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OECD Employment Outlook

Chapter 2

More Jobs but Less Productive? The Impact of Labour Market Policies on Productivity

The Restated OECD Jobs Strategy identifies a number of different policy packages that can generate higher employment. But what impact do these policies have on productivity? Is a market-reliant labour market the only way to achieve high employment and strong productivity growth simultaneously? Labour market policies can increase productivity by encouraging training, enabling the movement of resources into emerging, high-productivity activities, improving the quality of job matches and increasing the spread of technological change. However, pro-employment policies can depress measured productivity by, among other things, increasing the proportion of low-skilled workers employed. The bottom line is that both the employment and productivity impacts of policy reforms should be taken into account when evaluating their success.

Introduction

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.

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 (OECD, 2003a). 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. 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.

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 growth and therefore have ambiguous overall effects on living standards, at least as measured by GDP per capita. 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 *and* productivity growth simultaneously.

In order to improve our understanding of this issue, this chapter examines the impact of various labour market policies on productivity levels and growth rates (both labour productivity and multi-factor productivity are considered in this chapter). Key channels through which labour market policies affect productivity are identified and assessed empirically.

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 impact of selected policies. The chapter concludes with a discussion of the overall productivity impact of the recommendations put forward in the Restated OECD Jobs Strategy and provides some suggestions for further research.

Main findings

- *Employment growth tends to be associated with lower average measured labour productivity growth – but this does not mean that higher employment causes productivity of individual workers to fall*. This result arises because, other things being equal, policy reforms which increase employment can promote job opportunities for low-skilled workers, generate diminishing returns to labour input or expand labour-intensive activities, thereby exerting downward pressure on average measured labour productivity. However, this does not mean that policies that raise employment will lead to lower productivity growth of individual workers. Indeed, pro-employment policies may exert a direct effect on individuals' productivity – which may either offset the negative aggregate productivity effect associated with employment gains 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 (characterised by limited welfare benefits and 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 the chapter 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 growth trends are larger than between-group differences.
- Over and above their employment effects, *labour market reforms can have a sizeable impact on productivity levels and growth rates through multiple channels,* including: *i)* 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); *ii)* by facilitating *reallocation of resources* into activities where productivity is above-average or grows more rapidly; *and iii)* 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.
- *First, stringent employment protection for regular contracts has a small negative impact on long-run 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, labour productivity growth would increase, on average, by about 0.04 percentage points per year. The effect is larger and more robust in the case of multi-factor productivity growth, which measures efficiency gains and technological change.
- *Second, increases in the ratio of minimum to median wages appear to have a positive impact on the aggregate level of measured productivity*. In the long-run, increasing this ratio by 10 percentage points could increase average labour productivity by almost 2 percentage points. The favourable effect of the minimum wage on productivity may be due to improved incentives for investing in training, or come as a result of substitution of skilled labour for unskilled labour. The relative importance of the two interpretations is key for policy purposes but could not be assessed empirically in the chapter.
- *Third, reforms that reduce the generosity of unemployment benefits are likely to reduce the aggregate level of measured productivity*. There are three reasons for this. First, reducing the generosity of unemployment benefits can adversely affect productivity by limiting 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 long-run impact* of lowering unemployment benefits *on the level of GDP per capita* (incorporating both the positive employment effect and the negative productivity effect) *appears to be negligible.*

- *Finally, additional parental leave appears to increase the level of productivity, in part 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 not always statistically robust. While the results reported in this chapter focus on parental leave, it is possible that other policies that encourage sustained workforce participation by parents, such as child care or family-friendly working arrangements, could have a similar positive impact on productivity.
- Previous empirical evidence on the negative growth impact of excessive tax burdens and anti-competitive product market regulation together with the results presented in this chapter suggest that, overall, the *reforms advocated in the Restated OECD Jobs Strategy are likely to have a beneficial impact on GDP per capita*. In addition, even where policies appear to have a negligible overall impact on GDP per capita the long-term social and economic benefits of higher employment and lower welfare dependency for individuals and society as a whole should be considered as part of a thorough evaluation of their success.

1. Economic growth in OECD countries

1.1. Decomposing GDP per capita growth

OECD countries grew at very different rates over the past decade. 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, 2007a, for a more detailed overview of broad trends in growth performance).

Labour productivity performance over the past decade has been mixed

GDP per capita growth can be decomposed into 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 similar variability 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, and to less than 1% per year in Mexico, the Netherlands and Spain.[1]

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. 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 has contributed 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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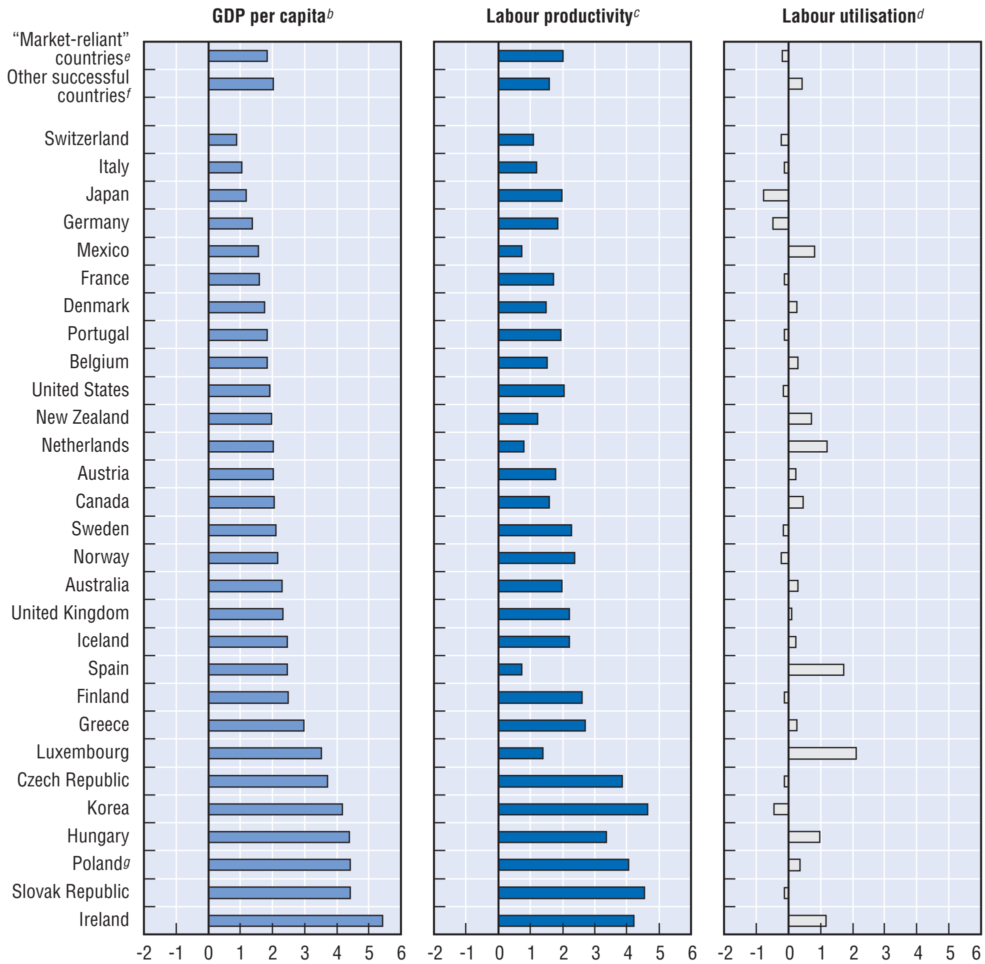
Figure 2.1. **There were large cross-country differences in economic growth in the past decade**

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 of Australia, Canada, Japan, New Zealand, Switzerland, the United Kingdom and the United States.
f) GDP-weighted average of Austria, Denmark, the Netherlands, Norway and Sweden.
g) 2000-05.

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 (2007a).

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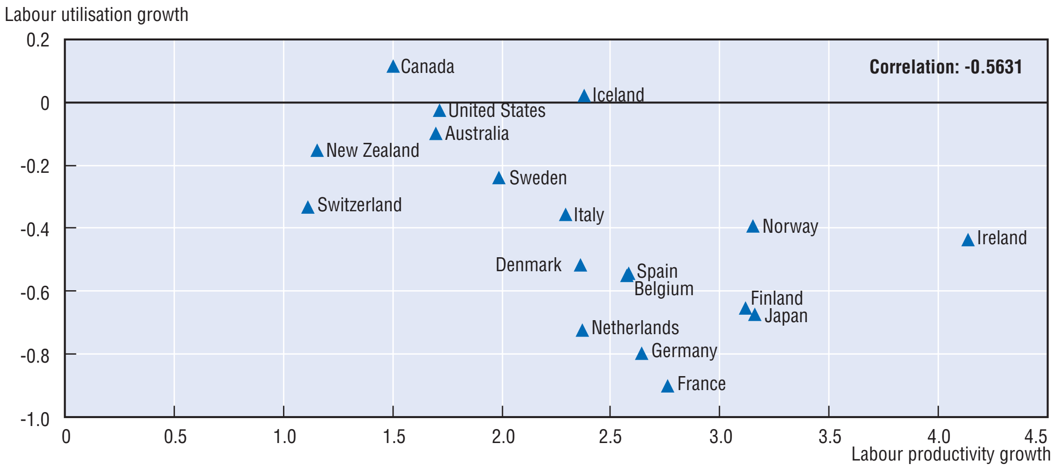
1.2. The statistical relationship between employment growth and aggregate productivity growth

Employment growth and aggregate productivity growth are negatively correlated…

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 average labour productivity. Over the period 1970-2005, the

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

Average annual growth rates in percentage, 1970-2005



a) Growth of total hours worked divided by total population.
b) Growth of GDP per hour worked.
Source: OECD Productivity database.

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cross-country correlation coefficient between growth of hours per capita and labour productivity growth was –0.56 (statistically significant at the 5% level). This negative correlation appears to be a long-term phenomenon rather than simply reflecting opposing movements of employment and productivity over the business cycle.

The negative relationship between employment growth and average measured labour productivity growth has been highlighted in previous studies (see *e.g.* OECD, 2007a) and has a number of explanations. First, it arises, in part, because conventional measures of labour productivity do not adequately control for changes in the quality of labour.[2] Aggregate employment growth is usually associated with faster employment growth for the low-educated than for the highly-educated, so reduces the average level of skills and productivity among the employed (see *e.g.* Nickell and Bell, 1996; Belorgey, Lecat and Maury, 2006). 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 average measured 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 being 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.* Bourlès and Cette, 2005).

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 average measured labour productivity, even with no reduction in the output of workers already in employment before the reform. A number of authors have argued that this dampening effect can be large. For instance, Dew-Becker and Gordon (2006) estimate that, other things being equal, an increase in total hours per capita of 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 Belorgey, Lecat and Maury (2006), Bourlès and Cette (2005, 2007), Gust and Marquez (2004) 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 average measured 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 aggregate labour productivity growth can be misleading

Although more research is needed on this issue, the negative correlation between employment growth and average measured labour productivity growth suggests that evaluating the success of employment-enhancing structural reforms by measuring labour productivity growth 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 growth 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). However, any slowdown in average measured productivity resulting directly from a change in employment is, to a large extent, a *statistical artefact* and does not imply that individual productivity has fallen. Its implications for policy evaluation, therefore, are not immediately obvious.[3]

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 Strategy, see OECD 2006a, 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.[4] This comparison must, however, 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.

1.3. Sources of labour productivity growth in OECD countries

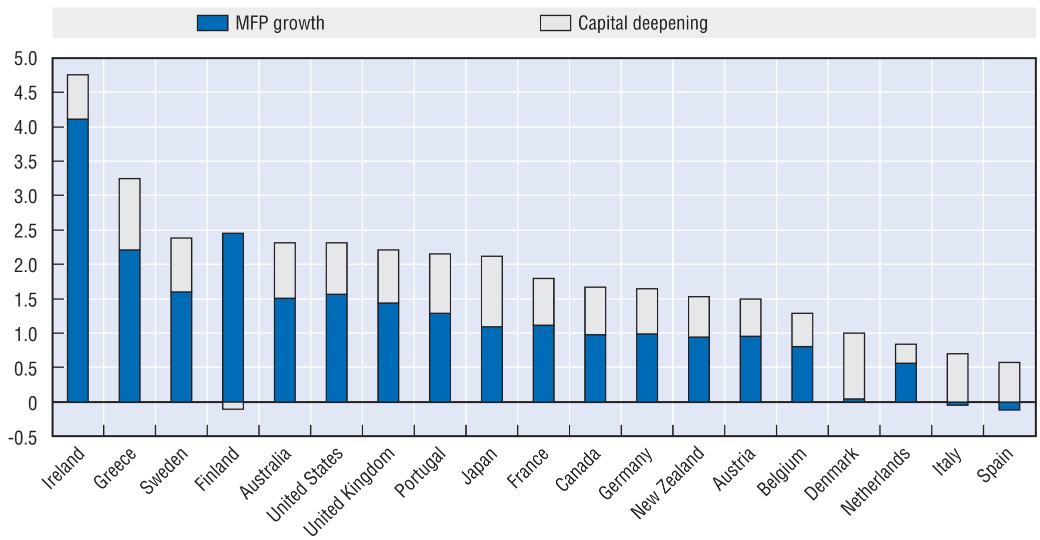
Over and above composition effects due to changes in labour utilisation, cross-country differences in labour productivity growth are the result of a range of factors, including among others labour market policies and institutions. A full analysis of these factors goes beyond the scope of this chapter. 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, 2007a). 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 and multi-factor productivity

Historically, capital deepening (or growth of the capital-to-labour ratio) is one of the major determinants of labour productivity growth. Reliable estimates attribute about half of aggregate output growth in the last 40 years of the 20th 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, which measures average efficiency gains and technological change.[5] Yet, cross-country differences in labour productivity growth were essentially due to cross-country differences in MFP growth.[6] MFP growth was particularly high in Ireland, Finland and Greece, close to zero in Denmark and negative in Italy and Spain. Therefore, factors influencing MFP growth will also be key determinants of labour productivity and GDP per capita growth.

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 hour worked into average annual growth rate of MFP and average annual growth rate of capital input, 1995 to 2005[a, b]



MFP: Multi-factor productivity.

a) Calculated using 1995-2004 data for Australia, Japan and Spain and 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.

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Human capital

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; Cohen and Soto, 2007; de la Fuente and Domenéch, 2006; OECD, 2003b), 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 potential for growth (OECD, 2004).

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Better skills also help to speed up the pace of technological change, thus contributing directly to economic growth.[7] 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).

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.[8] 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% (see 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

At least some of the observed cross-country variation in labour productivity and MFP 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, Hungary, Korea 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

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.[9]

Institutions and policies

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 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.

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

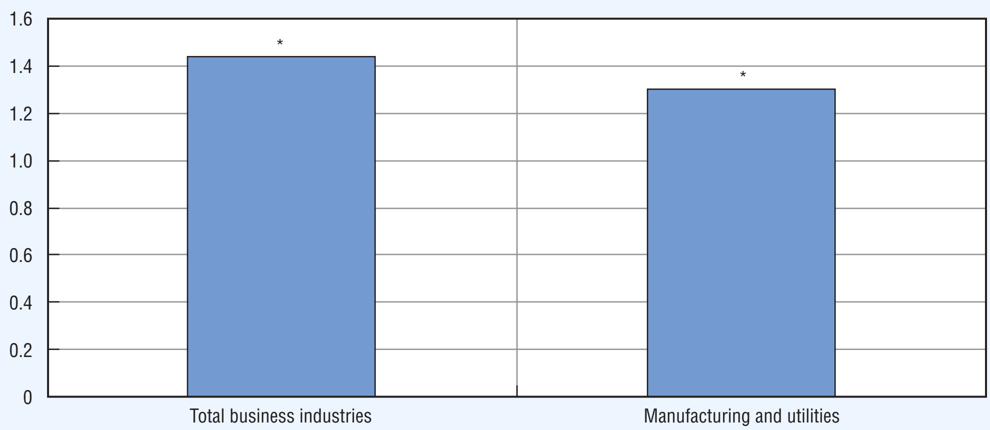
There are two main types of quantitative studies of the effect of training on productivity: survey-based studies; and case studies – sometimes company-sponsored. Survey-based studies have the advantage that the findings can be generalised to other firms if the survey is sufficiently representative. However, 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 levels with respect to training between 0.05 and 0.15, although the comparison of results across different studies is hampered by differences in training definitions and methodologies. 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, Ohtake and Ariga (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 OECD, 2007b for a description of data and methods used to obtain these estimates).

Workplace training has a positive impact on the level of productivity

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



MFP: Multi-factor productivity.
* significant at 10%.
Derived from GMM estimates. See OECD (2007b) for more details.

Source: OECD estimates.

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2. What role for labour market policies?

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

The discussion in Section 1.2 highlights the negative correlation between employment growth and average productivity growth: 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, pro-employment policy reforms may indirectly affect aggregate productivity by reducing social spending and make room for more public or private spending on education, R&D or other productivity-enhancing activities. Labour market policies can also directly affect productivity through a number of channels:

- policies that influence incentives for workers or firms to invest in training or education can affect productivity by altering the stock of human capital;
- policies that encourage the movement of resources between declining and emerging firms, industries or activities can enhance productivity by helping firms respond quickly to changes in technology or product demand;
- 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;
- policies that make labour more expensive might affect the direction and pace of technological change; and
- policies that reduce social conflict 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. In general, it is difficult to establish, *a priori*, whether policies are likely to affect the level of productivity, its growth rate, or both.

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.

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, 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-differences specification of the type described in Box 2.2. It is possible that the operation of these policies could also influence

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 for regular workers	
• 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 new high-productivity activities. • Encourages shirking by employees by making it more difficult for them to be dismissed for poor performance.
Restrictions on temporary contracts	
• By reducing opportunities to substitute temporary for permanent workers, increase incentives for firms that typically hire temporary workers to train their employees, and increase incentives for workers to invest in firm-specific human capital.	• Reduce firms' ability to adapt quickly to changes in technology or product demand by moving labour resources into emerging, higher productivity activities. • By reducing temporary employment, reduce workers' incentives to invest in human capital to escape job insecurity.
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).

Source: Acemoglu and Pischke (1999a, 1999b); Acemoglu and Shimer (1999, 2000); Agell (1999); Arulampalam, Booth and Bryan (2004); Bartelsman *et al.* (2004); Belot, Boon and van Ours (2002); Bertola (1994); Boone (2000); Boone and van Ours (2004); 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).

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; y, k and h are output, physical capital and 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; and A is the level of technological and economic efficiency. A is the product of two components: economic efficiency dependent on institutions and economic policy; and the level of technology, which 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 ($\alpha + \beta$ 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, Vs denote policies affecting efficiency, χ_{it} are country-by-period (say: five-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 pooled mean group 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 average measured labour productivity. For instance, they may increase employment and thereby reduce average measured labour productivity through composition effects discussed in Section 1.2. 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 OECD (2007b), 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.

Box 2.2. **Model specification** *(cont.)*

For the purposes of this chapter, the effects of employment protection legislation (EPL), minimum wages and parental leave on productivity have been estimated at an industry-level using a reduced-form difference-in-differences model (see Bassanini and Venn, 2007, for full details). 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.

This difference-in-differences estimation strategy has the advantage that it controls for policies or institutions that influence productivity in the same way in all industries. More precisely, all factors and policies that can be assumed to have, on average, the same effect on productivity in policy-binding industries as in other industries can be controlled for by country-by-time dummies. Assuming that a particular policy only affects the growth of productivity, the long-run 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. To the extent that available capital stock data are not adjusted for quality changes, the relevant concept of MFP used here incorporates both disembodied and embodied technological change. 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. 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 have a different average effect on productivity in policy-binding industries and in other industries.

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.* For this reason, in the difference-in-differences 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.

Box 2.2. **Model specification** *(cont.)*

As stressed in OECD (2006a), policy changes have distributional consequences. Therefore, certain groups are likely to lobby in their favour, while other will attempt to resist change. The size and influence of different lobby groups are likely to be affected by economic conditions. As a consequence, policies may not be exogenous, as is assumed in the estimation of difference-in-differences specifications in this chapter. It is not obvious what impact this assumption has on the results, given that the aggregate correlation between policies and performance is controlled for by country-by-year dummies. Yet, the reader should keep this potential limitation in mind when interpreting the results.

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.

Estimated aggregate impacts represent the average effect of policy changes on productivity across OECD countries. The actual outcome of policy reforms in individual countries could vary, however, depending on the particular economic and institutional situation. Where data availability allows, interactions between policies and institutions have been examined. 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).

* 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.

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. Yet, the analysis of these interactions remains exploratory (see Box 2.2).

2.2. Employment protection legislation

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

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 a lower threat of layoff in response to poor work performance or absenteeism (Ichino and Riphahn, 2001).

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, Boon and van Ours, 2002).[10]

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

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.[11] Autor, Kerr and Kugler (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. They find that some of the restrictions have a positive effect on capital deepening, a negative effect on MFP and no effect on labour productivity. Using a difference-in-differences 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. Ichino and Riphahn (2001) and Riphahn (2004) find that EPL in Germany significantly increases absenteeism, probably reducing productivity.

There is some support for the argument that 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.[12] 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…

For the purpose of this chapter, the impact of EPL for regular contracts on productivity growth is estimated using the difference-in-differences 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 Annex 2.A1 for more details on data and Bassanini and Venn, 2007, for a full description of estimation methods and detailed results).[13]

Figure 2.4 shows that EPL on regular contracts is estimated to have a small but statistically significant negative effect on aggregate productivity growth.[14] 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

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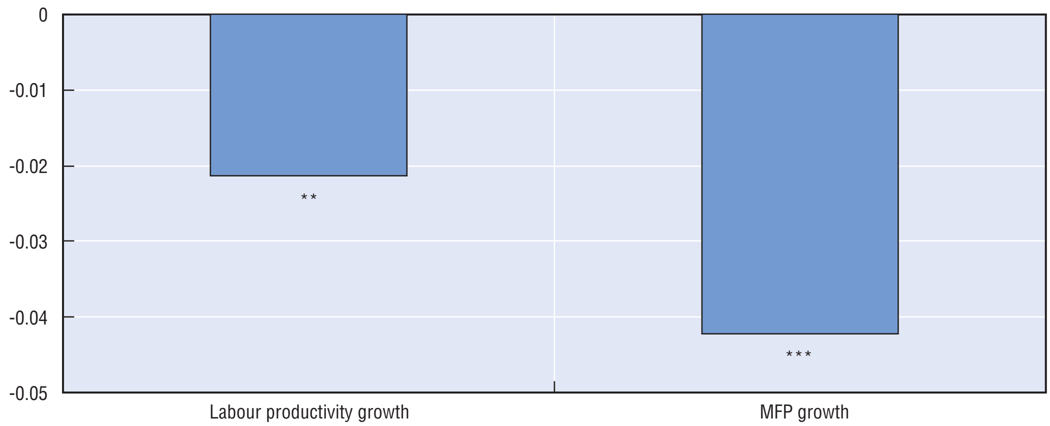
Figure 2.4. **EPL has a negative effect on productivity growth**

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



EPL: Employment protection legislation; MFP: Multi-factor productivity.
** significant at 5%; *** significant at 1%.
Derived from difference-in-differences OLS estimates. The estimates in this figure are calculated by multiplying the estimated effect of EPL in EPL-binding industries 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.
Source: OECD estimates.

StatLink http://dx.doi.org/10.1787/023318538003

lowest value of the EPL index (United States)[15] – appears to reduce the annual growth rate of labour productivity by at least 0.02 percentage points and the annual growth rate of MFP by at least 0.04 percentage points.[16] 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.

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.

If stringent EPL slows productivity growth by impeding the flow of resources into high productivity activities, it might be expected that the dampening effect of EPL on productivity growth is 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), the effect of EPL on productivity might 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

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 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, 2004), or even are more prone to workplace accidents (Guadalupe, 2003).

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.[17]

2.3. Minimum wages

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

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 measured productivity.[18]

… or by influencing training or innovation decisions

Minimum wages also compress the lower tail of the wage distribution without necessarily affecting individual productivity, thereby increasing employers' incentives 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, unskilled 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 unskilled to invest in training. More importantly, high minimum wages prevent low-wage workers from accepting wage cuts to finance training (Rosen, 1972).

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

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 the effect of minimum wages on training, but no consensus emerges as to the overall effect of minimum wages.[19]

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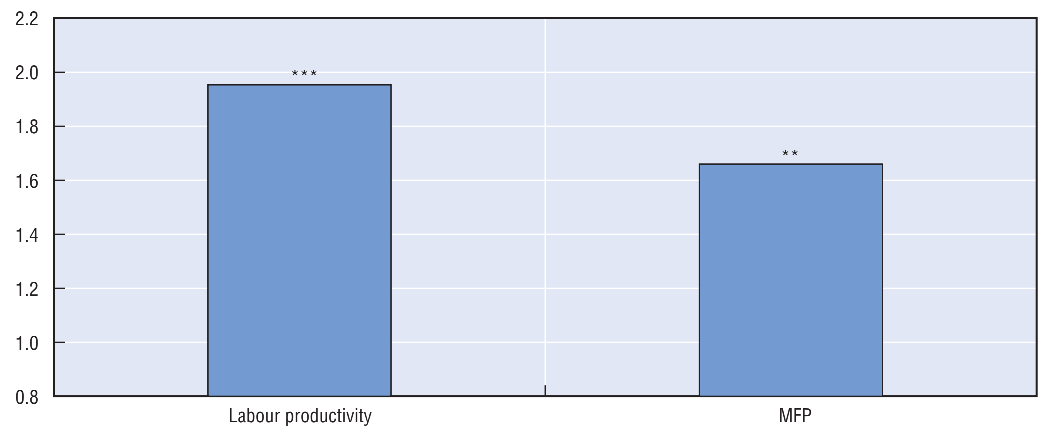
Minimum wages are estimated to have a positive effect on average measured productivity…

The impact of statutory minimum wages on measured average productivity was estimated using the difference-in-differences 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.[20] Minimum wages are measured as the economy-wide ratio of the gross statutory minimum wage to the median wage (see Annex 2.A1 for more details on data and Bassanini and Venn, 2007, for a full description of estimation methods and detailed results).[21, 22]

Figure 2.5 shows that an increase of 10 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 measured labour productivity and MFP.[23] The estimated effects are relatively robust to changes in the sample of countries used in the estimation.

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

Percentage-point impact on labour productivity and MFP levels of a 10 percentage-point increase in the ratio of the minimum wage to median earnings



MFP: Multi-factor productivity; IV: Instrumental variables.

** significant at 5%; *** significant at 1%.

Derived from difference-in-differences 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 by the share of low-wage industries in total GDP. This assumes that there is zero impact of the policy in non-low-wage 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.

Source: OECD estimates.

StatLink http://dx.doi.org/10.1787/023352553420

… but this might simply reflect substitution of skilled for unskilled workers

It is not clear, however, to what extent the positive impact of minimum wages on productivity is simply due to substitution of skilled for unskilled 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. 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 skilled for unskilled workers explains at least part of the story.[24]

Competing explanations – that is, training *vs.* skilled/unskilled substitution effects – however, have very different policy implications. In fact, while the training story would imply a virtuous link, the substitution story would suggest that the positive productivity effect is purely a statistical artefact and point to undesirable distributional consequences of excessive minimum wages. The possibility that a large proportion of the productivity effect of minimum wages is due to reduced demand for unskilled workers should be kept in mind when drawing policy implications from these results.

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. A number of interactions between minimum wages and other policy variables were tested to determine whether the impact of minimum wages on productivity depends, at least in part, on the broader policy settings in a particular country. Previous OECD research (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 that is independent of any interaction with taxes.

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

There is some qualified evidence that generous unemployment benefits may reduce the positive impact of minimum wages on productivity in low-wage industries.[25] 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 unskilled workers to invest in training to avoid unemployment, high replacement rates could dull this effect by reducing the opportunity cost of remaining unemployed.[26]

2.4. Unemployment benefits

Unemployment benefits could increase average measured productivity through their impact on employment,…

There are a number of channels through which unemployment benefits could affect productivity. First, generous unemployment benefits have been shown to reduce employment rates, so could have a positive impact on productivity through the so-called composition effect

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discussed in Section 1.2.[27] 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,…

Second, generous unemployment benefits (in terms of either duration, 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 experience, resulting in higher quality matches between the unemployed and available job vacancies (Marimon and Zilibotti, 1999).[28] 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

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 so carry 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 therefore be more likely to offer such jobs, increasing the share of high-productivity jobs and the aggregate level of productivity.

Unemployment benefits can also have some negative effects on productivity…

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).

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

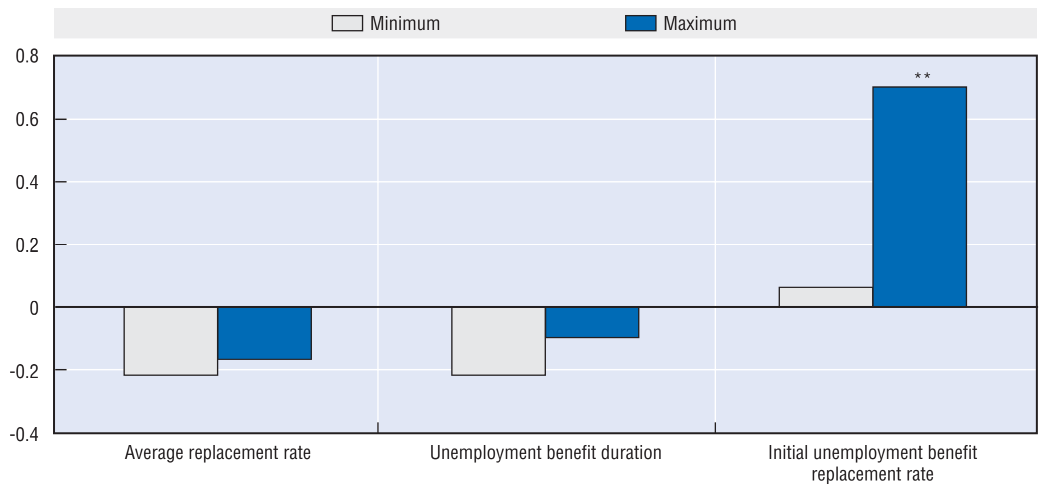
Given the range of possible impacts of unemployment benefits on productivity and their unambiguous negative effect on labour utilisation, the net effect on GDP per capita is, *a priori*, ambiguous. In contrast with EPL, minimum wages and parental leave (see Section 2.5 below), there is a long time series of data on unemployment benefit replacement rates, allowing the impact of unemployment benefits on GDP per capita to be estimated using the structural model discussed in Box 2.2. 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…

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 impact, in the long-run, 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 measured 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 a reduction in the generosity of unemployment benefits is likely to have a positive effect on productivity over and above composition effects.

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



** significant at 5%.

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 OECD (2007b).

Source: OECD estimates.

StatLink http://dx.doi.org/10.1787/023373173580

Both of the 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 – seem to receive some support from the empirical evidence.

… possibly as a result of higher quality job matches…

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).

… or through the creation of risky, higher productivity jobs

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 10 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) shows that high-risk jobs pay higher wages in the United States, 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 in high-risk industries compared to low-risk industries (see Box 2.3).

Overall, the net impact of unemployment benefits on average measured 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 facilitating the creation of riskier, higher productivity jobs by providing insurance against future job loss. Yet, the net impact on GDP per capita appears to be small.

These findings, however, do not mean that reforms to reduce the disincentive effects of generous unemployment benefits will be ineffective at improving living standards. The social benefits of increasing employment rates are well known. In addition, some of the productivity benefits associated with generous unemployment benefits, such as better job matches, could be replicated through effective active labour market programmes.

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

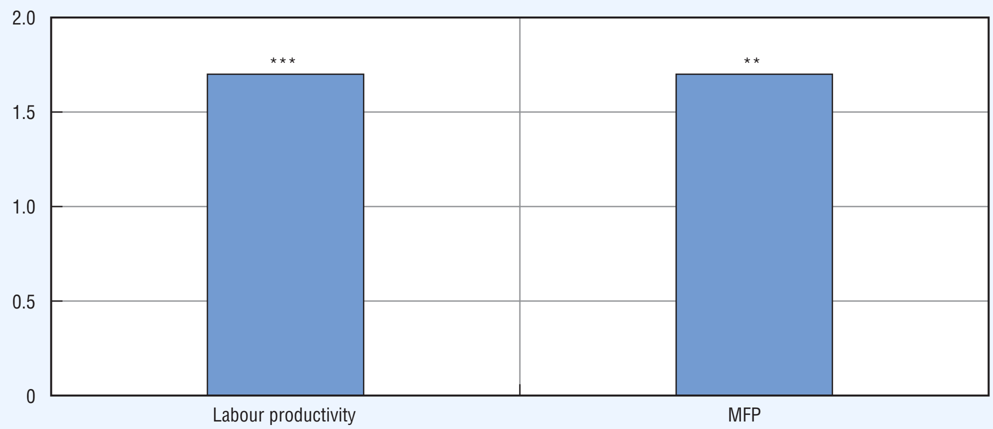
One of the channels through which unemployment benefits could affect productivity is by providing security for workers to search for, and accept, high-productivity jobs that have a high risk of future layoff, in turn increasing the number of high-productivity jobs offered by employers. Under somewhat restrictive assumptions, a difference-in-differences 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 Annex 2.A1 for more details on data and Bassanini and Venn, 2007, for a full description of estimation methods and results).*

Higher average replacement rates are found to be associated with significantly higher measured average 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. 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 skilled for unskilled 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



MFP: Multi-factor productivity.
** significant at 5%; *** significant at 1%.
Derived from difference-in-differences OLS estimates.
Source: OECD estimates.

StatLink http://dx.doi.org/10.1787/023478304336

* 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.

2.5. Parental leave

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. In addition, if new workers lacking in job-specific skills are hired to replace employees taking parental leave, productivity could fall, at least temporarily.

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 childbirth, and additional (paid or unpaid) leave after the birth. Because comparable cross-country data are available 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…

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.

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.[32] Time spent out of the workforce after childbirth 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 away from work (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…

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.

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

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%.

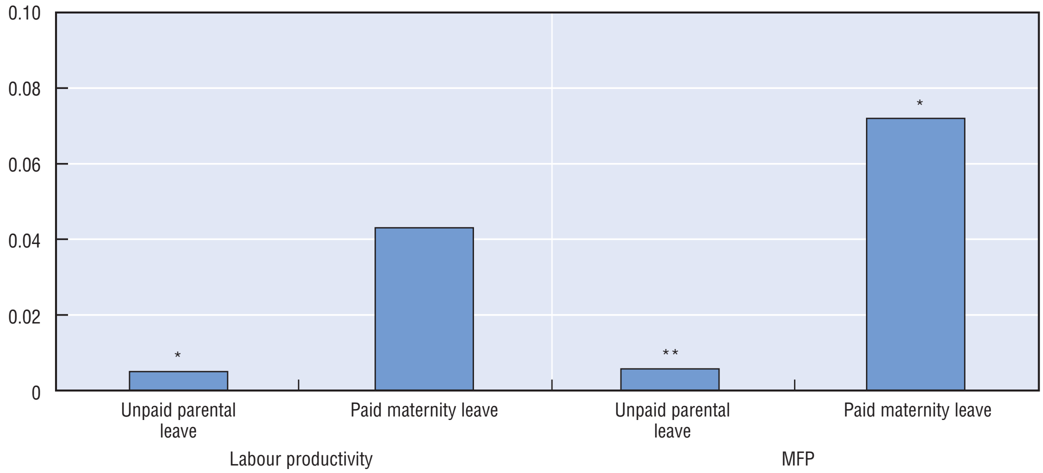
Unpaid parental leave has a small, positive impact on average measured productivity

The impact of parental leave on productivity has been estimated using the difference-in-differences technique described in Box 2.2 for a sample of 18 OECD countries over the period 1980-99. 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 Annex 2.A1 for more details on data and Bassanini and Venn, 2007, for a full description of estimation methods and detailed results).

The 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 the level of aggregate labour productivity and MFP of between 0.005 and 0.01 percentage points.

Figure 2.7. **Parental leave has a positive effect on average measured 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[a]



MFP: Multi-factor productivity.

* significant at 10%; ** significant at 5%.

Derived from difference-in-differences OLS estimates. The estimates in this figure are calculated by multiplying the estimated effect of parental leave in female-dominated industries 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.

a) The sample means are 64 weeks of unpaid parental leave and 15 weeks of paid maternity leave.

Source: OECD estimates.

StatLink http://dx.doi.org/10.1787/023375065083

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

The results for paid maternity leave are more ambiguous: longer periods of available paid maternity leave are associated with higher productivity levels, but the effects are only statistically significant for MFP.[33] 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 (15 weeks), they could increase their MFP by about 1.1% in the long-run. The statistical significance of the results for both unpaid parental leave and paid maternity leave is sensitive, however, to changes in the sample of countries included in the analysis.[34]

A number of alternative specifications were tested to determine whether the positive productivity impact of parental leave declines with very long periods of leave and whether the productivity effect of an increase in paid maternity leave is influenced by the provision of unpaid parental leave, and *vice versa*. 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. Increases in the length of unpaid parental leave only appear to be associated with higher productivity in countries where paid maternity leave is short or non-existent. In countries where women already have access to ten weeks or more of paid maternity leave, changes in unpaid parental leave have no significant impact on productivity.

… but at least part of the effect is due to changes in employment

It is possible that at least part of the increase in average measured productivity resulting from an increase in the length of parental leave is due to changes in the level of employment rather than changes in individual productivity. For example, if firms believe that an extension of parental leave will impose additional costs on employing parents (such as hiring and training replacement workers), they could reduce total employment, which could lead to higher productivity through the composition effects discussed in Section 1.2. Over the longer term, firms might substitute capital for labour in order to reduce the potential cost of parental leave, increasing the capital-to-labour ratio and raising labour productivity. Additional analysis suggests that employment and composition effects could explain up to half of the productivity effect of paid maternity leave (and a smaller proportion for unpaid parental leave), although this result varies substantially between countries.

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 to 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.[35] 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 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.

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 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.

Conclusion

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 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 GDP per capita.

The main finding of this chapter is that pro-employment policies are unlikely to lower productivity among existing workers. Moreover, even taking into account a temporary reduction in aggregate productivity due to the fact that pro-employment policies will help more low-skilled get a job – thus depressing aggregate measured productivity – pro-employment policies will often raise GDP per capita.

It has been reasonably well established that tax reforms and pro-competitive product market regulation can enhance productivity and GDP per capita growth. However, evidence on the productivity effects of other labour market reforms advocated in the Restated OECD Jobs Strategy does not loom large in the existing empirical literature. The results of the industry-level analysis presented in this chapter partially fill this gap.

The clearest result emerging from the analysis is that too strict 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. However, it is not clear whether partial reforms to EPL, whereby rules on temporary contracts are relaxed while leaving EPL on regular contracts unchanged, would have any impact on productivity.

Results for other policies are more tentative and the policy implications of these findings are less clear:

- Higher minimum wages appear to be associated with higher average productivity levels, but it is unclear to what extent this reflects improved incentives to invest in training or substitution of skilled for unskilled workers. Clearly, more research is needed on the channels through which minimum wages affect productivity. In the absence of more clear-cut findings, the results presented in this chapter cannot be taken as an endorsement of using higher minimum wages as a means to improve productivity performance, particularly given the possible adverse distributional consequences of reducing employment opportunities for unskilled workers.
- Parental leave also appears to increase average productivity, in part by allowing workers with family responsibilities to maintain their links to the workforce in general, and to their existing jobs in particular, around the time of childbirth. However, these results are somewhat sensitive to the empirical specification used and at least some of the productivity impact of parental leave in some countries can be explained by composition effects.
- There is also some scattered evidence that reforms that reduce the generosity of 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. This is offset by a positive employment effect, so that the overall long-run impact of lowering unemployment benefits on GDP per capita appears to be either negligible or positive. In addition, a well-designed activation policy for job-seekers could potentially replicate some of the positive productivity impacts associated with generous unemployment benefits, such as improving the quality of job matches, while also promoting employment.

The productivity impact of the other policy reforms considered in the Restated 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.

This chapter also sheds light on a critical methodological issue, namely the importance of taking into account the composition effects associated with pro-employment policies. Policy reforms that boost employment will likely have a negative impact on average measured productivity growth simply by increasing the proportion of unskilled 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 does not generally reflect lower productivity of individual workers. 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, 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. Policy reforms that increase both the overall level of employment and GDP per capita should be encouraged, regardless of whether or not they lower average measured labour productivity.

Finally, looking at the impact of labour market reforms on GDP per capita is only one of a number of ways to evaluate their success. Policies that encourage people to move into work are likely to have social benefits in excess of their impact on GDP per capita, particularly in the longer term. These include higher household incomes and reduced reliance on welfare, allowing public revenue formerly used for welfare payments to be redirected to other social programmes or used to lower taxes.

Notes

1. 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 Section 1.2).
2. Schwerdt and Turunen (2006) 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.
3. In addition, policies that lead to an expansion in employment for low-skilled workers could have significant social benefits. Any resulting productivity slowdown, therefore, should be considered in a broader context when evaluating the impact of policy changes.
4. 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.
5. MFP measures the components of output and labour productivity that are not accounted for by factor inputs.
6. 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.
7. 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.

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8. 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).
9. 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).
10. 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 have a negative effect on productivity, particularly in times of diffusion of radical new technological paradigms (Wasmer, 2006).
11. In Nickell and Layard (1999), the relationship between labour productivity growth and EPL is not statistically significant once the productivity gap to the United States is included in regressions, but the relationship between MFP growth and EPL continues to hold.
12. 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.
13. However, the structure of layoffs in the United States might be distored by the fact that the unemployment insurance system is experience-rated with premia dependent, at least in part, on the risk of layoff. For this reason, turnover rates are also used in a sensitivity analysis. While turnover rates are quite variable across industries, the ranking of industries by turnover has been shown to be extremely stable across countries (Haltiwanger, Scarpetta and Schweiger, 2006).
14. Theory does not unambiguously predict whether EPL is more likely to affect productivity levels or growth rates. A model selection exercise, 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. The results presented in this chapter are based on a model where EPL affects growth only.
15. One point corresponds also to one standard deviation in the cross-country distribution of the EPL index for regular contracts.
16. The fact that EPL appears to have a stronger effect on MFP growth than labour productivity might reflect a positive impact on capital deepening.
17. 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.
18. This effect should be distinguished from the composition effect discussed in Section 1.2 because the substitution of skilled for unskilled labour is not necessarily accompanied by a change in the overall level of employment or hours.
19. 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. 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).
20. It is possible that the distribution of low-wage workers in the United Kingdom prior to the introduction of the minimum wage reflected economic conditions of the time period examined, rather than an underlying propensity for employing low-wage workers. However, the baseline results appear to be relatively robust to the use of alternative indicators based on the average distribution of low-wage workers by industry across a number of European countries (see Bassanini and Venn, 2007).

21. 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 requires the use of detailed tax models for each country and year and data are available only since 2000 (Immervöll, 2007).

22. 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. 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.

23. 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. Taken at face value, these estimates imply that 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 average measured labour productivity would be, other things being equal, about 6 percentage points greater than it actually is. While minimum wages appear to have a greater impact on labour productivity than MFP, the difference between the effects is not statistically significant.

24. Despite a lack of empirical evidence on a link between minimum wages and overall employment, an alternative specification – including employment as an explanatory variable – was tested to rule out the possibility that the observed positive relationship between minimum wages and productivity is purely the result of a composition effect due to lower employment. The results suggest that very little of the productivity impact of minimum wages can be attributed to changes in overall employment. This does not, however, rule out a substitution effect, whereby the skill composition, but not the overall level, of employment is altered.

25. The average unemployment benefit replacement rate was included as a control variable both individually and interacted with minimum wages. However, the results are somewhat sensitive to the sample used.

26. Alternatively, this 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 unskilled workers of remaining unemployed and creating an incentive for the unemployed to move quickly into any available job vacancy.

27. For instance OECD (2006a) reports 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.

28. 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-differences 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.

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. Canadian data on gross replacement rates refer only to the Province of Ontario. Yet, eliminating Canada from the sample yields an even less negative point-estimate, thus reinforcing the results. See Annex 2.A1 for more details on data and OECD (2007b) for detailed results.

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 (OECD, 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%, implying an elasticity no greater than –0.02. Such a low elasticity cannot be entirely explained through composition effects (see Section 1.2).

32. 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.

33. 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 2.7.

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 average productivity. The difference-in-differences 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.

35. 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.

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 1970-90 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.

Variables common to aggregate and industry-level analyses

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.

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.

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Aggregate analysis

GDP per capita

Definition: GDP in volume terms.

Source: OECD Productivity database.

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 64 years.

Source: OECD Economic Outlook database.

Investment rate

Definition: Ratio of gross fixed capital formation to GDP.

Source: OECD Economic Outlook database.

Tax revenue to GDP

Definition: Tax revenue as a percentage of GDP.

Source: OECD Revenue Statistics database.

Industry-level analysis

The main sources of data for all the industry-level analyses are the 60-Industry database of the Groningen Growth and Development Centre (*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.

The sample used for the analysis in this section covers at most 18 OECD countries and 16 industries over the years 1979-2003. 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. The industries included are 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. Selection of countries and years is due to availability of reliable data. Not all observations are included in each model, due to data availability.

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.

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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 measured by the mean absolute deviation from 1.

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 decreasing 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.
60-64	Transport, storage and communications services	3
65-67	Financial intermediation	7.5

n.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 worker earnings. The tax wedge expresses 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 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 one month of tenure at the moment of the survey to ensure that reported training was taken while working in the same industry. 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-state 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 zero 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.

EPL for regular contracts

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

Source: OECD (2004), *OECD Employment Outlook*.

EPL for temporary contracts

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

Source: OECD (2004), *OECD Employment Outlook*.

EPL total

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

Source: OECD (2004), *OECD Employment Outlook*.

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 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).

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).

Ratio of statutory minimum wage to median wage

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

Source: OECD Minimum Wages database.

Real minimum wage

Definition: Minimum wage in 2000 US dollars PPP.

Source: OECD Minimum Wages database.

Share of low-wage workers

Definition: UK 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 1994-99.

Source: British Household Panel Survey module of the European Community Household Panel.

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Employment share of entering firms surviving for only one year

Definition: Proportion of total employment in new firms in a given year that exit that same year. This is equal to the product of the ratio of employment in entering firms to total employment and the ratio of employment of firms that do not survive until the following year to total employment in entering firms.

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

Data adjustments: Equal to employment in entry firms that last one year only, divided by total employment. 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.

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 canton are not included).

Source: Gauthier and Bortnik (2001).

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 canton 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:

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

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-USD. 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 revision, 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:

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

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).

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