated for each of the years 2001, 2002 and 2003. Total employment for each year is estimated for January 2004 from CPS and deflated by employment growth rate between 2004 and each year. Employment growth rates are calculated using STAN database and refer to dependent employment.

Average job turnover rate

Definition: Average gross job turnover rate aggregated from establishment level data (assuming, for continuous firms, that net employment changes are equal to gross employment changes). Data refer to the United States, from 1990 to 1996.

Source: Haltiwanger, Scarpetta and Schweiger (2006).

Minimum wages

Minimum wage

Definition: Ratio of statutory minimum wage to median wage, in percent.

Source: OECD Minimum Wages Database.

Share of low-wage workers

Definition: share of wage and salary employees working at least 30 hours per week with gross monthly wages less than two-thirds of the median wage in total workers, averaged over countries.

Source: European Community Household Panel covering pre-enlargement EU countries between 1994 and 2001 with the exception of Sweden and Luxembourg.

Unemployment benefits

Average unemployment benefit replacement rate

Definition: average unemployment benefit replacement rate across two income situations (100% and 67% of APW earnings), three family situations (single, with dependent spouse, with spouse in work) and three different unemployment durations (first year, second and third years, and fourth and fifth years of unemployment).

Source: OECD Benefits and Wages Database.

Data adjustments: original data are available only for odd years. Data for even years are obtained by linear interpolation.

Employment share of entering firms surviving for one year or more

Definition: proportion of total employment in new firms in a given year that do not exit that year.

Source: OECD calculations from the OECD Firm-Level Database.

Data adjustments: equal to employment in entry firms that survive until the following year, divided by the sum of employment in entry firms and employment in firms that last one year only. Calculated as an average across countries and years using firm-level data from Germany (1993-2000), Denmark, France, UK, Italy, the Netherlands, Portugal and the United States for the years 1977-2000.

Average excess job turnover rate

Definition: difference between the average gross job turnover rate and the absolute value of the difference between job creation and job destruction rates. Data are aggregated from establishment level data (assuming, for continuous firms, that net employment changes are equal to gross employment changes). Data refer to the United States, from 1990 to 1996.

Source: Haltiwanger, Scarpetta and Schweiger (2006).

Parental leave

Weeks of unpaid parental leave

Definition: maximum number of leave weeks that can be taken by a mother for the birth of a first child as maternity leave, parental leave and childcare leave. Focus is on the most generous provisions that can be obtained, even though these may not apply to all women depending on their employment history or income. Only leave provided under national legislation is used (variations in schemes by region, province, länder, or caton are not included).

Weeks of paid maternity leave

Definition: maximum number of paid leave weeks that can be taken by a mother for the birth of a first child as maternity leave or parental leave. Focus is on the most generous provisions that can be obtained, even though these may not apply to all women depending on their employment history or income. Only leave provided under national legislation is used (variations in schemes by region, province, länder, or caton are not included). Does not include lump-sum benefits paid upon birth of a child where these are not connected to a maternity leave scheme.

Source: Gauthier and Bortnik (2001).

Data adjustments: calculated by multiplying weeks of unpaid maternity leave by the maternity leave replacement rate. Where cash benefits are paid as flat-rate benefits, they were converted into a percentage using data on the average female wage in manufacturing and the average female hours worked in manufacturing published in the ILO Yearbook of Labour Statistics.

Proportion of female employment

Definition: proportion of women in total employment by industry.

Source: OECD calculations based on data from the European Union Labour Force Survey from 1995 to 2002.

Data adjustments: total employment of women divided by total employment averaged over years for each country and then over countries for each industry. The countries included in the sample are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Switzerland, Sweden and the United Kingdom.

Tax incentives for part-time work

Definition: increase in household disposable income between a situation where the husband earns the entire household income (133% of average production worker earnings) and a situation where husband and wife share earnings (100% and 33% of average production worker earnings respectively) for a couple with two children. Denoting the first scenario by A and the second by B, the calculation is:

$$Tax\,incentives\,to\,part-time = \frac{(Household\,net\,income)_A - (Household\,net\,income)_B}{(Household\,net\,income)_A}$$

Source: OECD calculations based on OECD tax models.

Data adjustments: as this series began after 1980 for some countries, missing data prior to the first observation were replaced with the value of the variable in the first year it was available.

Public expenditure on child-care

Definition: public spending on formal day care and pre-primary school per child in 1995 PPP-US$. Data on formal day care do not include tax expenditures (*i.e.* tax allowances and tax credits for child-care expenses) unless they are refundable. Spending on pre-primary school includes both direct and indirect – *i.e.* transfers and payments to private entities – expenditure.

Source: the main sources for formal day care and pre-primary school spending are the OECD Social Expenditures Database and the OECD Education Database respectively. The target population of children for formal day care and pre-primary school is calculated using data on age of entry to primary school from the UNESCO Statistical Yearbook (various years) and data on the number of children by age category from national sources for EU countries and from the United Nations World Population Prospects 1950-2050 (the 2000 revisions, February 2001) for other countries.

Data adjustments: country-specific details are provided in Jaumotte (2004). In addition, as this series began after 1980 for some countries, missing data were extrapolated from existing data using the average growth rate of expenditures on child-care for each country over the period for which data were available.

Relative marginal tax rates on second earners

Definition: ratio of the marginal tax rate on the second earner to the tax wedge for a single-earner couple with two children earning 100% of APW earnings (see definition of the "labour tax wedge" above). The marginal tax rate on the second earner is in turn defined as the share of the wife's earnings which goes into paying additional household taxes:

$$Tax\,2nd\,earner = 1 - \frac{(Household\ Net\ Income)_B - (Household\ Net\ Income)_A}{(Household\ Gross\ Income)_B - (Household\ Gross\ Income)_A}$$

where A denotes the situation in which the wife does not earn any income and B denotes the situation in which the wife's gross earnings are X%of APW. Two different tax rates are calculated, depending on whether the wife is assumed to work full-time (X = 67%) or part-time (X = 33%). In all cases it is assumed that the husband earns 100% of APW and that the couple has two children. The difference between gross and net income includes income taxes, employee's social security contribution, and universal cash benefits. Means-tested benefits based on household income are not included (apart from some child benefits that vary with income) due to lack of time-series information. However, such benefits are usually less relevant at levels of household income above 100% of APW.

Source: OECD calculations based on OECD tax models.

Data adjustments: as this series began after 1980 for some countries, missing data prior to the first observation were replaced with the value of the variable in the first year it was available.

Female education

Definition: number of years of education of female population aged 25 years and over.

Source: Barro and Lee (2000).

ANNEX 2.A2. INDUSTRY-LEVEL EMPIRICAL SPECIFICATIONS

Training

The elasticity of multi-factor productivity (MFP) to the stock of human capital accumulated through workplace training, reported in Section 1.2, is estimated by fitting the following augmented production function:

$$\log y_{ijt} = \delta \log k_{ijt} + \beta \log T_{ijt} + \mu_{ij} + \chi_{it} + \varepsilon_{ijt} \qquad [1]$$

where y is labour productivity, k is the capital-labour ratio, T is the training stock per worker, i, j, and t index country, industry and time respectively, and Greek letters represent coefficients or disturbances. This specification departs from existing industry-level estimates where training stocks are computed on the basis of training participation rates (Barrett and O'Connell, 2001; Dearden, Reed and van Reenen, 2005; Conti, 2005), insofar as training stocks are specified in logarithms rather than in absolute levels. Yet, specifications including level training stocks are justified in the literature under the unrealistic assumption that workers can be divided into two homogeneous groups (trained and untrained). By contrast, if human capital is thought to be a continuous variable, with training participation rates indicating the frequency of human capital investments, a logarithmic specification appears to be more reasonable (see *e.g.* Ballot, Fakhfakh and Taymaz, 2001, 2006, who use training stocks computed from continuous measures of training investment).

Equations are estimated using OLS and system GMM, where training and capital stocks are treated as endogenous variables (Table 2.A3.1 and Table 2.A3.2). In OLS specifications, fixed effects are included to capture two-dimensional disturbances. System GMM estimators use (appropriately) lagged levels of endogenous explanatory variables as instruments for their current variation as well as lagged differences as instruments for their current levels (see *e.g.* Blundell and Bond, 1998). In specifications estimated by GMM, each variable is demeaned by subtracting its country-by-time means in order to control for country-by-time effects without incurring the risk of having a number of instruments greater than the number of panels.

Augmented production functions such as [1] were estimated on comparable cross-country data on training and productivity for European countries. Training stock data are reconstructed from training participation rates from the 1992 to 2002 waves of the European Labour Force Survey for Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Spain, Sweden and the United Kingdom (see Annex 2.A1 for details on the construction method). These were matched with data from the OECD STAN Database and the Groningen Growth and Development Centre 60-Industry Database on productivity and capital stock at the industry-level. Due to data availability, not all years or industries are included in the estimation sample (see Annex 2.A1 for more details on data and sources). In the case of GMM, due to the demeaning procedure (see above), for each country the sample was reduced to the same number of industry in each year. For this reason, the sample size was too small to estimate [1] on construction and service industries only.

Difference-in-difference analysis

General specification

The specification used in the difference-in-difference models reported in Section 3 is based on a number of assumptions. First, a particular policy (*POL*) has an impact on MFP and/or MFP growth. Second, the effect is greater in industries where the policy is more likely to be binding (hereafter called policy-binding industries). If industries can be split into two groups, policy-binding industries and other industries, then the difference between MFP growth in policy-binding industries and other industries can be modelled as a function of the policy:

$$\overline{\Delta \log MFP_{it}^{b}} - \overline{\Delta \log MFP_{it}^{nb}} = f(POL_{it}, \Delta POL_{it}) \qquad [2]$$

where *i* stands for countries and *t* for time, while the bar indicates an average over different industries. In other words the group of other industries (*nb*) are used as a control for the treated group (policy-binding industries (*b*)). The analysis is marginally more complex than standard treatment-control since observations in the treated group do not receive the same amount of treatment. If *f* is linear in *POL* and ΔPOL, [2] can be estimated in differences using the following specification:

$$\Delta \log MFP_{ijt} = \beta I_{bj} \Delta POL_{it} + \gamma I_{bj} POL_{it} + \delta I_{bj} + \eta_{it} + \upsilon_{ijt} \qquad [3]$$

where I_b is the indicator function of the set of policy-binding industries *j* and Greek letters represent either coefficients or disturbances. Alternatively, [2] can be estimated using a specification in levels such as:

$$\log MFP_{ijt} = \beta I_{bj} POL_{it} + \gamma I_{bj} \sum_{k=0}^{t} POL_{ik} + \delta I_{bj} t + \mu_{ij} + \chi_{it} + \varepsilon_{ijt} \qquad [4]$$

where Greek letters represent either coefficients or disturbances. In fact, one can obtain [3] by simply first-differencing [4] and setting $\eta_{it} = \chi_{it} - \chi_{it-1}$ and $\upsilon_{ijt} = \varepsilon_{ijt} - \varepsilon_{ijt-1}$. The advantage of [4] with respect to [3] is that it can better capture lagged effect of independent variables on productivity. Insofar as long-run effects are the object of analysis, only specifications derived from [4] are considered in this chapter.

To the extent that industries might be in different stages of their life-cycle, [4] can be augmented by including a full system of two-dimensional disturbances:

$$\log MFP_{ijt} = \beta I_{bj} POL_{it} + \gamma I_{bj} \sum_{k=0}^{t} POL_{ik} + \delta I_{bj} t + \mu_{ij} + \chi_{it} + \varsigma_{jt} + \varepsilon_{ijt} \qquad [5]$$

Without using a dynamic model, in which minor specification errors could lead to serious inconsistency problems, or a structural model, which would require cross-country data on MFP at an industry-level which are only available until the mid-1990s, it is difficult to accurately estimate a specification that incorporates both growth and level effects of policy variables on MFP. In the models estimated in this chapter, policy variables are assumed to have an impact either on growth only (that is $\partial f/\partial \Delta POL$=0 in [2]) or on efficiency only (that is $\partial f/\partial$POL=0 in [2]), based on the predictions of the existing theoretical literature. So equation [4] is appropriate subject to the restrictions $\beta = 0$ (for growth only) or $\gamma = 0$ (for levels only). Hereafter, estimates of β or γ will be referred to as the "level effect" and the "growth effect", respectively, of the policy *POL*. Models incorporating both a growth and level effect are estimated for model selection purposes only where the theoretical literature does not provide unambiguous guidance.

In the absence of recent cross-country, industry-level MFP data, a Cobb-Douglas production function with constant returns to scale is assumed and [5] is estimated using:

$$\log y_{ijt} = \delta \log k_{ijt} + \beta I_b POL_{it} + \gamma I_{bj} \sum_{k=0}^{t} POL_{ik} + \mu_{ij} + \chi_{it} + \varsigma_{jt} + \varepsilon_{ijt} \qquad [6]$$

where y is labour productivity, and k is the capital-labour ratio, subject to the restrictions $\beta = 0$ or $\gamma = 0$, depending on the policy under examination. [6] is the baseline specification whose results are reported in Section 2.

Assuming that other factors might affect MFP, [6] can be estimated as:

$$\begin{aligned} \log y_{ijt} = \delta \log k_{ijt} + \beta I_b POL_{it} + \gamma I_{bj} \sum_{k=0}^{t} POL_{ik} + \sum\nolimits_m \gamma_m CNTRL1_{ijt}^{m} + \\ + I_{bj} \sum\nolimits_n \gamma_n CNTRL2_{ijt}^{n} + \mu_{ij} + \chi_{it} + \varsigma_{jt} + \varepsilon_{ijt} \end{aligned} \qquad [7]$$

where m indexes control variables (*CNTRL*1) that affect MFP in all industries, and n indexes control variables (*CNTRL*2) that affect MFP more in policy-binding industries than in other industries.

In order to estimate the impact of policies on labour productivity, the same framework as above is applied. As a consequence, specifications [6] and [7] are estimated by omitting the capital-labour ratio.

All equations are estimated using OLS, including fixed effects to capture two-dimensional disturbances.

Employment protection

The baseline model uses a cardinal index of EPL for regular contracts (see Annex 2.A1 for details on data and sources). An alternative measure of EPL for temporary contracts and an overall measure of EPL stringency are used to test the sensitivity of the baseline results (see Table 2.A3.5).

The sample used for the analysis of EPL covers 18 OECD countries over the years 1982 to 2003. The countries included in the sample are Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, the United Kingdom and the United States. Due to data availability, not all years or industries are included in the estimation sample for MFP for every country.

EPL-binding industries are identified in the baseline model based on layoff rates for the United States as a proxy for underlying layoff propensities (see Annex 2.A1 for details on data and sources). Layoff rates in a particularly country are likely to be influenced by prevailing EPL: industries that would have high layoff rates in the absence of EPL might record low layoff rates in countries where firing costs are very high. Using layoff rates for the United States (where EPL is weak) reduces the likelihood that the indicator for EPL-binding industries is correlated with the variable of interest (EPL). For the baseline specification, EPL-binding industries are defined as those where the layoff rate is above the average layoff rate for all industries in each of the three years 2001 to 2003. Some alternative measures based on US layoff rates and US average job turnover rates are used as a sensitivity test (see Table 2.A3.7 for details of the measures used and results of the sensitivity tests). A potential problem with using US layoff rates as a measure of underlying layoff propensity is that unemployment insurance premia in the United States are, in part, dependent on the risk of future layoff. It is possible that, despite very weak EPL, this imposes an additional cost for firing workers in high layoff industries, acting as quasi-EPL in these industries. It is not clear what impact this could have on the results. However, sensitivity testing to the use of alternative indicators for EPL-binding industries based on turnover shows that the baseline results are relatively robust.

Measures based on US average job turnover rates have the advantage that: a) they are more appropriate in the case of temporary contracts; and b) it has been shown that they explain an extremely large fraction of cross-country/cross-industry variation in job turnover rates within OECD countries (Haltiwanger, Scarpetta and Schweiger, 2006). In other words, the cross-industry distribution of US job turnover rates closely resembles the cross-industry distribution of turnover rates of any other country except for at worst a scale factor. The latter observation suggests the possibility of constructing quantitative rather than qualitative indicators of the degree to which EPL is binding. In the case of one of the sensitivity analyses, therefore, US average job turnover rates, computed at the industry level, have been substituted for the indicator variable for the set of EPL-binding industries (see Table 2.A3.5, Panel B). The disadvantage of measures based on job turnover rates is that they tend to have high value in industries characterised by a high share of hires and/or voluntary quits in total turnover. To minimise biases stemming from this source, separate country-by-time dummies for downsizing or constant industries (manufacturing and energy) and upsizing industries (services and construction) are included in all specifications with job turnover measures.

Various controls were included to test the sensitivity of the baseline results (see Table 2.A3.4 for results). Employment growth was included in the specification assuming that it affects productivity in all industries. All other control variables entered the specification multiplied by the EPL-binding indicator, assuming a greater impact on productivity in EPL-binding industries than in other industries. These controls include the aggregate index of stringency of anti-competitive product market regulation (PMR) and the average unemployment benefit replacement rate (ARR). Both are specified in such a way that their coefficients capture "growth effects" (that is using a cumulative indicator interacted with the EPL-binding industry dummy). In the case of ARR, it has also been specified in such a way that their coefficients capture a "level effect".

It has been argued that high statutory or contractual employment protection might act as a signalling device to workers about firm commitment, increasing worker effort or incentives to invest in firm-specific human capital (Soskice, 1997). If this is the case, firing regulations might have less negative effect in industries characterised by cumulative technologies, where innovation relies heavily on internal know-how and where, therefore, specific human capital is more important. Using the taxonomy for manufacturing developed by Bassanini and Ernst (2002), difference-in-difference models were estimated separately for cumulative (machinery and transport equipment) and non-cumulative (all other manufacturing) industries (see Table 2.A3.6 for results). Yet, no evidence of a smaller effect of EPL on productivity was found in cumulative industries.

Estimates of the overall impact on EPL of productivity shown in Figure 2.4 were derived from the baseline specification by multiplying the estimated coefficient on EPL by GDP in EPL-binding industries as a proportion of total GDP in 2002, averaged over the countries included in the sample.

Minimum wages

Minimum wages are measured as the ratio of the statutory minimum wage to median earnings. The analysis of minimum wages uses a sample of 11 OECD countries over the years from 1979 to 2003. The countries included in the sample are Belgium, Canada, France, Greece, Ireland, Japan, the Netherlands, Portugal, Spain, the United Kingdom and the United States. Data for the United Kingdom and Ireland are from 2000 to 2003, following the introduction of a statutory minimum wage in 1999-2000 in these countries. Due to data availability, not all years or industries are included in the estimation sample for MFP for every country (see Annex 2.A1 for full details on data and sources).

The ratio of the minimum wage to median earnings used in the analysis could be endogenous, due to the pro-cyclical nature of both productivity and median wages. The baseline specification was estimated using both OLS and instrumental variables (IV) approaches. The logarithm of the real minimum wage in 2000 US dollars PPP as an instrument for the ratio of the minimum wage to median earnings (see Table 2.A3.8 for results). For the baseline specification, a Hausman test for endogeneity (see *e.g.* Wooldridge, 2002) rejected the hypothesis that the ratio of the minimum wage to median earnings is exogenous, so IV estimates are preferred and consistently conclusions are drawn only from them.

The estimation is based on the assumption that changes in minimum wages have a greater impact on productivity in industries that are more heavily reliant on low-wage workers. For the model to produce unbiased estimates, the measure used to identify low-wage industries must be uncorrelated with the measure of the minimum wage. It is possible that changes in minimum wages could have an impact on the incidence of low-wage workers in particular industries. In countries where statutory minimum wages are very high, firms might shift towards capital and skill-intensive technologies in specific industries where this is technically feasible, reducing their incidence of low-wage workers. In order to overcome this potential source of endogeneity, an indicator for low-wage industries was developed based on the incidence of low-wage workers by industry in the United Kingdom prior to the introduction of the minimum wage in that country in 1999. Data are from the British Household Panel Survey (BHPS) component of the European Community Household Panel (ECHP) for the years from 1994 to 1999. An industry is defined to be low-wage if its average proportion of low-wage workers between 1994 and 1999 was above the cross-industry median over the same period. A number of alternative indicator variables were also tested (based on data on low-wage workers averaged across all countries included in the ECHP) (see Table 2.A3.11).

The baseline results assume that factors other than minimum wages have the same impact on productivity in low-wage and other industries. To test the sensitivity of the baseline results to this assumption, the baseline specification was augmented with a number of policy and economic variables. (see Table 2.A3.10). Overall, the baseline results are relatively robust to the inclusion of control variables. In all but one of the specifications tested, the coefficients on minimum wages remained positive and statistically significant after including controls.

Previous OECD research (see OECD, 2006a) shows that minimum wages can influence the way in which the tax wedge affects unemployment. Higher minimum wages make it more difficult for employers to pass on tax increases to workers, reducing demand for labour. If minimum wages intensify the negative effect of taxes on employment, resulting lower employment rates could induce higher levels of productivity through a composition effect. In this way, the estimated positive impact of minimum wages on productivity could simply be a result of their amplifying the effect of taxes on employment. In order to test this hypothesis, the tax wedge was included separately (Table 2.A3.10, columns 1 and 8) and interacted with the minimum wage variable (columns 2 and 9). The coefficient on the interaction term was not statistically significant and the inclusion of the tax wedge appears to make little difference to the estimated coefficients on minimum wages.

The higher the minimum wage relative to the unemployment benefit replacement rate, the greater the opportunity cost of remaining unemployed. If minimum wages increase productivity by reducing demand for unskilled labour and providing incentives for low-skilled workers to invest in training to avoid unemployment, high replacement rates could dull this effect by reducing the opportunity cost of remaining unemployed. To test this hypothesis, the average unemployment benefit replacement rate was included as a control variable both individually (columns 3 and 10) and interacted with minimum wages (columns 4 and 11). The coefficient on the replacement rate is positive and statistically significant, and its inclusion reduces the size of the coefficient on minimum wages. The coefficient on the interaction term is negative, but only statistically significant in the MFP estimation. This provides qualified support for the hypothesis that high replacement rates reduce the positive impact of minimum wages on productivity, although the result does not hold for the full estimation sample for labour productivity.

Estimates of the overall impact of minimum wages on productivity shown in Figure 2.5 were derived from the baseline specification by multiplying the estimated coefficient on minimum wages by GDP in low-wage industries as a proportion of total GDP in 2002, averaged over the countries included in the sample.

Unemployment benefits

The estimation of the effect of unemployment benefits (measured as the average gross replacement rate) on productivity in so-called "risky industries" uses a sample of 18 OECD countries over the years from 1979 to 2003. The sample includes Austria, Belgium, Canada, Germany, Denmark, Spain, Finland, France, the UK, Greece, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Sweden and the United States. Due to data availability, not all years or industries are included in the estimation sample for MFP for every country (see Annex 2.A1 for details on data and sources).

Risky industries are industries where new jobs are more likely to be destroyed. Intuitively, risky industries should be characterised by high rates of creation and destruction of new jobs. It is possible to proxy this concept by looking at job creation by entering firms and job destruction due to exit of recently entered firms, both obtained from the OECD firm-level database (see Annex 2.A1). An industry can be considered to be riskier, the higher the share of its firms that only survive one year in total industry employment, which in turn is equal to the job creation rate due to entrant firms that do not survive one year. For the purpose of the econometric analysis, a dummy variable for risky industries is constructed on the basis of this indicator. This dummy takes value one when the share of firms that only survive for one year in total employment is above the average for all industries and zero otherwise. The indicator is calculated as an average across countries and years using firm-level data from Germany (1993 and later), Denmark, France, UK, Italy, the Netherlands, Portugal and the United States for the years 1977-2000.

This indicator has the disadvantage of not considering job creation and destruction in incumbent firms. An alternative measure could be constructed by using job turnover data (see Annex 2.A1) However, standard job turnover data (computed using a methodology similar to Davis, Haltiwanger and Schuh, 1996) have the disadvantage that they do not track destruction of newly created jobs. For instance, an indicator of turnover would not serve the purpose because fast but steadily expanding or contracting industries can have high turnover without necessarily being high-risk industries. Indicators of excess job turnover, although more appropriate, suffer from the same problem whenever industries are composed of many sub-industries, some of which might be steadily growing or contracting. Nevertheless, the baseline results were replicated using a measure of excess job turnover for the United States (see Annex 2.A1), where risky industries were defined as those with excess job turnover rates above the average for all industries. The results (not reported) are almost identical to the baseline results reported in Table 2.A3.14.

The estimation is complicated by the interaction between unemployment benefits and job tenure: more generous unemployment benefits are associated with matches that last longer and therefore longer job tenure. However, risky industries are likely to have shorter job tenure than non-risky industries. Although it is not obvious whether, as a result of more generous unemployment benefits, longer-living tenure matches will occur more frequently in industries characterised by high or low tenure, this effect might act as a confounding factor. In order to control for it, the interaction between the industry average of years of tenure and the average replacement rate was included as a control in all specifications. Additionally, as a sensitivity test, a stratified mean-group estimator was derived: the sample was broken into three groups of industries on the basis of similar average tenure (excluding industries with too extreme values for average tenure); after checking that productivity comparisons within each group were not dependent on the interaction between average tenure and average replacement rates, a separate estimate was obtained for each group; the overall effect was then derived by averaging group-specific estimates. The results are similar to the baseline results that control for tenure (see Table 2.A3.15 for results).

Various controls were included to test the sensitivity of the baseline results (see Table 2.A3.14 for results). Employment growth was included in the specification assuming that it affects productivity in all industries. All other control variables (EPL, PMR and tax wedge) entered the specification multiplied by the risky industry indicator, assuming a greater impact on productivity in risky industries than in other industries.

The baseline model for labour productivity was re-estimated using a more disaggregated measure of risky industries, which increased the sample size from 16 to 22 industries. Unfortunately, capital stock data were not available at this level of disaggregation, so re-estimating the results for MFP were not possible. The results for labour productivity are broadly consistent with the baseline results. The coefficients on the level effect of unemployment benefits are slightly smaller, but still statistically significant. There appears to be no statistically significant effect of unemployment benefits on labour productivity growth using this specification (see Table 2.A3.16 for results).

Parental leave

The analysis of parental leave is based on the assumption that parental leave will have a greater impact on productivity in industries where employment is female-dominated. Two policy measures are used: total weeks of legislated unpaid parental leave including child-care leave; and total weeks of legislated paid maternity leave, estimated at average manufacturing worker wages (see Annex 2.A1 for details on data and sources). A number of alternative specifications were tested to allow for non-linearity in the relationship between parental leave and productivity. The log specification appears to fit the data best for both paid and unpaid leave. There was no consistent evidence of a quadratic relationship (see Table 2.A3.17 for details). Specifications allowing the coefficient on leave to vary between long and short periods of leave or introducing leave as a series of dummy variables did not produce convincing results, probably due to the lack of variability in leave periods over time within most countries. These results are not reported.

The analysis uses a sample of 18 OECD countries over the period 1980-1999 (1999 is the latest year for which comparable data on parental leave are available). The countries used for the estimation are Austria, Belgium, Canada, Denmark, Finland, France, Germany (1991-1999), Ireland, Italy, Japan, Norway, the Netherlands, Spain, Sweden, the United Kingdom and the United States. Greece and Portugal were also included in the sample for labour productivity. Due to data availability, not all years or industries are included in the estimation sample for MFP for every country. Data for the year 1979 were excluded from the sample because the results were overly sensitive to an increase from 14 to 162 weeks in unpaid parental leave in Spain between 1979 and 1980.

For the model to produce unbiased estimates, the measure used to identify female-dominated industries must be uncorrelated with the measure of parental leave. It is possible that changes in parental leave policy could have an impact on whether particular industries are female-dominated. For example, very long periods of parental leave might impose high non-wages costs on businesses, such as the cost of replacing employees on parental leave or retraining employees returning from parental leave. In countries where mandated parental leave is very long, industries where these costs are high (for example, industries where skills depreciate rapidly when employees are on leave) might be less inclined to employ women in order to avoid these costs, making them less likely to be female-dominated than in the absence of long periods of mandated leave. In order to overcome this possible relationship, an indicator for female-dominated industries was developed by averaging the proportion of women employed in each industry over the years from 1995 to 2002 and over a sample of European countries from the European Labour Force Survey. An industry is classified as female-dominated if the proportion of women employed in that industry is higher than the proportion of women employed across the whole economy (see Annex 2.A1 for details on data and sources). An alternative indicator of female-dominated industries was derived using data on the proportion of women in white-collar occupations. However, using this measure, exactly the same industries were classified as female-dominated as using proportion of women in total employment.

The availability of the female-dominated industry indicator variable at a disaggregated level allowed the results for labour productivity to be estimated using data at a 2-digit ISIC level for 37 industries (capital stock is not available at this level of aggregation, and therefore the impact on MFP was not re-estimated), increasing the sample size and increasing the accuracy with which industries are classified as female dominated. (For example, in the baseline analysis, wholesale and retail trade are grouped together and classified as female-dominated. In the disaggregated analysis, the industries are treated separately. Retail trade is classified as female-dominated, but not wholesale trade.) The results are not substantially different from those for the baseline (see Table 2.A3.18 for results).

Various controls were included to test the sensitivity of the baseline results (see Tables 2.A3.19 and 2.A3.20 for results). Employment growth was included in the specification assuming that it affects productivity in all industries. All other control variables entered the specification multiplied by the female-dominated industry indicator, assuming a greater impact on productivity in female-dominated industries than in other industries. The control variables were included to take into account other policy settings that potentially affect women's labour force attachment. These were tax incentives (the overall tax wedge, tax incentives to work part-time and relative marginal tax rate on second earners), public expenditure on child-care, female education rates, the average unemployment benefit replacement rate and product market regulation (see Annex 2.A1 for details on data and sources).

Estimates of the overall impact of parental leave on productivity shown in Figure 2.7 were derived from the baseline specification by multiplying the estimated coefficient on minimum wages by GDP in female-dominated industries as a proportion of total GDP in 1999, averaged over the countries included in the sample.

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Working Party on Employment

MORE JOBS BUT LESS PRODUCTIVE?
THE IMPACT OF LABOUR MARKET POLICIES ON PRODUCTIVITY
ANNEXES 3 & 4

29-30 March 2007

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ANNEX 2.A3. DETAILED EMPIRICAL RESULTS

Training

Table 2.A3.1. **Impact of employee training on MFP[a] – OLS estimates**

	Total business industries		Manufacturing and utilities		Construction and services	
Training	0.036	[2.49]**	0.036	[2.36]**	0.033	[1.03]
Capital stock	0.255	[6.99]***	0.252	[5.95]***	0.268	[4.59]***
Country x year dummies	yes		yes		yes	
Country x year x service industry dummies	yes		yes		yes	
Country x industry dummies	yes		yes		yes	
Industry x year dummies	yes		no		yes	
Observations	1585		1065		520	
R-squared	1		1		1	

MFP: multi-factor productivity; OLS: ordinary least squares.
Robust t-statistics in brackets. ** significant at 5%; *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. Training is the logarithm of training stock per worker. Capital stock is the logarithm of the capital-to-labour ratio. For each country i and year t, the corresponding country x year x service industry dummies take value 1 in construction and services and 0 elsewhere. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.2. **Impact of employee training on MFP[a] – GMM estimates[b]**

	Total business industries		Manufacturing and utilities	
Training	0.144	[1.72]*	0.130	[1.76]*
Capital stock	0.229	[2.16]**	0.262	[2.89]***
Country x year dummies	yes		yes	
Country x year x service industry dummies	yes		yes	
Country x industry dummies	no		no	
Industry x year dummies	no		no	
Industry dummies	yes		yes	
Hansen-Sargab test (P-value)	0.312		0.307	
Arellano-Bond AR1 test	-3.5		-3.45	
Arellano-Bond AR2 test	-0.22		-0.49	
Observations	1055		685	

MFP: multi-factor productivity; GMM: One-step system generalised method of moments.
Robust t-statistics in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. Training is the logarithm of training stock per worker. Capital stock is the logarithm of the capital-to-labour ratio. See Annex 2.A1 for details on data and sources.
b) The error term in the GMM specification is modelled as an ARMA process with up to an AR(2) component (choice made on diagnostics). Productivity, capital stock and training are treated as endogenous variables. The common factor restriction is not imposed. Only long-run effects are presented. In order to control for country by time by manufacturing/service effects, each variable is demeaned by subtracting its country by time by manufacturing/service means. Productivity capital stock and training dated *t-a*-1 to *t-a*-3 (where *a* is sum of the orders of the AR and MA components) are used as instruments in the difference equation. The Hansen-Sargan statistic provides a test of overidentifying restrictions. The model is rejected if the statistic is significant. Arellano-Bond statistics test the autocorrelation of the first difference of the residuals at order 1 and 2 and are normally distributed under the null. The model is rejected if evidence of autocorrelation is found at order 2.

Source: OECD estimates.

Employment protection legislation

Table 2.A3.3. **Effect of EPL on MFP and labour productivity[a] – baseline and model selection**

Results from OLS estimation of difference-in-difference models

	MFP with level effect		MFP with growth effect		MFP with level and growth effect		Labour productivity with level effect		Labour productivity with growth effect		Labour productivity with level and growth effect	
Level effect of EPL	0.053	[2.82]***			0.013	[0.65]	0.042	[2.16]**			0.018	[0.95]
Growth effect of EPL			-0.003	[4.58]***	-0.003	[4.05]***			-0.001	[2.35]**	-0.001	[1.88]*
Capital stock	0.217	[11.22]***	0.224	[11.66]***	0.223	[11.50]***						
Country x year dummies	yes		yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes		yes	
Observations	4168		4168		4168		6064		6064		6064	
R-squared	1		1		1		1		1		1	

MFP: multi-factor productivity; EPL: employment protection legislation; OLS: ordinary least squares.
Robust t-statistics in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of EPL between binding and non-binding industries. Binding industries are those where the layoff rate is above the average layoff rate for all industries for each year from 2001 to 2003. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.4. **Effect of EPL on MFP and labour productivity growth[a] – sensitivity to inclusion of controls**

Results from OLS estimation of difference-in-difference models

Panel A. MFP

	Baseline + employment growth		Baseline + level effect of ARR		Baseline + growth effect of ARR		Baseline + PMR		Baseline + employment growth, PMR and level effect of ARR		Baseline + employment growth, PMR and growth effect of ARR		Baseline + PMR + interaction between EPL and PMR	
Growth effect of EPL	-0.003	[4.68]***	-0.003	[4.44]***	-0.003	[5.25]***	-0.003	[4.96]***	-0.003	[4.97]***	-0.003	[5.28]***	-0.003	[3.56]***
Capital stock	0.236	[11.94]***	0.225	[11.70]***	0.223	[11.63]***	0.226	[11.75]***	0.238	[12.02]***	0.237	[11.99]***	0.226	[11.72]***
Country x year dummies	yes		yes		yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes		yes		yes	
Observations	4136		4168		4168		4168		4136		4136		4168	
R-squared	1		1		1		1		1		1		1	

Panel B. Labour productivity

	Baseline + employment growth		Baseline + level effect of ARR		Baseline + growth effect of ARR		Baseline + PMR		Baseline + employment growth, PMR and level effect of ARR		Baseline + employment growth, PMR and growth effect of ARR		Baseline + PMR + interaction between EPL and PMR	
Growth effect of EPL	-0.001	[2.39]**	-0.001	[2.05]**	-0.002	[3.28]***	-0.002	[2.74]***	-0.002	[2.64]***	-0.002	[3.11]***	-0.002	[2.49]**
Country x year dummies	yes		yes		yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes		yes		yes	
Observations	6016		6064		6064		6064		6016		6016		6064	
R-squared	1		1		1		1		1		1		1	

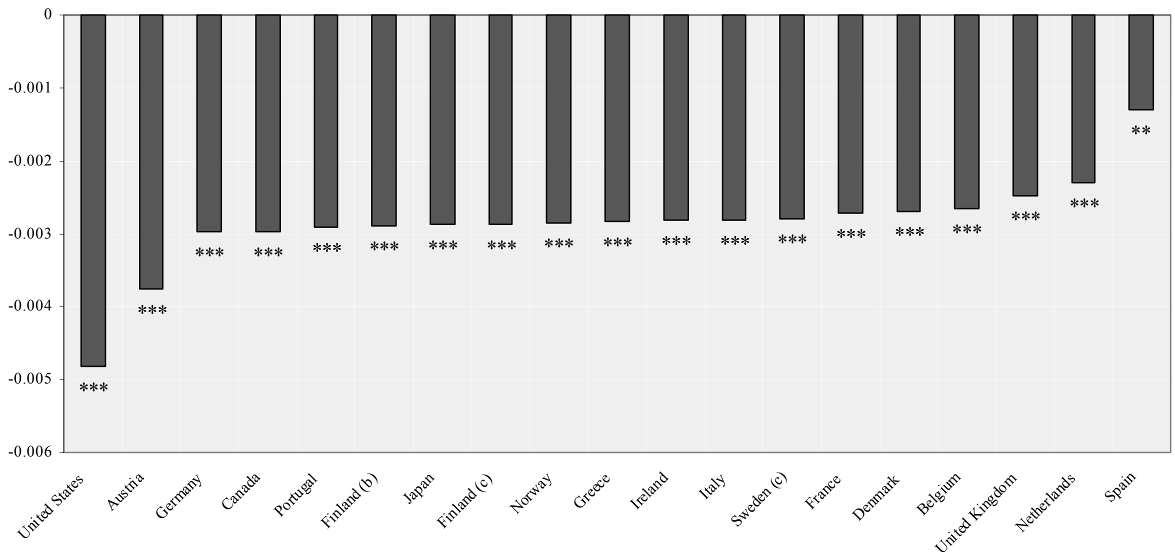
MFP: multi-factor productivity; EPL: employment protection legislation; PMR: product market regulation; ARR: average replacement rate; OLS: ordinary least squares.
Robust t-statistics in brackets. ** significant at 5%; *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of EPL between binding and non-binding industries. Binding industries are those where the layoff rate is above the average layoff rate for all industries for each year from 2001 to 2003. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

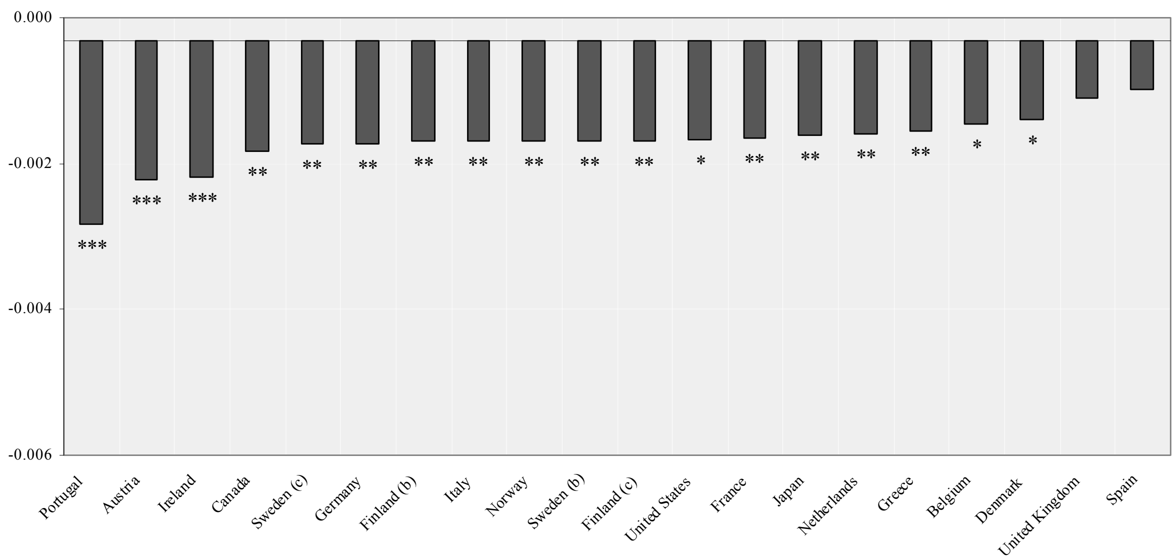
Figure 2.A3.1. **Effect of EPL on MFP and labour productivity growth[a] – sensitivity to countries in sample**

Coefficient on growth effect of EPL from OLS estimation of difference-in-difference models when countries are excluded one-by-one from the sample

Panel A. MFP



Panel B. Labour productivity



MFP: multi-factor productivity; EPL: employment protection legislation; OLS: ordinary least squares.
* significant at 10%; ** significant at 5%; *** significant at 1%.
a) The chart reports the relative effect of EPL between binding and non-binding industries obtained by excluding groups (country and country by period in the case of Sweden and Finland) one-by-one. Excluded groups are reported in the label of each bar. Binding industries are those where the layoff rate is above the average layoff rate for all industries for each year from 2001 to 2003. The benchmark specifications correspond to results reported in Table 2.A3.3, Columns 2 and 5. See Annex 2.A1 for details on data and sources.
b) 1982-1990.
c) 1993-2003.
d) Groups are in order of magnitude of coefficients.

Source: OECD estimates.

Table 2.A3.5. **Effect of EPL on MFP and labour productivity growth[a] – sensitivity to measures of EPL**

Results from OLS estimation of difference-in-difference models

Panel A. Layoff 1[b] used as binding indicator

	MFP with EPL total		MFP with EPL regular, temporary and interaction between regular and temporary		MFP with EPL regular and temporary	
EPL total	-0.001	[2.02]**				
EPL regular			-0.004	[6.22]***	-0.003	[4.87]***
EPL temporary			-0.001	[2.35]**	0.001	[1.76]*
EPL regular x temporary			-0.003	[5.34]***		
Capital stock	0.232	[11.00]***	0.225	[10.63]***	0.237	[11.26]***
Country x year dummies	yes		yes		yes	
Country x year x service industry dummies	yes		yes		yes	
Country x industry dummies	yes		yes		yes	
Industry x year dummies	yes		yes		yes	
Observations	3912		3912		3912	
R-squared	1		1		1	

Panel B. Turnover 1[c] used as binding indicator

	MFP with EPL total		MFP with EPL regular, temporary and interaction between regular and temporary		MFP with EPL regular and temporary	
EPL total	-0.015	[2.65]***				
EPL regular			-0.008	[1.36]	-0.008	[1.34]
EPL temporary			-0.009	[1.80]*	-0.008	[1.87]*
EPL regular x temporary			-0.003	[0.52]		
Capital stock	0.234	[11.00]***	0.234	[10.84]***	0.235	[10.85]***
Country x year dummies	yes		yes		yes	
Country x year x service industry dummies	yes		yes		yes	
Country x industry dummies	yes		yes		yes	
Industry x year dummies	yes		yes		yes	
Observations	3912		3912		3912	
R-squared	1		1		1	

Table 2.A3.5. **Effect of EPL on MFP and labour productivity growth – sensitivity to measures of EPL (cont'd)**

Panel C. Turnover 2[d] used as binding indicator

	MFP with EPL total		MFP with EPL regular, temporary and interaction between regular and temporary		MFP with EPL regular and temporary	
EPL total	-0.002	[2.26]**				
EPL regular			-0.002	[2.86]***	-0.002	[2.67]***
EPL temporary			-0.001	[1.20]	0.000	[0.48]
EPL regular x temporary			-0.001	[1.40]		
Capital stock	0.237	[11.33]***	0.243	[11.20]***	0.245	[11.36]***
Country x year dummies	yes		yes		yes	
Country x year x service industry dummies	yes		yes		yes	
Country x industry dummies	yes		yes		yes	
Industry x year dummies	yes		yes		yes	
Observations	3912		3912		3912	
R-squared	1		1		1	

MFP: multi-factor productivity; EPL: employment protection legislation; OLS: ordinary least squares. See Annex 2.A1 for full description of EPL variables.
Robust t-statistics in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of EPL between binding and non-binding industries. See Annex 2.A1 for details on data and sources.
b) Layoff 1: binding industries are those where the layoff rate is above the average layoff rate for all industries for each year from 2001 to 2003.
c) Turnover 1: The reported coefficient corresponds to the interaction of the average job turnover rate over the period 1990 to 1996 with the EPL variables. The growth effect of EPL for each industry can be obtained by multiplying the reported coefficient by the industry average of job turnover (at the sample average job turnover is equal to 0.19).
d) Turnover 2: binding industries are those where the average job turnover rate over the period 1990 to 1996 is above the average job turnover rate for all industries over the period from 1990 to 1996.

Source: OECD estimates.

Table 2.A3.6. **Effect of EPL on MFP and labour productivity growth[a] – sensitivity to changes in industries**

Results from OLS estimation of difference-in-difference models

	MFP manufacturing		MFP cumulative		MFP non-cumulative		Labour productivity manufacturing		Labour productivity cumulative		Labour productivity non-cumulative	
Growth effect of EPL	-0.004	[5.39]***	-0.010	[5.86]***	-0.002	[3.22]***	-0.002	[2.93]***	-0.014	[9.85]***	0.000	[0.27]
Capital stock	0.183	[7.27]***	0.264	[2.95]***	0.241	[7.75]***						
Country x year dummies	yes		yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes		yes	
Observations	2649		550		2099		3790		758		3032	
R-squared	1		1		1		1		1		1	

MFP: multi-factor productivity; EPL: employment protection legislation; OLS: ordinary least squares.
Robust t-statistics in brackets. *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of EPL between binding and non-binding industries. Binding industries are those where the layoff rate is above the average layoff rate for all industries for each year from 2001 to 2003. Cumulative industries are machinery and transport equipment manufacturing. Non-cumulative industries are all other manufacturing industries. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.7. **Effect of EPL on MFP growth[a] – sensitivity to EPL-binding indicators**

Results from OLS estimation of difference-in-difference models

	Layoff 1		Layoff 2		Layoff 3		Layoff 4		Turnover 1 + full dummies	
Growth effect of EPL	-0.003	[4.58]***	-0.002	[2.65]***	-0.001	[2.23]**	-0.002	[3.43]***	-0.014	[2.32]**
Capital stock	0.224	[11.66]***	0.225	[11.67]***	0.222	[11.49]***	0.227	[11.70]***	0.237	[11.58]***
Country x year dummies	yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes	
Country x year x service industry dummies	no		no		no		no		yes	
Industry x year dummies	yes		yes		yes		yes		yes	
Observations	4168		4168		4168		4168		4168	
R-squared	1		1		1		1		1	
	Turnover 2 + full dummies		Layoff 1 + full dummies		Layoff 2 + full dummies		Layoff 3 + full dummies		Layoff 4 + full dummies	
Growth effect of EPL	-0.002	[3.36]***	-0.003	[4.34]***	-0.002	[2.74]***	-0.001	[2.10]**	-0.002	[3.23]***
Capital stock	0.244	[11.95]***	0.232	[11.36]***	0.235	[11.52]***	0.231	[11.27]***	0.237	[11.46]***
Country x year dummies	yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes	
Country x year x service industry dummies	yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes	
Observations	4168		4168		4168		4168		4168	
R-squared	1		1		1		1		1	

MFP: multi-factor productivity; EPL: employment protection legislation; OLS: ordinary least squares.
Robust t-statistics in brackets. ** significant at 5%; *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of EPL between binding and non-binding industries. See Annex 2.A1 for details on data and sources.
b) Layoff 1: binding industries are those where the layoff rate is above the average layoff rate for all industries for each year from 2001 to 2003.
c) Layoff 2: binding industries are those where the layoff rate is above the average layoff rate for all industries for two of the three years 2001 to 2003.
d) Layoff 3: binding industries are those where the average layoff rate over the period from 2001 to 2003 is above the average layoff rate for all industries over the period from 2001 to 2003.
e) Layoff 4: binding industries are those where the layoff rate is above the average layoff rate for all industries for both 2002 and 2003.
f) Turnover 1: The reported coefficient corresponds to the interaction of the average job turnover rate over the period 1990 to 1996 with the EPL variable. The growth effect of EPL for each industry can be obtained by multiplying the reported coefficient by the industry average of job turnover (at the sample average job turnover is equal to 0.19).
g) Turnover 2: binding industries are those where the average job turnover rate over the period 1990 to 1996 is above the average job turnover rate for all industries over the period from 1990 to 1996

Source: OECD estimates.

Minimum wages

Table 2.A3.8. **Effect of the minimum wage on MFP and labour productivity[a] – controlling for endogeneity**

Comparison of results from OLS and IV[b] estimation of difference-in-difference models

	MFP - OLS		MFP - IV		Labour productivity - OLS		Labour productivity - IV	
Minimum wage	-0.001	[0.33]	0.006	[2.28]**	0.001	[0.76]	0.007	[3.01]***
Capital stock	0.129	[5.68]***	0.121	[5.30]***				
Country x year dummies	yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes	
F-test on instrument			2133.3				1933.5	
Hausman test statistic			15.51				7.9	
Observations	2439		2439		3664		3664	
R-squared	1		1		1		1	

MFP: multi-factor productivity; OLS: ordinary least squares; IV: instrumental variables.
Robust t-statistics in brackets. ** significant at 5%; *** significant at 1%
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. Minimum wage is ratio of the minimum wage to median earnings. The table reports the relative effect of minimum wage between low-wage and other industries. Low-wage industries are derived from BHPS-ECHP data on wages for the United Kingdom prior to the introduction of the minimum wage in 1999. An industry is defined to be low-wage if its average proportion of low-wage workers between 1994 and 1999 was above the cross-industry sample median over the same period.. See Annex 2.A1 for details on data and sources.
b) The logarithm of real minimum wage in 2000 US dollars PPP is used as an instrument for the ratio of the minimum wage to median earnings.

Source: OECD estimates.

Table 2.A3.9. **Effect of the minimum wage on MFP and labour productivity[a] – baseline and model selection**

Results from IV estimation of difference-in-difference models

	MFP with level effect		MFP with growth effect		MFP with level and growth effect		Labour productivity with level effect		Labour productivity with growth effect		Labour productivity with level and growth effect	
Level effect of minimum wage	0.006	[2.28]**			0.005	[0.96]	0.007	[3.01]***			0.007	[3.19]***
Growth effect of minimum wage			0.000	[1.16]	0.000	[0.18]			0.001	[2.45]**	0.000	[0.93]
Capital stock	0.121	[5.30]***	0.131	[5.85]***	0.123	[5.09]***						
Country x year dummies	yes		yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes		yes	
F-test on instrument	2133.3		129.1		1155.0		1933.5		42.1		982.5	
Observations	2439		2439		2439		3664		3664		3664	
R-squared	1		1		1		1		1		1	

MFP: multi-factor productivity; IV: instrumental variables.
Robust t-statistics in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. Minimum wage is ratio of the minimum wage to median earnings. The table reports the relative effect of minimum wage between low-wage and other industries. Low-wage industries are derived from BHPS-ECHP data on wages for the United Kingdom prior to the introduction of the minimum wage in 1999. An industry is defined to be low-wage if its average proportion of low-wage workers between 1994 and 1999 was above the cross-industry sample median over the same period.. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.10. **Effect of the minimum wage on MFP and labour productivity[a] – sensitivity to inclusion of control variables**

Results from IV estimation of difference-in-difference models

Panel A. MFP

	Baseline + tax wedge		Baseline + tax wedge + interaction		Baseline + ARR		Baseline + ARR + interaction		Baseline + employment growth		Baseline + output gap		Baseline + tax wedge + ARR	
Minimum wage	0.010	[3.76]***	0.011	[3.98]***	0.004	[1.69]*	0.006	[2.34]**	0.004	[1.53]	0.007	[2.87]***	0.007	[2.56]**
Capital stock	0.129	[6.01]***	0.128	[5.94]***	0.114	[5.34]***	0.111	[5.19]***	0.127	[5.73]***	0.119	[5.55]***	0.118	[5.49]***
Country x year dummies	yes		yes		yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes		yes		yes	
F-test on first instrument	1548.65		836.82		2653.44		1356.84		1880.07		2080.31		1858.53	
F-test on second instrument			962.93				1884.03							
Observations	2439		2439		2439		2439		2368		2439		2439	
R-squared	1		1		1		1		1		1		1	

Panel B. Labour productivity

	Baseline + tax wedge		Baseline + tax wedge + interaction		Baseline + ARR		Baseline + ARR + interaction		Baseline + employment growth		Baseline + output gap		Baseline + tax wedge + ARR	
Minimum wage	0.009	[3.61]***	0.007	[1.85]*	0.006	[2.92]***	0.006	[2.89]***	0.006	[2.50]**	0.008	[3.30]***	0.007	[3.20]***
Country x year dummies	yes		yes		yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes		yes		yes	
F-test on first instrument	1650.87		828.31		3645.13		2092.53		1711.96		1794.21		3245.07	
F-test on second instrument			134.62				171.15							
Observations	3664		3664		3664		3664		3520		3664		3664	
R-squared	1		1		1		1		1		1		1	

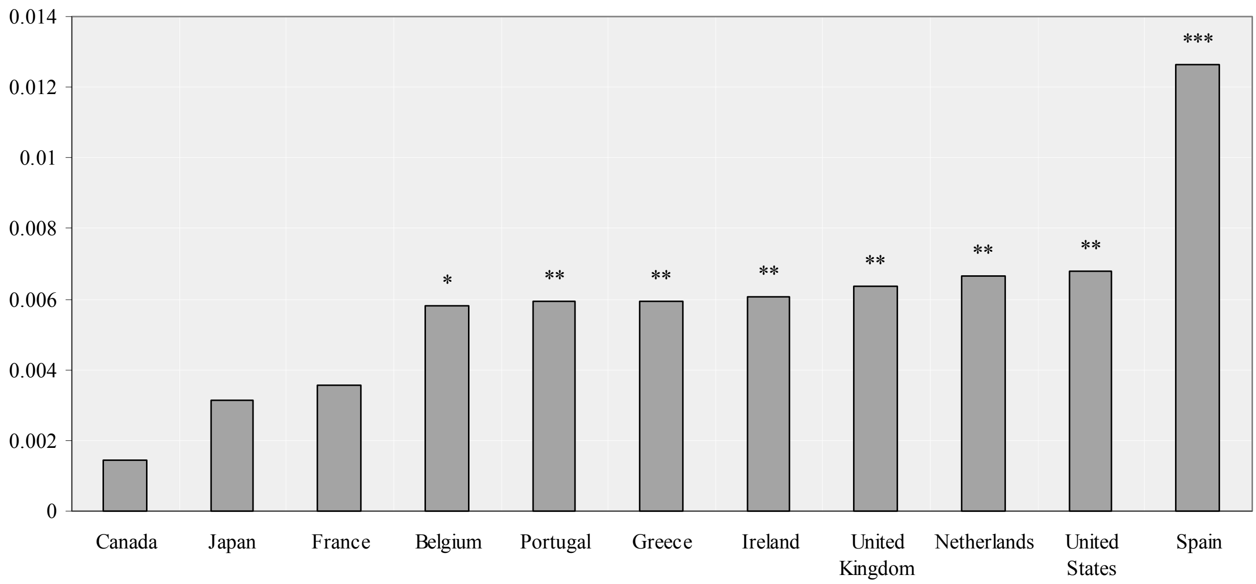
MFP: multi-factor productivity; IV: instrumental variables.
Robust t-statistics in brackets. ** significant at 5%; *** significant at 1%
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. Minimum wage is ratio of the minimum wage to median earnings. The table reports the relative effect of minimum wage between low-wage and other industries. Low-wage industries are derived from BHPS-ECHP data on wages for the United Kingdom prior to the introduction of the minimum wage in 1999. An industry is defined to be low-wage if its average proportion of low-wage workers between 1994 and 1999 was above the cross-industry sample median over the same period.. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

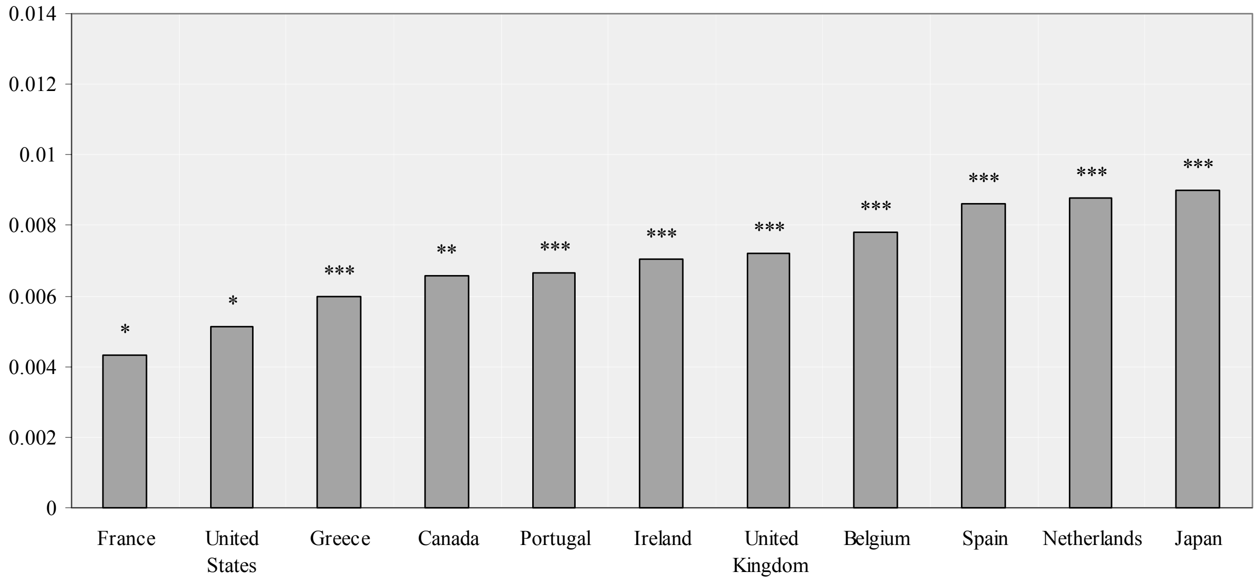
Figure 2.A3.2. **Effect of the minimum wage on MFP and labour productivity[a] – sensitivity to countries included in sample**

Coefficient on minimum wage level effect from IV estimation of difference-in-difference models when countries are excluded one-by-one from the sample

Panel A. MFP



Panel B. Labour productivity



MFP: multi-factor productivity; IV: instrumental variables.
** significant at 5%; *** significant at 1%
a) The benchmark specifications correspond to results reported in Table 2.A3.8, Columns 1 and 4. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.11. **Effect of the minimum wage on MFP and labour productivity[a] – sensitivity to the use of alternative low-wage indicators**

Results from OLS and IV[b] estimation of difference-in-difference model

Panel A. MFP

	Low-wage 1		Low-wage 2		Low-wage 3	
	OLS	IV	OLS	IV	OLS	IV
Minimum wage	-0.007 [2.92]***	0.008 [2.72]***	0.003 [1.26]	0.010 [4.03]***	0.006 [2.57]**	0.010 [3.82]***
Capital stock	0.137 [6.06]***	0.118 [5.10]***	0.125 [5.57]***	0.116 [5.15]***	0.126 [5.70]***	0.125 [5.68]***
Country x year dummies	yes	yes	yes	yes	yes	yes
Country x industry dummies	yes	yes	yes	yes	yes	yes
Industry x year dummies	yes	yes	yes	yes	yes	yes
F-test on instrument		2089.8		2164.3		2232.9
Hausman test statistic		72.2		20.5		6.2
Observations	2439	2439	2439	2439	2439	2439
R-squared	1	1	1	1	1	1

Panel B. Labour productivity

	Low-wage 1		Low-wage 2		Low-wage 3	
	OLS	IV	OLS	IV	OLS	IV
Minimum wage	0.001 [0.38]	0.004 [1.81]*	0.004 [2.50]**	0.005 [2.13]**	0.007 [4.36]***	0.006 [2.42]**
Country x year dummies	yes	yes	yes	yes	yes	yes
Country x industry dummies	yes	yes	yes	yes	yes	yes
Industry x year dummies	yes	yes	yes	yes	yes	yes
F-test on instrument		1933.51		1933.5		1933.51
Hausman test statistic		3.37		0.2		0.4
Observations	3664	3664	3664	3664	3664	3664
R-squared	1	1	1	1	1	1

MFP: multi-factor productivity; OLS: ordinary least squares; IV: instrumental variables.
Robust t-statistics in brackets. ** significant at 5%; *** significant at 1%
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. Minimum wage is ratio of the minimum wage to median earnings. The table reports the relative effect of minimum wage between low-wage and other industries. Low-wage industries are derived from ECHP data on wages (see notes below). See Annex 2.A1 for details on data and sources.
b) The logarithm of real minimum wage in 2000 US dollars PPP is used as an instrument for the ratio of the minimum wage to median earnings.
c) Low-wage 1: low-wage industries are defined as industries where the average share of low-wage workers in the United Kingdom prior to the introduction of the minimum wage in 1999 is above the mean proportion for all industries in the sample. Alternatively, the same classification of industries is obtained if low-wage industries are defined as industries where the share of low-wage workers across the ECHP sample of European countries is above the median proportion for all industries in the sample in an above-average number of countries and years.
d) Low-wage 2: low-wage industries are defined as industries where the share of low-wage workers across the ECHP sample of European countries is above the mean proportion for all industries in the sample in an above-average number of countries and years.
e) Low-wage 3: low-wage industries are defined as industries where the average share of low-wage workers across the ECHP sample of European countries is above the mean (or median) proportion for all industries in the sample in an above-average number of years.

Source: OECD estimates.

Unemployment benefits

Impact of unemployment benefits on GDP per capita growth

Table 2.A3.12. **Effect of unemployment benefits on GDP per capita[a]**

Results from PMG estimation of GDP per capita growth convergence models

	Baseline		Baseline + PMR		Baseline + Initial unemployment benefit replacement rate + unemployment benefit duration	
Convergence coefficient	-0.114	(5.57)***	-0.190	(3.38)***	-0.214	(8.32)***
Investment rate	0.171	(2.28)**	0.225	(6.81)***	0.360	(8.82)***
Human capital	0.755	(2.09)**	1.280	(5.73)***	0.792	(5.91)***
Population growth	-10.998	(3.88)***	-3.648	(4.24)***	-6.740	(5.35)***
Average replacement rate	-0.001	(0.37)	-0.001	(0.47)		
Initial unemployment benefit replacement rate (%)					0.001	(0.56)
Unemployment benefit duration (years)					-0.180	(0.99)
PMR			-0.101	(8.39)***		
Tax revenue to GDP ratio	-0.513	(3.01)***	-0.470	(7.57)***	-0.269	(3.32)***
Country dummies	yes		yes		yes	
Country x period [b] dummies	yes		yes		yes	
Observations	576		576		540	
	Baseline + PMR + Initial unemployment benefit replacement rate + unemployment benefit duration		Baseline + Initial unemployment benefit replacement rate		Baseline + PMR + Initial unemployment benefit replacement rate	
Convergence coefficient	-0.248	(7.92)***	-0.221	(8.20)***	-0.258	(7.81)***
Investment rate	0.356	(9.95)***	0.372	(9.04)***	0.352	(10.19)***
Human capital	0.520	(3.28)***	0.825	(8.27)***	0.593	(5.00)***
Population growth	-5.566	(4.68)***	-6.749	(5.74)***	-6.194	(5.76)***
Average replacement rate						
Initial unemployment benefit replacement rate (%)	0.002	(1.98)**	0.000	(0.19)	0.001	(1.13)
Unemployment benefit duration (years)	-0.081	(0.36)				
PMR	-0.038	(4.42)***			-0.035	(4.27)***
Tax revenue to GDP ratio	-0.282	(4.02)***	-0.238	(3.10)***	-0.226	(3.40)***
Country dummies	yes		yes		yes	
Country x period [b] dummies	yes		yes		yes	
Observations	540		540		540	

PMG: Pooled Mean Group; PMR: product market regulation
Absolute value of z-statistics in brackets. ** significant at 5%; *** significant at 1%.
a) Dependent variable is the first-difference of the logarithm of GDP per capita. Investment rate and human capital are expressed in logarithms. All specifications include first-differenced terms for all variables. Only the average of the convergence coefficients and long-run coefficients are reported. For explanation of other variables, see Annex 2.A1.
b) Period is 5 years.

Source: OECD estimates.

Impact of unemployment benefits on productivity in risky industries

Table 2.A3.13. **Effect of unemployment benefits on MFP and labour productivity[a] – baseline and model selection**

Results from OLS estimation of difference-in-difference models

	MFP with level effect		MFP with growth effect		MFP with level and growth effect		Labour productivity with level effect		Labour productivity with growth level		Labour productivity with level and growth effect	
Level effect of ARR	0.003	[4.72]***			0.003	[4.61]***	0.007	[9.78]***			0.007	[10.02]***
Growth effect of ARR			0.000	[0.11]	0.000	[0.61]			0.000	[2.94]***	0.000	[3.64]***
Capital stock	0.191	[11.25]***	0.196	[11.46]***	0.191	[11.24]***						
Country x year dummies	yes		yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes		yes	
Observations	4584		4584		4584		6880		6880		6880	
R-squared	1		1		1		1		1		1	

MFP: multi-factor productivity; ARR: average replacement rate; OLS: ordinary least squares.
Robust t-statistics in brackets. *** significant at 1%
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of unemployment benefits between risky and other industries. Risky industries are defined as those whose share of firms that only survive for one year in total employment is above the average for all industries. All specifications include the interaction between ARR and average industry tenure. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.14. **Effect of unemployment benefits on MFP and labour productivity[a] – sensitivity to inclusion of control variables**

Results from OLS estimation of difference-in-difference models

Panel A: MFP

	Baseline + employment growth		Baseline + EPL		Baseline + PMR		Baseline + Employment growth, EPL, PMR and tax wedge	
Average replacement rate	0.003	[4.75]***	0.003	[4.66]***	0.003	[4.24]***	0.003	[3.54]***
Capital stock	0.206	[11.33]***	0.219	[11.45]***	0.191	[11.29]***	0.232	[11.82]***
Country x year dummies	yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes	
Observations	4436		4168		4584		4136	
R-squared	1		1		1		1	

Panel B: Labour productivity

	Baseline + employment growth		Baseline + EPL		Baseline + PMR		Baseline + Employment growth, EPL, PMR and tax wedge	
Average replacement rate	0.006	[9.14]***	0.005	[6.46]***	0.007	[9.85]***	0.006	[7.04]***
Country x year dummies	yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes	
Observations	6560		6064		6880		6016	
R-squared	1		1		1		1	

MFP: multi-factor productivity; OLS: ordinary least squares; EPL: employment protection legislation; PMR: product market regulation. Robust t-statistics in brackets. *** significant at 1%.

a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of unemployment benefits between risky and other industries. Risky industries are defined as those whose share of firms that only survive for one year in total employment is above the average for all industries. All specifications include the interaction between ARR and average industry tenure. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.15. **Average effect of unemployment benefits on MFP and labour productivity[a] – groups based on tenure**

Results from mean group estimation of difference-in-difference models

Panel A: MFP

	Baseline		Baseline + employment growth		Baseline + EPL		Baseline + PMR		Baseline + Employment growth, EPL, PMR and tax wedge	
Average replacement rate	0.004	[4.67]***	0.004	[4.85]***	0.003	[4.51]***	0.004	[4.86]***	0.003	[3.74]***
Country x year dummies	yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes	
Observations	3259		3410		3202		3529		3178	
R-squared	1		1		1		1		1	

Panel B: Labour productivity

	Baseline		Baseline + employment growth		Baseline + EPL		Baseline + PMR		Baseline + Employment growth, EPL, PMR and tax wedge	
Average replacement rate	0.006	[7.47]***	0.006	[6.93]***	0.004	[4.30]***	0.006	[7.85]***	0.005	[4.87]***
Country x year dummies	yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes	
Observations	5160		4920		4548		5160		4512	
R-squared	1		1		1		1		1	

MFP: multi-factor productivity; ARR: average replacement rate; EPL: employment protection legislation; PMR: product market regulation.
Robust t-statistics in brackets. *** significant at 1%
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of unemployment benefits between risky and other industries. Risky industries are defined as those whose share of firms that only survive for one year in total employment is above the average for all industries. Only industries with cross-country/cross-time average tenure comprised between 9 and 12 years are included. Industries are divided in three groups according to tenure: 9 to 10 years; 10 to 11 years; and 11 to 12 years. Only average effects of ARR are shown. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.16. **Effect of unemployment benefits on labour productivity[a] – results using disaggregated data**

Results from OLS estimation of difference-in-difference models

	Labour productivity with level effect		Labour productivity with growth level		Labour productivity with level and growth effect	
Level effect of ARR	0.004	[4.93]***			0.005	[5.17]***
Growth effect of ARR			0.000	[0.22]	0.000	[0.18]
Country x year dummies	yes		yes		yes	
Country x industry dummies	yes		yes		yes	
Industry x year dummies	yes		yes		yes	
Observations	9458		9453		9453	
R-squared	0.99		0.99		0.99	

ARR: average replacement rate; OLS: ordinary least squares.
Robust t-statistics in brackets. *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. The table reports the relative effect of unemployment benefits between risky and other industries. Risky industries are defined as those whose share of firms that only survive for one year in total employment is above the average for all industries. All specifications include the interaction between ARR and average industry tenure. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Parental leave

Table 2.A3.17. **Effect of parental leave on MFP and labour productivity[a] – baseline and model selection**

Results from OLS estimation of difference-in-difference model

Panel A: Paid maternity leave

	MFP baseline linear		MFP baseline log-linear		MFP baseline quadratic		Labour productivity baseline linear		Labour productivity baseline log-linear		Labour productivity baseline quadratic	
PML	0.001	[0.84]			0.011	[2.26]**	0.003	[3.68]***			0.001	[0.32]
Log of PML			0.050	[1.78]*					0.030	[1.24]		
Squared PML					-0.019	[2.20]**					0.002	[0.46]
Capital stock	0.197	[9.45]***	0.197	[9.47]***	0.196	[9.48]***						
Country x year dummies	yes		yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes		yes	
Observations	3611		3611		3611		5488		5488		5488	
R-squared	1		1		1		1		1		1	

Panel B: Unpaid parental leave

	MFP baseline linear		MFP baseline log-linear		MFP baseline quadratic		Labour productivity baseline linear		Labour productivity baseline log-linear		Labour productivity baseline quadratic	
UPL	0.000	[0.73]			0.000	[0.59]	0.000	[1.31]			-0.001	[1.59]
Log of UPL			0.018	[2.40]**					0.014	[1.90]*		
Squared UPL					0.000	[0.98]					0.001	[2.73]***
Capital stock	0.197	[9.48]***	0.197	[9.51]***	0.197	[9.47]***						
Country x year dummies	yes		yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes		yes	
Observations	3611		3611		3611		5488		5488		5488	
R-squared	1		1		1		1		1		1	

MFP: multi-factor productivity; PML: paid maternity leave; UPL: unpaid parental leave; OLS: ordinary least squares.
Robust t-statistics in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of unemployment benefits between female-dominated and other industries. An industry is classified as female-dominated if the proportion of women employed in that industry is higher than the proportion of women employed across the whole economy. Parental leave variables are measured in weeks. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.18. **Effect of parental leave on labour productivity[a] – results using disaggregated data**

Results from OLS estimation of difference-in-difference model

	PML baseline linear		PML baseline log-linear		UPL baseline linear		UPL baseline log-linear	
PML	0.004	[3.56]***						
Log of PML			0.048	[1.69]*				
UPL					0.001	[2.54]**		
Log of UPL							0.024	[3.00]***
Country x year dummies	yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes	
Observations	12720		12720		12720		12720	
R-squared	0.99		0.99		0.99		0.99	

PML: weeks of paid maternity leave; UPL: weeks of unpaid parental leave OLS: ordinary least squares.
Robust t-statistics in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. The table reports the relative effect of unemployment benefits between female-dominated and other industries. An industry is classified as female-dominated if the proportion of women employed in that industry is higher than the proportion of women employed across the whole economy. Parental leave variables are measured in weeks. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.19. **Effect of paid maternity leave on MFP and labour productivity[a] – sensitivity to inclusion of control variables**

Results from OLS estimation of difference-in-difference model

Panel A: MFP

	Baseline + employment growth		Baseline + tax wedge + Tax incentives to work part-time + Relative marginal tax rate on second earner		Baseline + controls in (2) + Public expenditures on childcare (1995 PPP - US$) + Female education (years)		Baseline + controls in (3) + ARR +PMR		Baseline + tax wedge + Tax incentives to work part-time + Relative marginal tax rate on second earner + Employment growth	
Log of PML	0.052	[1.66]*	0.028	[0.80]	0.059	[1.63]	0.062	[1.49]	0.027	[0.78]
Capital stock	0.225	[9.87]***	0.231	[9.75]***	0.241	[9.60]***	0.241	[9.61]***	0.248	[10.08]***
Country x year dummies	yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes	
Observations	3436		3311		3141		3141		3279	
R-squared	1		1		0.99		0.99		1	

Panel B: Labour productivity

	Baseline + employment growth		Baseline + tax wedge + Tax incentives to work part-time + Relative marginal tax rate on second earner		Baseline + controls in (2) + Public expenditures on childcare (1995 PPP - US$) + Female education (years)		Baseline + controls in (3) + ARR +PMR		Baseline + tax wedge + Tax incentives to work part-time + Relative marginal tax rate on second earner + Employment growth	
Log of PML	0.060	[2.66]***	0.095	[3.51]***	0.077	[2.28]**	0.096	[2.71]***	0.092	[3.44]***
Country x year dummies	yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes	
Observations	5168		4656		4368		4368		4608	
R-squared	1		1		0.99		0.99		1	

MFP: multi-factor productivity; PML: paid maternity leave; OLS: ordinary least squares.
Robust t-statistics in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of unemployment benefits between female-dominated and other industries. An industry is classified as female-dominated if the proportion of women employed in that industry is higher than the proportion of women employed across the whole economy. Parental leave variables are measured in weeks. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

Table 2.A3.20. **Effect of unpaid parental leave on MFP and labour productivity[a] – sensitivity to inclusion of control variables**

Results from OLS estimation of difference-in-difference model

Panel A: MFP

	Baseline + employment growth		Baseline + tax wedge + Tax incentives to work part-time + Relative marginal tax rate on second earner		Baseline + controls in (2) + Public expenditures on childcare (1995 PPP - US$) + Female education (years)		Baseline + controls in (3) + ARR +PMR		Baseline + tax wedge + Tax incentives to work part-time + Relative marginal tax rate on second earner + Employment growth	
Log of UPL	0.018	[2.36]**	0.023	[2.84]***	0.015	[1.95]*	0.018	[2.29]**	0.022	[2.76]***
Capital stock	0.225	[9.90]***	0.230	[9.77]***	0.241	[9.63]***	0.242	[9.63]***	0.247	[10.10]***
Country x year dummies	yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes	
Observations	3436		3311		3141		3141		3279	
R-squared	1		1		0.99		0.99		1	

Panel B: Labour productivity

	Baseline + employment growth		Baseline + tax wedge + Tax incentives to work part-time + Relative marginal tax rate on second earner		Baseline + controls in (2) + Public expenditures on childcare (1995 PPP - US$) + Female education (years)		Baseline + controls in (3) + ARR +PMR		Baseline + tax wedge + Tax incentives to work part-time + Relative marginal tax rate on second earner + Employment growth	
Log of UPL	0.015	[1.88]*	0.018	[2.11]**	0.016	[1.67]*	0.015	[1.55]	0.018	[2.11]**
Country x year dummies	yes		yes		yes		yes		yes	
Country x industry dummies	yes		yes		yes		yes		yes	
Industry x year dummies	yes		yes		yes		yes		yes	
Observations	5168		4656		4368		4368		4608	
R-squared	1		1		0.99		0.99		1	

MFP: multi-factor productivity; OLS: ordinary least squares; ARR: average replacement rate; PMR: product market regulation.
Robust t-statistics in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
a) Dependent variable is the logarithm of labour productivity. Capital stock is the logarithm of the capital-to-labour ratio. The table reports the relative effect of unemployment benefits between female-dominated and other industries. An industry is classified as female-dominated if the proportion of women employed in that industry is higher than the proportion of women employed across the whole economy. Parental leave variables are measured in weeks. See Annex 2.A1 for details on data and sources.

Source: OECD estimates.

ANNEX 2.A4. COMPOSITION EFFECTS IN AGGREGATE AND INDUSTRY-LEVEL ANALYSES

Aggregate relationship between labour utilisation and labour productivity

Increases in the employment rate or hours worked are likely to reduce labour productivity for three reasons. First, because high-skilled workers are more likely to be employed than low-skilled workers, an increase in the employment rate is likely to increase the proportion of low-skilled workers in the workforce. This will reduce the quality of labour input and reduce available measures of productivity, which do not control for labour quality. Second, productivity will be reduced due to diminishing returns to labour input (particularly in the case of an increase in hours worked with no change in the employment rate). Third, if employment and hours increase because of a labour supply surge, labour intensive industries (with lower labour and possibly multi-factor productivity) are likely to expand.

The relationship between labour productivity and total hours per capita, controlling for fixed country factors as well as shocks that are common across countries can be estimated using the following specification:

$$\log y_{it} = \delta \log l_{it} + \eta_i + \lambda_t + \varepsilon_{it} \qquad [1]$$

where $y = Y/L$ is labour productivity, l is total hours per capita, i and t index country and time, respectively, η and λ represent country and time effects, respectively, χ represents the disturbance and δ the parameter to be estimated. It might be tempting to interpret OLS estimates of δ as estimates of the elasticity of labour productivity to employment (that is as a measure of the possible "composition effect" of policies affecting employment on productivity). Yet, this conclusion would be unwarranted insofar as policies and other factors can have an independent impact on productivity, which is not due to their impact on labour utilisation. However, it is difficult to find in an aggregate context a variable that affects employment without directly affecting productivity and can serve as a suitable instrument. Nonetheless, one can interpret OLS estimates as providing an upper bound (in absolute value) to the true composition effect.

This specification was estimated by OLS on annual data for the years 1970-2003 for 21 OECD countries. The countries included in the sample are Australia, Austria (1995-2003), Belgium, Canada, Denmark, Finland, France, Germany (1993-2003), Greece (1983-2003), Ireland, Italy, Japan, the Netherlands, Norway, New Zealand, Portugal (1986-2003), Spain, Sweden, Switzerland (1975-2003), the United Kingdom and the United States. Column 1 of Table 2.A4.1 shows a very strong negative relationship between labour productivity and total hours per capita in the past 3 decades. Removing Australia, New Zealand and Switzerland and limiting the time period used in the estimation to that following the second oil price shock of the 1970s (to make the estimates comparable with the industry-level results presented in the next section) gives a less strong, but still sizeable, relationship (Column 2).

These correlations suggest that composition effects, in the absence of valid instruments, cannot be easily dismissed in an aggregate analysis. By the same token this implies, they imply that an aggregate analysis of the impact of policies on productivity will be unable to estimate any other independent effect of policies on productivity. The resulting findings will be, therefore, of little practical use for policy guidance.

Table 2.A4.1. **Aggregate estimates of relationship between total hours per capita and labour productivity**

Aggregate estimates using OLS

	All countries		All countries excluding Australia, NZ & Switzerland & years prior to 1979	
Total hours per capita	-0.857	[17.29]***	-0.435	[6.27]***
Country dummies	yes		yes	
Year dummies	yes		yes	
Observations	628		405	
R-squared	1		1	

OLS: ordinary least squares.
Robust t-statistics in brackets. *** significant at 1%.

Source: OECD estimates.

Industry-level relationship between labour utilisation and labour productivity

Using industry-level data it is possible to look at the within-industry co-variation of labour utilisation and productivity while controlling for aggregate effects through time-by-country dummies. This implies estimating specifications of the following type:

$$\log y_{ijt} = \delta \log l_{ijt} + \mu_{ij} + \chi_{it} + \varepsilon_{ijt} \qquad [2]$$

where y is labour productivity, l is total hours per capita, i, j, and t index country, industry and time respectively, and Greek letters represent coefficients or disturbances.

This relationship was estimated using the same sample of countries and years as for the results presented in Column 2 of Table 2.A4.1. The sample includes industry-level data for all industries except agriculture, hunting, forestry and fishing, mining and quarrying, business services, public administration and defence, education, health and social work and other community, social and personal services.

Columns 1 and 2 of Table 2.A3.2 show the results from an OLS estimation of [2], including fixed effects for any two-dimension disturbance. While the negative association between labour utilisation and labour productivity is still significant, the estimated coefficient is much smaller than the aggregate estimates in Table 2.A4.1. This coefficient is further reduced by about one half if the capital/labour ratio is included in the list of controls (results not shown in Table 2.A4.2).

Table 2.A4.2. **Industry level estimates of relationship between total hours per capita and labour productivity**

Industry-level estimates using OLS and GMM models

	OLS				GMM			
	Total business sector		Manufacturing & utilities		Total business sector		Manufacturing & utilities	
Total hours per capita	-0.143	[9.92]***	-0.042	[2.00]**	0.034	[0.97]	0.050	[1.22]
Country dummies	yes		yes		yes		yes	
Year dummies	yes		yes		yes		yes	
Sector dummies	yes		yes		yes		yes	
Country x year dummies	yes		yes		yes		yes	
Country x sector dummies	yes		yes		yes		yes	
Hansen-Sargan test (P-value)					0.166		0.484	
Arellano-Bond AR1 test					-9.44	***	-6.32	***
Arellano-Bond AR2 test					-1.96	*	1.28	
Observations	6880		4730		6560		4290	
R-squared	1		1					

OLS: ordinary least squares; GMM: One-step system generalised method of moments. In GMM models, the error term is modelled as an ARMA process with up to an AR(2) component (choice made on diagnostics). Productivity and hours per capita are treated as endogenous variables. The common factor restriction is not imposed. Only long-run effects are presented. In order to control for country by time effects (country x year dummies), each variable is demeaned by subtracting its country by time means. Productivity and hours dated *t-a*-1 to *t-a*-3 (where *a* is sum of the orders of the AR and MA components) are used as instruments in the difference equation. The Hansen-Sargan statistic provides a test of overidentifying restrictions. The model is rejected if the statistic is significant. Arellano-Bond statistics test the autocorrelation of the first difference of the residuals at order 1 and 2 and are normally distributed under the null. The model is rejected if evidence of autocorrelation is found at order 2.
Robust t-statistics in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Source: OECD estimates.

It might be difficult however to interpret these estimates as an upper bound to within-industry composition effects. If workers tend to flow to industries where productivity (and wages) are higher, OLS estimates could also be upward-biased and the real within-industry elasticity greater (in absolute value) instead of being at worse smaller. However, with industry-level data, there is a sufficiently large panel to use an instrumental variables approach to control for endogeneity, by exploiting the time-series properties of the data. Equation [2] was re-estimated using System GMM estimators with (appropriately) lagged levels of endogenous explanatory variables as instruments for their current variation as well as lagged differences as instruments for their current levels (see *e.g.* Blundell and Bond, 1998). The results are reported in Columns 3 and 4 of Table 2.A4.2. No evidence emerges to suggest that the OLS estimates are upward biased.

Overall, the results presented in Table 2.A4.2 suggest that within-industry composition effects are, at worse, negligible, and industry-level analyses, when feasible, can meaningfully shed light on the independent impact of selected labour market policies on productivity.

BIBLIOGRAPHY

Blundell, R. and S. Bond (1998), "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics*, vol. 87, no. 1, pp. 115-143.