

## Chapter 3

# Earnings Volatility: Causes and Consequences

*This chapter presents, for the first time, comparable estimates of the extent to which individuals' earnings fluctuate from year to year in a large number of OECD countries. It looks at which individuals are most likely to be affected by earnings volatility and at what causes it, as well as the impact of taxes and benefits. It also examines how wages and earnings vary across the business cycle, and how policies and institutions influence such fluctuations and the relative importance of different adjustment margins. By breaking the latter down by level of education, the chapter also examines the effect of the business cycle on earnings inequality, a key issue for social cohesion that has to date been investigated for only a few countries.*

## Key findings

Many workers experience large fluctuations in before-tax labour earnings from one year to the next, due to changes in working hours, movements in and out of work and changes in pay. Youth entering the labour market and workers in non-standard jobs (such as temporary employment or self-employment) are the most likely to experience both large increases and large decreases in earnings. Other workers, such as those with a low level of education, poor health or approaching retirement, have only an increased chance of experiencing a large drop in earnings. However, even after taking personal and job characteristics into account, there are significant cross-country differences in the incidence of earnings volatility. Countries with the most dynamic labour markets – as measured by hiring, firing and quit rates – tend to have a relatively low incidence of earnings volatility.

It is often difficult for workers to predict changes in earnings and assess whether these are temporary or permanent. Additionally, private insurance and financial markets are poorly equipped to protect households against earnings fluctuations. Large drops in individual earnings are associated with increased risk of household poverty and financial stress, with the impact largest in the poorest households. Tax and welfare systems can help buffer households against volatile earnings. Taxes play a prominent role in reducing the impact of earnings fluctuations among full-time workers, while transfers such as unemployment benefits and social assistance are more important when volatility is due to movements into or out of work.

Tax and transfer systems can lower the risk of poverty or financial stress when earnings drop, but may also absorb the potential benefits of increased earnings and intensify the business cycle's effect on earnings. Generous unemployment benefits may reduce workers' resistance to job loss and increase unemployment duration, leading to a greater fall in earnings in downturns when unemployment rises. High marginal tax rates are associated with greater cyclical volatility of hourly wages because they reduce worker resistance to gross wage adjustments. During a recession, these effects amplify reductions in earnings and government revenues, making it harder for governments to provide protection against earnings fluctuations when the need is greatest.

Moderately progressive taxes and generous unemployment benefits, coupled with strictly-enforced work-availability conditions and a well-designed "activation" strategy, can provide a solid framework for reconciling labour market dynamism with adequate income security. Such measures can be costly and countries need to achieve a sound fiscal stance during periods of growth, so as to be able to sustain workers' incomes during a downturn. Care is also needed to ensure that such systems do not raise structural unemployment.

Employment protection – notably strict dismissal rules for workers with regular contracts – effectively mitigates the short-term impact of macroeconomic shocks on employment and earnings. However, strict dismissal regulations also tend to make the effects of shocks on labour income more persistent, notably by prolonging wage adjustments. Moreover, strict employment protection is often associated with labour

market duality, and workers with temporary contracts are more likely to experience earnings volatility than those with regular contracts. Policy makers need to strike a balance between the income-smoothing effect of stricter employment protection and the gains in efficiency associated with lower employment protection, as well as taking into consideration the goal of minimising labour market duality.

## Introduction

Earnings from labour market activity play a major role in household welfare. Yet little attention has been paid in the literature to the extent to which labour market volatility translates into fluctuations over time in individual and household income. Workers' earnings might fluctuate over time due to the dynamic nature of modern labour markets that are characterised by the continuous reallocation of labour (OECD, 2009, 2010a). Even workers remaining in the same job may find their earnings vary substantially from one pay period to the next if, for example, they have irregular working hours or depend on commissions or bonus payments. Tax and transfer systems in OECD countries are designed to cushion households against large earnings shocks. However, if their success in sheltering households is limited, earnings volatility could result in increased insecurity and poverty risk for households, particularly for those without access to credit or savings.

These risks are amplified during a recession, when the proportion of individuals experiencing large increases in earnings falls and the proportion experiencing large decreases rises. Most studies on the impact of the business cycle on the labour market, including previous OECD work, have focused essentially on fluctuations in employment and unemployment. A key issue for workers' well-being, however, is the extent to which cyclical downturns result in fluctuations in labour market earnings – that is the *combined* effect of changes in *employment, hours worked* and *wages*. Indeed, a recession can impact the labour income of employees even if they do not lose their job, by affecting the number of paid hours of work (through lower paid overtime or temporary cuts to working hours) and/or by reducing their real hourly wage (generally by compressing nominal wage growth). These issues assume a particular importance in the aftermath of the 2008/09 “Great Recession”. In a number of countries, much of the labour market adjustment has been in terms of reductions of working time rather than job losses. Quantifying the costs of a recession for workers involves, at the very least, assessing all sources of loss of labour income. This is also of crucial importance to the government budget in downturns because reductions in gross labour income are directly reflected in falling government revenues.

This chapter presents, for the first time, comparable estimates of the incidence of individual earnings volatility for a large number of OECD countries. It also examines the extent to which tax and benefit systems, and households themselves, provide a buffer against earnings volatility, and whether this volatility increases the risk of household poverty and financial stress. Using aggregate and industry-level data, the chapter also explores, for the first time in OECD work, how wages and earnings adjust across the business cycle and the role for policies and institutions in influencing earnings fluctuations and the relative importance of different adjustment margins.<sup>1</sup> Moreover, by breaking down adjustment patterns by level of education, the chapter also examines the effect of the business cycle on earnings inequality, a key issue for social cohesion that has so far been investigated for only a few countries.

The analysis in the chapter covers a period prior to the onset of the 2008/09 global recession, therefore some caution is necessary when applying the lessons from past downturns to the current situation. With the exceptions of Iceland, Ireland, Spain and the United States, the increase in unemployment during the 2008/09 recession was smaller than that experienced in many of the earlier recessions. Chapter 1 discusses some of the reasons for this difference, including large-scale fiscal stimulus plans, labour hoarding (encouraged by short-time work schemes) and, in some countries, reforms to activation policies enacted over the past decade. As a result, it could be expected that the shock to labour earnings was smaller than in previous downturns. Changes to unemployment benefit schemes during the course of the recession – most notably to improve coverage among previously-excluded workers – may also have buffered households against earnings shocks in a different way than prior to the recession. The effectiveness of the social safety net during the 2008/09 recession is discussed in Chapter 1.

This chapter is divided as follows. Section 1 outlines the incidence of earnings volatility in OECD countries. Section 2 discusses the consequences of earnings volatility for individuals and households, looking at the role of the tax and transfer system in buffering households against earnings volatility and at the impact of earnings volatility on household poverty risk and financial stress. Section 3 moves to an aggregate level to examine the extent to which the business cycle affects *total* earnings and the relative importance of different margins of adjustment. Section 4 then examines the role of selected labour market institutions in amplifying/mitigating or shortening/prolonging the effects of the business cycle on earnings, wages and hours. Finally, Section 5 looks at how earnings inequality between workers with different levels of education fluctuates over the business cycle and at the extent to which these fluctuations are affected by labour market institutions.

## 1. Individual earnings volatility

### **Earnings volatility in OECD countries**

There are several ways to measure earnings volatility (see Box 3.1). This section will adopt a categorical method used by the US Congressional Budget Office (2007) and define individual earnings volatility based on workers receiving a large increase or large decrease in annual labour earnings from one year to the next. Specifically, a worker will be said to

#### **Box 3.1. Alternative approaches to measuring earnings volatility**

In an attempt to explain the causes of growing US earnings inequality, Gottschalk and Moffitt (1994) pioneered an approach which distinguished between *permanent* earnings changes due to factors such as skill-biased technical change, and *transitory* changes, which they termed earnings or income *instability*. This approach was very influential and inspired a large literature tracing the evolution of earnings instability over time. In general, estimating transitory changes in earnings requires complex econometric models and various assumptions about functional forms that can dramatically alter estimates [although later work by Gottschalk and Moffitt (2009), finds that simpler statistics based on variation from a long-run average provide a good approximation for transitory variation estimates from more complex time-series models]. Long time-series of data for individual earnings are also required. As a result, the existing literature focuses largely on the United States (where such datasets are readily available) and there are few cross-country estimates of earnings instability (an exception is Gangl, 2005).

**Box 3.1. Alternative approaches to measuring earnings volatility (cont.)**

Recently, a new strand of literature has developed examining earnings volatility or overall changes in earnings for individuals or households across time. In contrast to the complex time-series models used in the earnings instability literature, this approach uses far simpler measures based on individual or cross-sectional variation in earnings. While it is not possible to distinguish between permanent and transitory variation in earnings using these approaches, several authors argue that overall measures of earnings volatility are in fact more useful when examining the potential impact on earnings risk because both permanent and transitory changes in earnings have the potential to impact on household welfare (e.g. Shin and Solon, 2008; Dynan *et al.*, 2007). Of course, increased volatility is not necessarily an indicator of increased risk; earnings changes may be the result of voluntary decisions by households. Even if earnings changes are involuntary, the extent to which they affect household welfare will depend on the extent to which household consumption is buffered against earnings volatility by the tax and transfer system, insurance markets and the labour supply and savings responses of households themselves (this issue will be examined in more detail in Section 2). Nevertheless, it is important to document the extent to which earnings fluctuate as a first step in understanding earnings risk.

There are three main approaches to estimating earnings volatility, all of which require longitudinal data on earnings for individuals:

- Time-series methods (e.g. Hällsten *et al.*, 2010; McManus and DiPrete, 2000; Beach *et al.*, 2006): earnings volatility is calculated for each individual as the standard deviation of earnings or earnings changes over several consecutive periods (typically 5-8 years). An overall measure of earnings volatility for a country or sub-group is then calculated as the average of the individual standard deviations.
- Cross-sectional methods (e.g. Shin and Solon, 2007; Dynan *et al.*, 2007; Ziliak *et al.*, 2010): earnings volatility is measured as the cross-sectional variance or standard deviation of year-to-year earnings changes. The idea is that increases in earnings volatility should appear as an increased dispersion of year-to-year changes.
- Categorical methods (e.g. US Congressional Budget Office, 2007; Dynan *et al.*, 2007): an individual is defined as having volatile earnings if they experience a large increase or decrease in earnings from one year to the next. An overall measure of earnings volatility can then be calculated as the proportion of workers in a particular country or sub-group with volatile earnings.

Each of these approaches has advantages and disadvantages. Time-series methods are quite data-intensive as they require long time-series of data for each individual. Cross-sectional and categorical methods are less data-intensive but more open to measurement error because they are based only on year-to-year changes rather than changes over a longer period of time. Both time-series and categorical methods have the advantage of providing individual-level indicators of earnings volatility which can then be regressed against the personal or job characteristics of individuals to explain how earnings volatility varies by, for example, education level or age.

have volatile earnings if their gross annual labour earnings increased by 20% or decreased by 20% in real terms from one year to the next.<sup>2</sup>

This approach has a number of advantages. First, it requires earnings data which are relatively easy to obtain for a large number of countries on a comparable basis.<sup>3</sup> Second, because volatility is defined at the individual level (rather than as a summary measure for

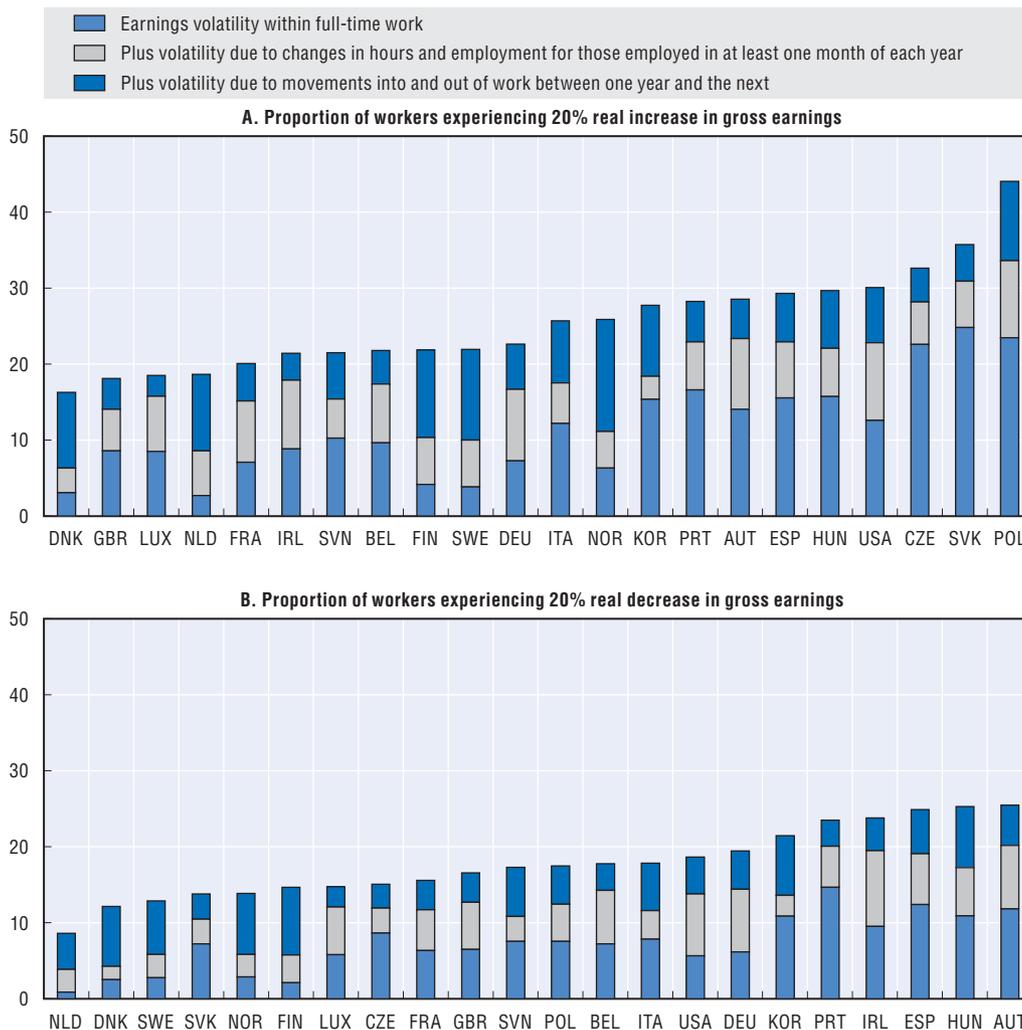
a whole country or sub-group of workers), it is possible to examine how personal and job characteristics affect its incidence. Third, volatility measures can be calculated using data from longitudinal surveys covering a minimum of two years rather than requiring long time-series of data, which expands the number of countries for which comparable earnings volatility measures can be calculated. On the other hand, using this method, it is impossible to distinguish between permanent and transitory earnings changes, which may have important policy implications. The relatively short window over which estimates are constructed makes it difficult to distinguish between structural and cyclical influences on earnings volatility, given that different countries are likely to be at different points of their business cycles. This should be kept in mind when considering cross-country comparisons. Concentrating on year-to-year changes also risks overestimating the extent of earnings volatility by capturing one-off earnings changes or even measurement errors.<sup>4</sup>

Workers' earnings may vary from year-to-year for many reasons. Their basic wage rate could be adjusted upwards or downwards, they could increase or reduce the number of overtime hours worked, they may receive (or not) performance pay, commissions or income from profit-sharing arrangements, they could switch from full-time to part-time work (or *vice versa*), take up a second job or move between work, unemployment and inactivity, or their self-employment income could fluctuate due to the performance of their business. The data used in this section are not suitable for examining pure wage volatility, being based on *annual* earnings. However, by examining earnings volatility for workers with different levels of labour market attachment, it is possible to get an idea of how important different types of adjustments are in influencing overall earnings volatility.

Figure 3.1 shows the incidence of earnings volatility in OECD countries for which data are available in the mid-2000s.<sup>5</sup> The estimates shown are for workers aged between 25 and 59 years to minimise the possibility that the results are driven by young people entering the labour market and older workers transitioning into retirement (earnings volatility for youth and older workers will be examined below). Overall earnings volatility is highest in Austria, Hungary, Korea, Portugal and Spain, which all have a high incidence of both large increases and large decreases. In addition, a large proportion of workers in the Czech Republic, the Slovak Republic and Poland faced large increases in earnings, while large decreases are relatively common in Ireland. Excluding the Czech Republic, Slovak Republic and Poland, which experienced annual GDP growth in excess of 6% during the period under examination, there is a high degree of symmetry between increases and decreases in earnings: countries with a large proportion of workers receiving an increase in earnings also tend to have a large proportion of workers receiving a decrease in earnings.<sup>6</sup>

Many workers who are employed full-time in both years experience earnings volatility, particularly in countries with overall high levels of volatility. Only a relatively small proportion of full-time employees change from one job to another each year (OECD, 2010a), so on average for the countries where data are available, around one quarter of earnings volatility within full-time work is the result of job changes, with the remainder due to changes in earnings within existing jobs (Venn, 2011). Movements into and out of work are also important contributors to earnings volatility, more so for earning decreases than increases and in countries with low overall levels of earnings volatility. For the remainder of this section, the analysis will focus on two main types of earnings volatility: i) *full-time earnings volatility* which refers to earnings volatility among workers who were employed full-time for the full year in both years (not necessarily in the same job) for which earnings volatility is calculated; and ii) *overall earnings volatility* which refers to earnings volatility

Figure 3.1. Incidence of year-to-year gross labour earnings volatility



Note: Data are for the income reference years 2004-07 for all countries except Italy and Portugal (2006-07), France (2005-06), Denmark (2004-05) and the United States (1995-96). Estimates are as a proportion of all workers who worked at least some time in at least one of the two years for which the estimates are made. Countries are ordered from left to right from lowest to highest earnings volatility within full-time work.

Source: OECD calculations using data from the European Survey of Income and Labour Conditions (EU-SILC) except for Germany, Korea, the United Kingdom and the United States, which are from the Cross-National Equivalence Files of the German Socio-Economic Panel, the Korean Labor and Income Panel Survey, the British Household Panel Survey and the Panel Study of Income Dynamics, respectively.

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among all workers who worked at least some time in one of the two years for which earnings volatility is calculated.

Earnings volatility trends vary substantially across the countries for which data are available (see Venn, 2011). Full-time earnings volatility has increased over time in the United States and Germany, declined in Korea and stayed relatively constant in the United Kingdom (apart from an increase in the late 1990s associated with the introduction of the minimum wage). In the most recent years, overall earnings volatility appears to be declining in all four countries.<sup>7</sup> As well as longer-term trends, the business cycle is likely to be a significant contributor to individual earnings volatility and could explain part of the

cross-country differences in earnings volatility shown in Figure 3.1. Periods of rising unemployment are typically accompanied by more large decreases in earnings and fewer large increases, due to greater fluctuations in the earnings of full-time workers, more labour market exits and fewer entries. However, important differences across countries suggest that country-specific policy and institutional settings may influence how the business cycle affects earnings volatility. Unfortunately, it is not possible to examine the effects of the business cycle on earnings volatility in more detail using microdata because few countries have a sufficiently long time-series on earnings volatility available. This issue will be taken up again using aggregate and industry-level data in Sections 3 to 5 of this chapter.

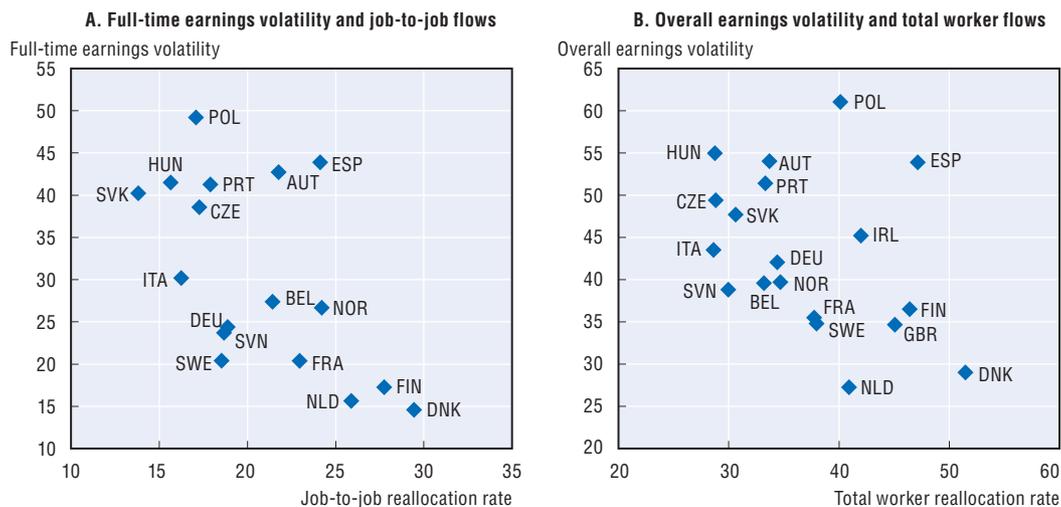
### **Explaining cross-country differences in earnings volatility**

The large cross-country differences in earnings volatility identified in Figure 3.1 raise questions about the extent to which country-specific policies and institutions affect the incidence of earnings volatility, over and above business-cycle effects. On the face of it, there are several institutional similarities among the group of countries with the least earnings volatility – the Nordic countries and the Netherlands – which tend to have generous unemployment benefits, an emphasis on activation for job-seekers, coordinated wage bargaining, widespread collective bargaining coverage and high labour taxes. However, other countries with similar features – notably Austria – have much more earnings volatility. Indeed, the countries with the highest incidence of earnings volatility – the eastern European countries plus Spain, Portugal, Austria and Korea – are quite disparate in their institutional settings.

One possible explanation for a high level of earnings volatility is that it is a by-product of other changes in labour market status. For example, in countries where workers move frequently into and out of work, the incidence of overall earnings volatility (which is partly driven by movements into and out of work) might be expected to be higher than in countries with lower labour mobility. Likewise, voluntary job-to-job movements are often associated with wage increases (OECD, 2010a), so countries with higher job-to-job flows might be expected to have greater (upwards) earnings volatility.

However, Figure 3.2 shows that there is a negative correlation between earnings volatility and labour mobility. Contrary to expectations, high job-to-job reallocation rates are associated with lower levels of full-time earnings volatility. This relationship also holds for increases in year-to-year earnings, but the relationship between job-to-job reallocation and the incidence of large decreases in earnings is weaker.<sup>8</sup> With the exceptions of Poland and Spain, countries with higher overall earnings volatility tend to have less worker flows and *vice versa*.<sup>9</sup> Crucially, there is little evidence that workers in countries with highly-dynamic labour markets, as measured by worker flows, are more likely to experience earnings volatility than those in other countries. In Poland and Spain, the high share of temporary workers could explain both high worker reallocation rates and the high incidence of earnings volatility. Bassanini *et al.* (2010) find that a larger share of temporary employees is associated with increased hirings and separations. The subsection below will show that temporary workers are also much more likely to experience earnings volatility, both within full-time jobs and due to movements into and out of work.

Instead of earnings volatility being a by-product of labour mobility, the two forms of labour market flexibility may be substitutes. It is conceivable that in countries where hiring and firing is difficult (either because of strict regulation or because it is difficult to convince workers who are well-matched to their job to move to another job), adjustments might

Figure 3.2. **Earnings volatility and labour mobility: complements or substitutes?**

Note: Full-time earnings volatility is the proportion of workers who are employed full-time for the full year in two years who experience either a 20% increase or decrease in gross labour earnings. Overall earnings volatility is the proportion of workers who are employed for at least some time in the two-year period who experience either a 20% increase or decrease in gross labour earnings. Total worker reallocation rate is the sum of total hirings and total separations, as a percentage of total employment. Job-to-job reallocation rate is the sum of job-to-job hirings and job-to-job separations as a percentage of total employment. See OECD (2010a) for full details on the calculation of worker reallocation data.

Source: Data on earnings volatility are from the sources described in the note to Figure 3.1. Data on worker reallocation are from OECD (2010a).

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take place on the *internal* margin through adjustments to base wages, bonus payments, overtime or hours of work. Countries with less dynamic labour markets also tend to have longer unemployment spells on average (Nickell and Layard, 1999), in which case workers would suffer a larger reduction in annual earnings in the event of unemployment than in countries where unemployment spells are shorter.

It is highly likely that country-specific policies and institutions impact on the relative ease or attractiveness of adjustment on the *internal versus external* margin. However, with the data available, it is very difficult to test this directly. There is very little cross-country correlation between the incidence of individual earnings volatility as measured in this chapter and a range of standard indicators for policy and institutional settings, including employment protection, wage-setting arrangements, taxes, working-time regulation, unemployment benefit generosity and product-market competition. Cross-country comparisons are confounded by correlations between policy indicators and possible measurement errors in data on earnings volatility, which may be country-specific. A more sophisticated analysis would require longer time-series of data on earnings volatility than are currently available for most OECD countries. In light of these limitations, the impact of policies and institutions on earnings volatility will be examined using aggregate and industry-level data in Sections 4 and 5.

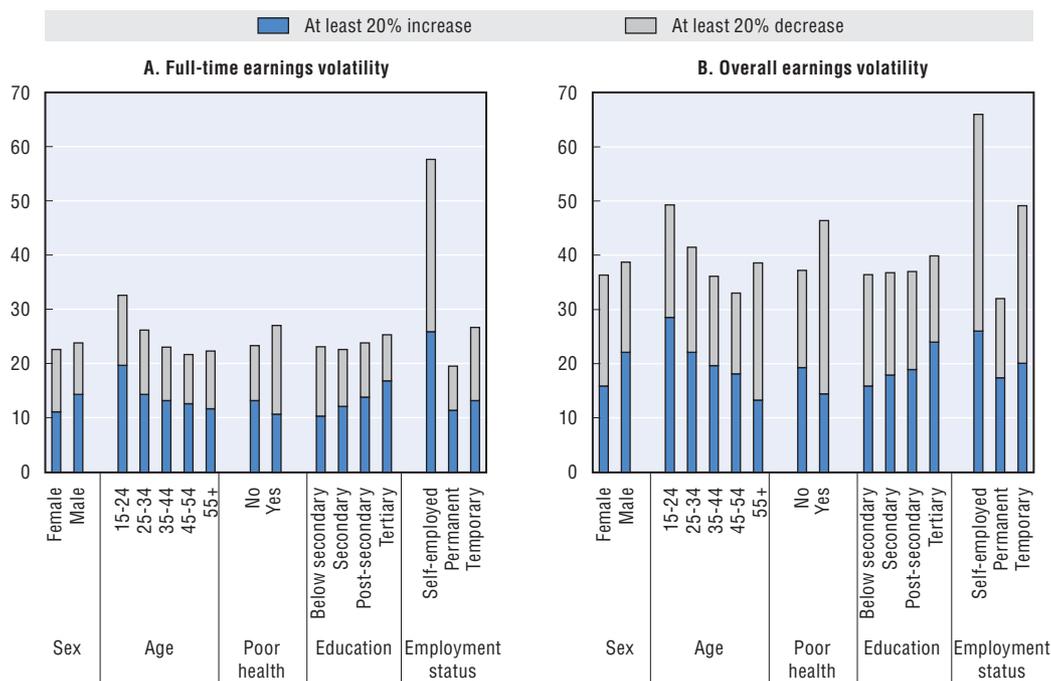
### Who has volatile earnings?

Personal and job characteristics have an important impact on whether or not an individual experiences high earnings volatility. The characteristics of those who tend to experience large increases in earnings often differ from those who are at risk of

experiencing large decreases. Figure 3.3 shows how various characteristics affect the likelihood of year-to-year earnings volatility, both for full-time workers and overall (results for multi-year earnings volatility are shown in Venn, 2011). All other things equal:

- Men are more likely than women to experience large year-to-year increases in earnings, while the opposite is true for large decreases in earnings.<sup>10</sup> This pattern persists both within full-time work and when movements into and out of work are taken into account. However, there is little gender difference in the incidence of multi-year earnings volatility.
- Young workers experience substantially more year-to-year earnings volatility – both increases and decreases – than prime-age workers. The effect is largest for those aged under 25 years, but persists into the late 20s and early 30s. This may reflect the impact of work experience and tenure in stabilising employment, but also the process of job search that younger workers undertake when joining the workforce.<sup>11</sup> Successive large increases in earnings are still more likely for younger workers, but large decreases in earnings over multiple years are only significantly more likely among older workers approaching retirement. However, there is no evidence that older workers experience more earnings volatility within full-time jobs than prime-age workers.
- Less-educated workers are more likely to experience a large decrease in year-to-year earnings and less likely to experience a large increase than more educated workers;

Figure 3.3. **Estimated probability of year-to-year earnings volatility by personal and job characteristics**



Note: Estimated probabilities from multinomial logit models where the dependent variable is a five-category indicator of year-to-year individual gross labour earnings volatility over a three-year period: at least 20% increase; 5-20% increase; 5% increase to 5% decrease; 5-20% decrease; at least 20% decrease. Probabilities are estimated for each variable holding all other variables at sample mean values. \*\*\*, \*\* and \* indicate that coefficients are significantly different from zero at the 99%, 95% and 90% level, respectively. Robust standard-errors are adjusted for clustering at the country-level. Estimates are weighted so that the effects represent the cross-country average effect. See Venn (2011) for full results.

Source: OECD calculations using data from EU-SILC for income reference years 2004 to 2007.

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however, there is little difference in the probability of multi-year earnings volatility by education level.

- Workers with health problems (who say that their current state of health is “bad” or “very bad”) are significantly more likely to have earnings decreases, both year-to-year and across multiple years. This is consistent with people with health problems pulling out of work or reducing their availability to work overtime if they work full-time.<sup>12</sup> On the other hand, workers with health problems are less likely to have multi-year earnings increases.
- Workers in “non-regular” employment are far more likely to experience earnings volatility than employees with permanent contracts. Temporary employees and the self-employed are more likely to have both large increases and large decreases in earnings within full-time work than permanent employees, and this holds for year-to-year and multi-year earnings volatility. For temporary employees, the earnings volatility gap compared with permanent employees grows even larger when movements into and out of work are taken into account. For the self-employed, most decreases in earnings result from decreases within full-time work, both on a year-to-year and multi-year basis. In contrast, multi-year earnings increases for the self-employed are driven mainly by labour market entry.

Additional insight into the characteristics of workers and jobs who experience earnings volatility can be gleaned by looking at the likelihood of receiving paid overtime or performance pay, which are the most volatile components of earnings (Anger, 2011; Devereux, 2001; Shin and Solon, 2007; Swanson, 2007; Urasawa, 2008). Indeed, earnings volatility is significantly more likely for workers in countries where paid overtime is more common. Firm characteristics are an important factor in determining the incidence of variable pay: workers in larger firms are more likely to have variable types of pay, while foreign-owned firms are more likely to operate performance-pay schemes than those in domestic ownership. Paid overtime is also more likely (and unpaid overtime less likely) when there is a collective agreement in place in the firm, whereas collective bargaining appears to have little impact on the use of performance-pay schemes. In general, the characteristics of workers with paid overtime are quite different to those with performance pay. Paid overtime is most likely for less-educated workers in blue-collar jobs, whereas performance pay is most likely for those with a tertiary qualification and longer job tenure, working in complex jobs. In both cases, women – particularly those with family responsibilities – are significantly less likely than men to receive variable types of pay (Venn, 2011).

## 2. Consequences of earnings volatility

In a world where workers have perfect foresight about future earnings, can buy insurance against earnings fluctuations, and are able to save or borrow money to smooth consumption, temporary changes in earnings should have no or limited impact on household consumption (Friedman, 1957). In reality, it is often difficult for workers to foresee earnings changes or assess whether they are permanent or temporary. Private insurance markets for individual earnings volatility are poorly developed. Public unemployment insurance typically provides income support only in the case of job loss (or loss of a significant number of hours of work) whereas public disability insurance only protects against income volatility in limited circumstances. Workers with the most volatile earnings, such as temporary workers or the self-employed, may have limited recourse to public insurance schemes (see Chapter 1). Access to credit and savings may also be limited

for workers who have lost a significant part of their income or among low-income earners more generally (*e.g.* Simpson and Buckland, 2009; Devlin, 2005).

However, even in the presence of market imperfections, there are several possible buffers against individual earnings volatility. Large fluctuations in individual earnings may be offset by changes in the earnings of other household members, other forms of income and the operation of the tax and transfer system. As a result, fluctuations in household disposable income, which is what matters most for consumption, are likely to be smaller than fluctuations in individual earnings. This section will examine the operation of these buffers and the extent to which individual earnings volatility translates into poorer household welfare.

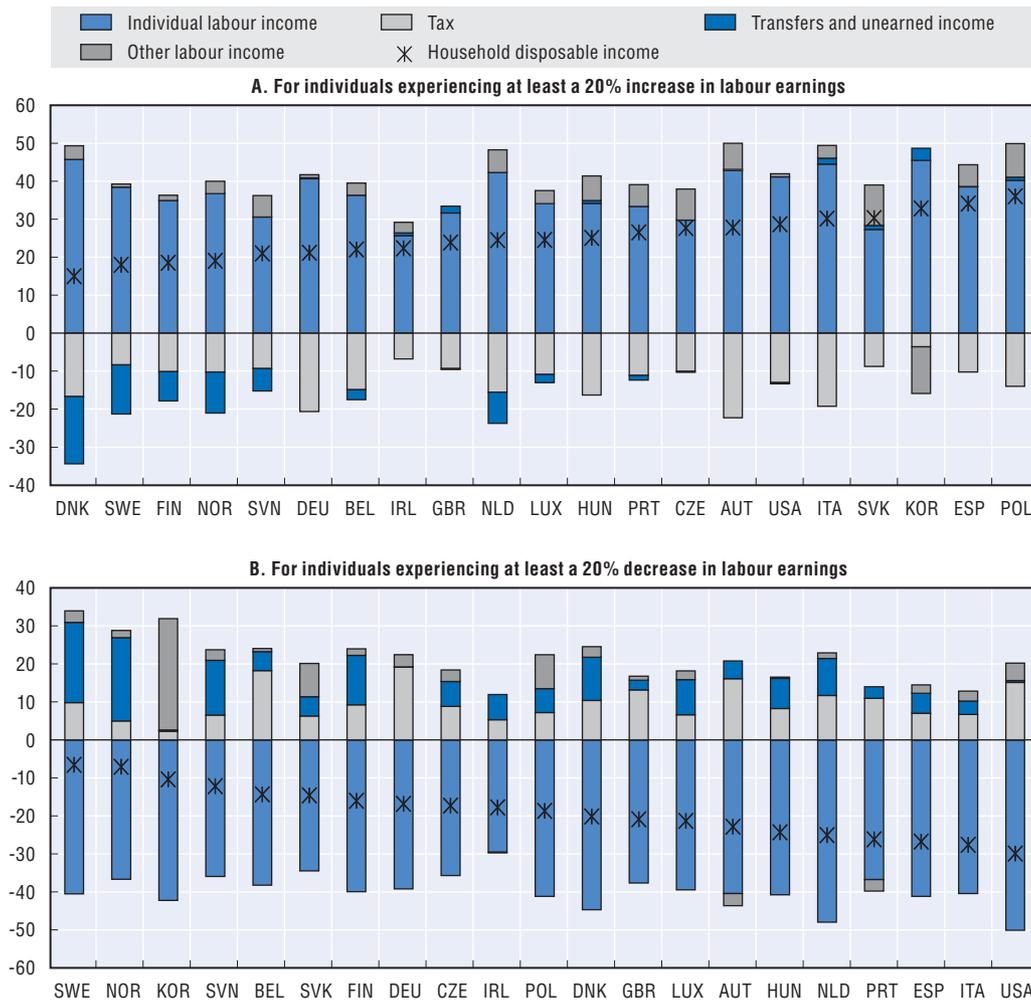
### **Buffers against individual earnings volatility**

Figure 3.4 shows how an increase or decrease in individual gross labour earnings of 20% or more affects household disposable income in selected OECD countries. The percentage change in household disposable income following an episode of individual earnings volatility can be decomposed into components due to changes in the earnings of the individual and other household members, changes in taxes paid and changes in transfers and other non-earned household income (such as income from rental properties or other investments).<sup>13</sup> To reduce the impact of changes in household size, the analysis is limited to households with one or two adults (and where the number of adults is the same in both years), with or without children aged under 18 years.

The results show that there is significant cross-country variation in the extent to which individual earnings volatility flows on to household disposable income. In almost every country, household disposable income is buffered from the full impact of individual earnings volatility.<sup>14</sup> Buffering is particularly strong in the Nordic countries, where the change in household disposable earnings is on average only 46% of the size of an increase in individual gross labour earnings and 30% of the size of a decrease. At the other end of the scale, in Portugal, Spain, Italy, Ireland and the United States, large increases and decreases in individual earnings translate into relatively large changes in household disposable income: 81% of the size of an increase in individual earnings and 66% of the size of a decrease, on average. It is interesting to note that the countries where buffering is most pronounced are also those with among the lowest incidence of earnings volatility (*cf.* Figure 3.1). In contrast, buffers are less effective in countries where earnings volatility is more widespread.

In most countries, offsetting changes in tax are the most prominent buffer for households against individual earnings volatility, especially in the case of large increases. In the case of large decreases in earnings, offsetting changes in transfers and other unearned income are relatively large. In cases where earnings volatility is due only to changes within full-time work (rather than including movements into and out of employment as in Figure 3.4), the role of transfers is much reduced (Venn, 2011). On average, the change in transfers is around 19% of the size of the reduction in individual earnings in the case of a large decrease and 7% in the case of a large increase when including volatility due to movements in and out of work, compared with 11% and 3%, respectively, in the case where only full-time workers are considered. This suggests that transfer payments are more effective at smoothing earnings volatility when it results from movements into and out of work than when it results from changes in earnings for workers who remain employed, which is not surprising given that most working-age income-support payments are available only in case of job loss and are withdrawn quickly

Figure 3.4. **Decomposition of change in household disposable income resulting from overall individual earnings volatility**



Note: People aged 25-59 years. Households with one or two adults and no year-to-year change in the number of adults in the household. Sample includes individuals who worked at least some time in each of the two years over which calculations are made.

Source: OECD calculations using data described in the note to Figure 3.1.

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when individuals take up work. In contrast, the proportionate change in taxes is slightly larger (26% the size of a decrease in individual earnings and 36% the size of an increase) where only full-time workers are considered compared to when there are movements into and out of work (24% and 34%, respectively).

In Korea, there are significant offsetting movements in household members' labour earnings. A large increase in an individual's labour earnings is accompanied by a decrease of around one-third of the size in the labour earnings of other household members, while a large decrease in individual earnings induces an increase by other family members of more than two-thirds the size. The same pattern is evident to a much more limited extent in Poland and the Slovak Republic when an individual has a large decrease in labour earnings. One possible explanation is that households are compensating for deficiencies in the social safety net in these countries. For example, in Korea around 40% of employees are

not registered for employment insurance (Kim, 2010), while in Poland and the Slovak Republic conditions for accessing unemployment benefits are strict so only a minority of the unemployed receive benefits (OECD, 2008).

Not surprisingly, the design of countries' tax and benefit systems explains part of the difference in the extent of buffering across countries. In the event of a large decrease in individual gross labour earnings, the countries with the largest offsetting declines in taxes tend to be the countries with among the highest marginal tax rates (Germany, Austria and Belgium). Likewise, the countries with the largest offsetting increases in transfers tend to have more generous unemployment benefits (Norway, Sweden, Finland and Denmark). However, this relationship is not always clear-cut. Gaps in the coverage of the tax and transfer system could also undermine its role in buffering households against earnings shocks. For example, in Portugal, where the effectiveness of transfers in buffering earnings shocks is low despite generous replacement rates, long contribution periods for unemployment insurance mean that younger workers or those on temporary contracts – both groups that are more vulnerable to earnings volatility – might not receive benefits if they become unemployed (OECD, 2010b).

### **How does earnings volatility affect households?**

The previous section shows that households and governments both play a role in buffering households against individual earnings volatility, but large increases and decreases in individual earnings typically flow through, at least in part, to household disposable income. However, there is little empirical evidence on the relationship between earnings volatility and household welfare.<sup>15</sup>

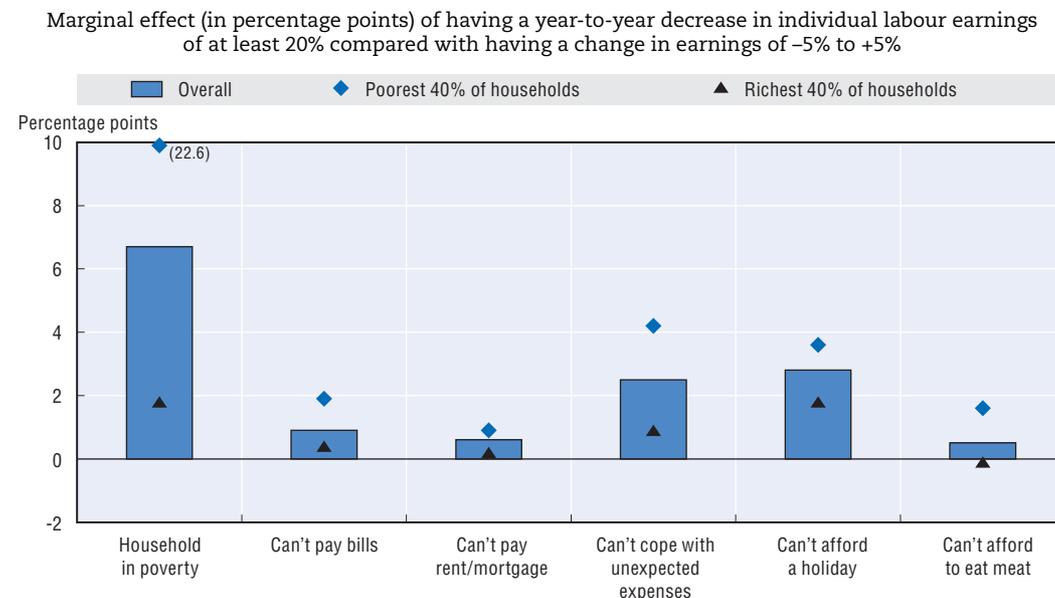
By definition, large changes in household income will affect the likelihood that a household experiences poverty, where poverty is defined on a relative basis depending on the household's position in the income distribution. In the analysis below, the link between earnings volatility and poverty risk is assessed by defining poor households as those with household disposable income (equivalised for household size) less than 50% of the median for the country in which they live. Large changes in income could also affect household consumption patterns. Unfortunately, the data used to estimate earnings volatility do not contain any measures of household consumption. However, it is possible to examine the impact of earnings volatility on consumption indirectly by looking at measures of *financial stress* in households. Five measures of household financial stress are used: i) whether the household has been unable to pay a scheduled rent or mortgage payment in the previous 12 months due to lack of money;<sup>16</sup> ii) whether the household has been unable to pay a scheduled bill for electricity, gas or water in the past 12 months due to lack of money; iii) inability to afford a one-week annual holiday away from home (regardless of whether or not the household has taken a holiday); iv) inability to afford a meal with chicken, meat or fish (or vegetarian equivalent) every second day, if wanted; and v) inability to face unexpected financial expenses using the financial resources of the household.

The analysis of the link between earnings volatility and household welfare is performed at the individual level. The main research question is whether or not an individual who experiences a large increase or large decrease in earnings is more likely to live in a poor household or in a household that has experienced financial stress in the subsequent year(s) than an individual who does not experience earnings volatility. Drawing on existing empirical literature on the factors that affect household financial stress (Boheim and Taylor, 2000; Diaz-Serrano, 2004; Georgarakos *et al.*, 2010; Worthington,

2006), the analysis controls for household composition (household size; marital status; whether someone in the household has a serious health problem), housing tenure and wealth (whether household are homeowners, renting at market or below-market rates; the extent to which housing costs are a financial burden; dwelling size) and personal characteristics to control for life-cycle effects, unobservable risk preference and access to credit markets (age, gender, education). The sample includes only individuals who did not experience poverty or financial stress in the year before the earnings shock.<sup>17</sup>

Figure 3.5 shows the additional likelihood of poverty or financial stress for individuals who experience at least a 20% decrease in earnings compared with those who have little or no change in earnings from year to year. Overall, large earnings shocks are associated with a significantly increased risk of poverty and all types of financial stress. The effects are even stronger for individuals in the poorest households, where earnings shocks are associated with a significant increase in the risk of poverty by more than 20 percentage points and of financial stress by between one and four percentage points. In contrast, in the richest households, earnings shocks are associated with only a small change in the likelihood of poverty and the ability to afford a holiday or unexpected expenses and no significant impact on other forms of financial stress. For both rich and poor households, negative earnings shocks are associated with increased poverty risk both in the year of the earnings shock and, to a lesser extent, in the two following years (Venn, 2011). These results suggest that earnings volatility at the individual level translates into earnings risk at the household level, particularly in the poorest households, who are likely to have less access to savings, credits and assets to smooth consumption, and that the effects may be relatively long-lasting.

Figure 3.5. **Effect of a large earnings shock on the incidence of household poverty and financial stress**



Note: The charts show marginal effects from probit regressions where the dependent variable is whether or not the individual lives in a household that experienced poverty/financial stress in the previous 12 months. Regressions also include controls for age, gender, marital status, education, employment status, household income quintile (financial stress models only), household size, dwelling size, housing tenure, financial burden from housing costs, whether a household member had bad or very bad health, country and year. Sample aged 25-59 years in households with one or two adults where the number of adults does not change over time.

Source: OECD calculations from EU-SILC, 2006-08.

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Additional analysis of the links between earnings volatility, poverty and financial stress suggests that some groups of workers may be more vulnerable than others to experiencing adverse consequences as a result of earnings volatility (Venn, 2011). As expected from the results in the previous section, the tax and transfer system buffers households from the adverse consequences of earnings volatility. Earnings shocks tend to be associated with smaller changes in poverty risk and some types of financial stress in countries where the buffering effect – as identified in Figure 3.4 – is strongest and larger changes in countries where buffers are less effective. This means that negative earnings shocks are less likely to be associated with increased poverty and financial stress in the “high-buffer” countries. However, positive earnings shocks are also buffered by tax and transfer systems. In “high-buffer” countries, a 20% increase in earnings does not translate into a reduced risk of poverty or financial stress.

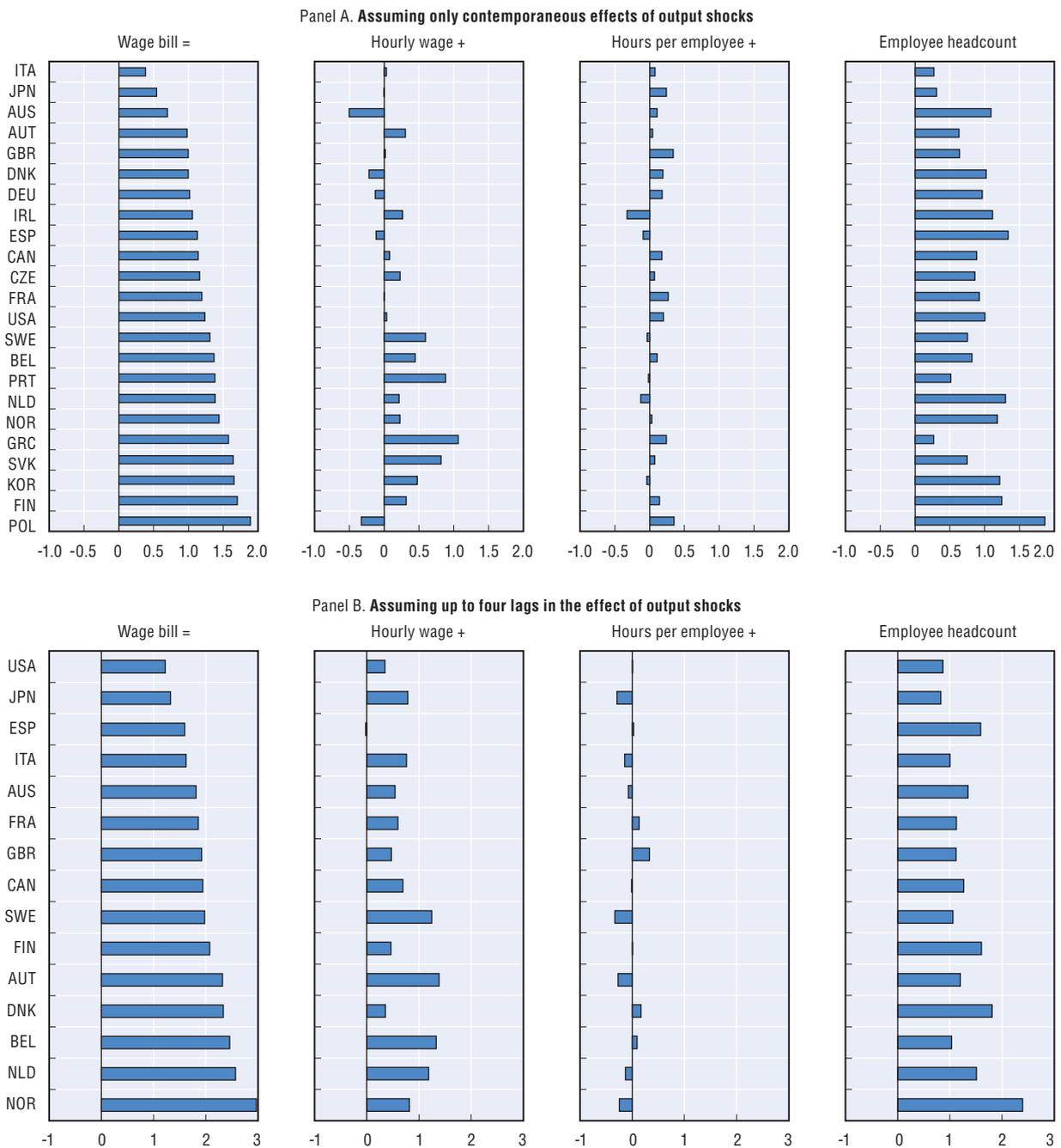
Within countries, workers who are less likely to be covered by unemployment benefits are also more likely to suffer from poverty and financial stress as a result of negative earnings shocks. Most notably, employees with temporary contracts, who are more likely than permanent employees to experience large drops in earnings, are also 2-3 times more likely to experience poverty and most types of financial stress in conjunction with a negative earnings shock than permanent employees. The self-employed also have a higher risk of poverty as a result of negative earnings shocks than permanent employees, but are more sheltered from financial stress than temporary workers, possibly because they have more assets or savings to smooth their consumption in the face of earnings volatility. Youth who experience negative earnings shocks have no greater risk of poverty than adults in the same situation, but may be more likely to default on a rent/mortgage or bill payment.

### 3. Cyclical fluctuations of earnings at the aggregate level

Evidence presented in Section 1 shows that the proportion of individuals experiencing large increases in earnings falls during recessions and the proportion experiencing large decreases rises. This suggests that business-cycle fluctuations are likely to be one of the key components of earnings volatility. Unfortunately, individual-level data on earnings volatility are available over a long period for only a small number of countries, which makes it difficult to examine cyclical fluctuations in individual earnings for a large number of countries. For this reason, this section uses aggregate business-sector data, and investigates the impact of business-cycle fluctuations on total gross annual earnings.

Quantifying the short-run cost of a recession for workers involves looking at all sources of loss in labour income, that is, whether or not workers were displaced, to what extent they were forced to reduce working hours and/or whether they experienced a reduction in hourly compensation.<sup>18</sup> Similarly, important insights into the labour market impact of business-cycle fluctuations can be drawn by considering the overall effect on total labour income. This is also of crucial importance to the government budget in downturns insofar as reductions in gross labour income are directly reflected in falling government revenues. In this vein, Figure 3.6 presents the estimated elasticity of the cyclical component of total gross real annual earnings in the business-sector (the so-called “wage bill”) to output fluctuations for all countries for which comparable data are available (see Box 3.2 for the methodology).<sup>19</sup> Output fluctuations are measured using the output gap as computed by the OECD. The gap between the actual level of total earnings and its trend is likely to be a good approximation of the cyclical fluctuations of total gross labour

Figure 3.6. Elasticity of total wage earnings to the output gap, 1971-2007



Note: 1971-2004 for Canada; 1972-2007 for the United Kingdom; 1973-2007 for Denmark; 1974-2005 for Japan; 1977-2007 for Finland; 1978-2007 for Austria; 1979-2007 for France; 1980-2007 for Spain; 1980-2006 for Norway; 1991-2005 for Portugal; 1993-2007 for Germany; 1994-2005 for Korea; 1996-2007 for Greece; 1996-2007 for Ireland; 1997-2003 for the Slovak Republic; 1997-2006 for Poland; and 1997-2007 for the Czech Republic. Data refer to wage and salary employees of the non-agricultural business-sector except for Norway, where they refer to total employment in this sector.

Source: OECD estimates on the basis of EUKLEMS, STAN and EO Databases.

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income (hereafter simply called the “gap” for brevity) which includes the combined effect of fluctuations in the labour input and its compensation. In turn, the magnitude of the transmission of macroeconomic shocks on gross labour income provides insights into the

### Box 3.2. Measuring the sensitivity of total gross earnings and its components to business-cycle fluctuations

A very simple and widely-used way to measure the impact of cyclical output fluctuations on a given aggregate variable (e.g. log total earnings) is to measure the covariation of the output gap and the cyclical component of that variable (see e.g. Abraham and Haltiwanger, 1995). Let us consider the following simple country-specific model:

$$\log W_t = \theta \log W_t^* + \sum_l \varphi_l OGAP_{t-l} + \varepsilon_t$$

where  $\log W$  is the log of total earnings, \* indicates its non-cyclical (i.e. trend or potential) component, OGAP is the output gap – measured by the OECD output gap – that is assumed to capture all business-cycle-related macroeconomic shocks,  $t$  indexes time and  $\varepsilon$  is an error term capturing shocks that are unrelated to the business cycle.

The non-cyclical component of total earnings is disentangled from the cyclical component through a Hodrick-Prescott (HP) filter (see Hodrick and Prescott, 1997), but all results are qualitatively robust to the use of a Baxter-King filter (Baxter and King, 1999). Hereafter, we will refer to the non-cyclical component of a variable as its trend and to the cyclical component as its gap, noting that the sum of the trend and gap yields the actual value by construction. To the extent that the trend captures all structural long-run determinants of the variable, including e.g. population growth and institutions, and shocks are stationary (with zero mean),  $\theta$  can be set equal to 1 and the above equation becomes:

$$\log WGAP_t = \sum_l \varphi_l OGAP_{t-l} + \varepsilon_t$$

where  $\log WGAP$  is the gap of  $\log W$ . The sum of  $\varphi$ s represents the long-run elasticity of fluctuations in  $\log W$  to macroeconomic fluctuations. Different lags can be tried for different variables in order to capture delayed business-cycle effects.

The HP filter preserves additivity: if a variable is equal to the sum of several other variables, gap and trend can be written as the sum of gaps and trends, respectively, of the other variables. This implies that one can decompose the elasticity of the cyclical component of total earnings to the output gap into the sum of the elasticity of the average hourly wage, average hours per employee and total dependent employment, in such a way that the contribution of each margin of labour market adjustment can be assessed separately.

effect of these shocks on both the labour tax base and workers' average income if these losses or gains are not buffered by tax and transfer policies (see, for example, section on "How does earnings volatility affect households?").

Looking at the elasticity of total earnings to output shocks suggests that the effects of business-cycle fluctuations on labour income are sizable. On average, a macroeconomic shock as large as one percentage point of GDP is associated with a deviation of at least 1.2 percentage-points of total earnings from its trend (Figure 3.6, Panel A). If it is assumed that the impact of output shocks are not entirely reflected in contemporaneous labour market indicators (see Box 3.2), the effect of shocks appears to be greater, and the longer the lag, the greater the estimated elasticity. The greatest estimated elasticity to output shocks is estimated if it is assumed that it takes four years to fully realise the impact of the shock. In this case, the average cumulated impact on earnings would be about *twice as large* as the initial shock (see Figure 3.6, Panel B), which implies that the labour market is, on average, severely affected by adverse shocks.<sup>20</sup> Differences across countries are large (of a factor of three) regardless of the assumptions about lagged effects.

Three facts emerge clearly from the decomposition of the output elasticity of total earnings (Figure 3.6). First, employment fluctuations are one key driver of total earnings fluctuations in most countries. On average they account for 65-75% of the effect of output fluctuations on total earnings, depending on the estimation method (compare Panels A and B in Figure 3.6). Second, the effect of the business cycle on average hours worked per employee is small. Finally, the contribution of average wages to overall earning fluctuations depends on the assumptions that are made on how long the effect of a shock lasts. In fact, the wage response takes time and typically emerges only when lagged effects are included in the statistical model (see Box 3.2). When the effects are assumed to be only contemporaneous, the contribution of wage fluctuations is limited, except in a few countries typically with large total earnings fluctuations (Figure 3.6, Panel A). By contrast, if it is assumed that the effect of a temporary macroeconomic shock on output could still be visible in labour market fluctuations four years later, the estimated cumulated response of aggregate wages to a 1% output shock climbs, on average, to an economically significant 0.75%, which accounts for 35% of the overall response in total earnings (see Figure 3.6, Panel B), compared with 17% when the effects are assumed to be only contemporaneous. This suggests that in most countries, the effects of downturns on average wages and total earnings are felt for several years *after* the shock, even when employment rates are back to equilibrium levels. However, just as there is considerable cross-country heterogeneity in the cyclical responsiveness of total earnings, there are also marked cross-country differences in the relative importance of the different margins of adjustment.

Two reasons might explain the small contribution of short-run wage fluctuations in most countries. First, there is evidence that the sensitivity of employment to downturns is greater among low-paid workers, youth, low-skilled and temporary workers (see *e.g.* Abraham and Haltiwanger, 1995; OECD, 2010a; Heathcote *et al.*, 2010; Robin, 2011), particularly in the short-run. Therefore, given the size of the employment elasticity, the low aggregate wage elasticity might reflect a compositional effect, with the average hourly wage remaining relatively unchanged when adverse shocks drive a large numbers of youth, low-paid and temporary workers into unemployment or inactivity.<sup>21</sup> Indeed, estimates based on microdata consistently indicate a greater pro-cyclicality of individual wages than those based on macrodata (*e.g.* Abraham and Haltiwanger, 1995; Brandolini, 1995; Devereux, 2001; Devereux and Hart, 2007). Second, when contracts cannot be re-negotiated each year, any short-run measure of the cyclicality of real wages tends to be dominated by changes in the consumption price deflator (*e.g.* Messina *et al.*, 2009). Moreover, even when contracts are frequently negotiated, there is evidence that nominal wages tend to be rigid both downward and upward, so that adjustments are delayed for several periods, particularly in times of low inflation when these rigidities bind (see in particular Elsby, 2009; and Bassanini, 2011, for more references).

Overall, the analysis of the descriptive patterns presented in this section suggests that the patterns of employment and wage adjustments to macroeconomic shocks vary significantly across countries. This fact suggests a potential role for policies and institutions in shaping these patterns, which is analysed in the next sections.

#### 4. Policies and institutions and cyclical fluctuations of earnings and wages

There is an increasingly large empirical literature that investigates cross-country differences in the way employment and unemployment react to macroeconomic shocks (Blanchard and Wolfers, 2000; Nickell *et al.*, 2005; Bassanini and Duval, 2006; Porter and

Vitek, 2008). Many studies also point to cross-country differences in the resilience of employment to shocks – most prominently between the United States and Continental European countries (Burgess *et al.*, 2000; Balakrishnan and Michelacci, 2001; Amisano and Serrati, 2003; Dustmann *et al.*, 2010; Ormerod, 2010). In this context, previous research, including many OECD studies, suggests that structural policy settings and labour market institutions can amplify or mitigate the employment effects of shocks and make them more or less persistent (Bassanini and Duval, 2006; OECD, 2010a, 2011). The literature on cross-country differences in the response of aggregate earnings to shocks is comparatively smaller (see *e.g.* Balmaseda *et al.*, 2000; Messina *et al.*, 2009; Dustmann *et al.*, 2010; Kandil, 2010). In order to fill this gap, this section examines the impact of policies and institutions on the cyclical variation of employment, earnings and wages.

### **Amplification/mitigation effects of policies and institutions**

To begin, the extent to which selected policies and institutions amplify or mitigate the impact of output shocks on total earnings, average wages and total hours worked will be estimated by fitting a simple aggregate cross-country/time-series and industry-level difference-in-difference models (see Box 3.3 for the methodology and Bassanini, 2011, for detailed results). In this analysis, estimated specifications include the standard set of policy and institutional variables (henceforth, institutions for brevity) for which quantitative indicators have been developed by the OECD and which have been widely used in previous empirical analyses of unemployment (see *e.g.* Blanchard and Wolfers, 2000; Nickell *et al.*, 2005; Bassanini and Duval, 2006).<sup>22</sup>

The tax wedge and the generosity of unemployment benefits are estimated to unambiguously amplify the impact of output-gap fluctuations on total annual earnings. Figure 3.7 in fact shows that both policies tend to increase the elasticity of total labour income to GDP shocks. Taken at face value, the estimates suggest that in a country where the average unemployment benefit replacement rate is about 5 percentage points greater than the OECD average (26% in 2007), the elasticity of cyclical fluctuations of total annual earnings to the output gap tends to be about 10% greater than in the average OECD country.<sup>23</sup> Consistent with previous OECD findings (OECD, 2006; Bassanini and Duval, 2006), this effect appears to be entirely due to the fact that, *ceteris paribus*, the employment impact of shocks tends to be larger in countries where unemployment benefits are more generous. Two mechanisms might explain this result. First, generous unemployment benefits might reduce workers' resistance to job loss, making them less inclined to challenge dismissals in courts, thereby increasing the reactivity of employment to product demand shocks. In support of this hypothesis, Bassanini *et al.* (2010) show that dismissals leading to unemployment spells are more common in countries with generous unemployment benefits. Second, a number of empirical studies suggest that longer durations of generous benefits tend to reduce job-search effort and make the unemployed more choosy about job offers, thereby lengthening the duration of unemployment spells (see *e.g.* OECD, 2006; Boeri and van Ours, 2008, for surveys), although a few recent studies have questioned these results.<sup>24</sup> Statistically, this would imply that in the year in which an adverse shock occurs, those who become redundant would remain in the unemployment pool longer, thereby dampening further average employment in that year (and possibly in subsequent years; see Zanetti, 2011, for a theoretical model incorporating these features).

By contrast, the effect of the average tax wedge on labour income appears to be essentially due to its role in amplifying gross wage fluctuations, while no significant

### Box 3.3. Estimating amplification/mitigation and persistence effects of institutions

In order to assess the amplification/mitigation effects of policies or institutions, these effects are modeled as interactions with the output gap. More precisely, the following static model\* is considered:

$$\log W_{it} = \theta \log W_{it}^* + \varphi_0 OGAP_{it-l} + \sum_k \varphi_k (X_{it}^k - \bar{X}^k) OGAP_{it} + \text{Other covariates} + \varepsilon_t$$

where  $\log W$  is the logarithm of total earnings, hours worked, or hourly wages, \* indicates their respective trend values, OGAP is the output gap,  $l$  and  $t$  index country and time, respectively,  $X$  stands for policies and institutions, indexed by  $k$ , a bar above a variable indicates its sample average and  $\varepsilon$  is an error term capturing shocks that are unrelated to the business cycle. Other covariates include country and time dummies, and the level of each included institution (for identification of the interaction terms). As in Box 3.2, to the extent that the trend captures all structural long-run determinants of the dependent variable (including *e.g.* population growth) and shocks are stationary (with zero mean),  $\theta$  can be set equal to 1 and the above equation becomes:

$$\log WGAP_{it} = \varphi_0 OGAP_{it-l} + \sum_k \varphi_k (X_{it}^k - \bar{X}^k) OGAP_{it} + \text{Other covariates} + \varepsilon_t$$

where  $\log WGAP$  is the gap of  $\log W$ . The hypothesis  $\theta = 1$  can be easily tested and in fact is never rejected in the specifications presented in this chapter. A positive estimated sign of  $\varphi_k$  for a given policy  $X_k$  implies that the policy significantly amplifies output shocks, while a negative sign means that the policy exerts a smoothing effect on output fluctuations.

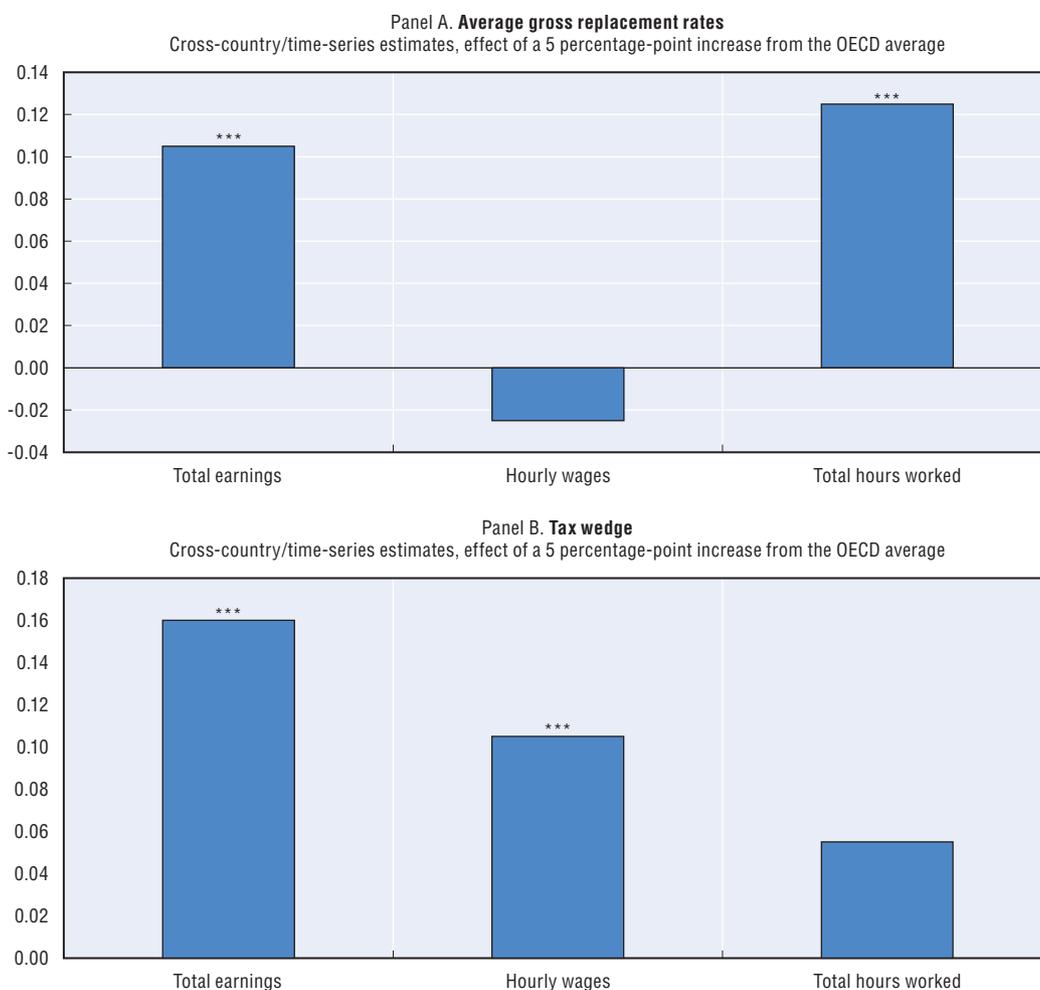
Following OECD (2007) and Bassanini *et al.* (2009), for the purposes of this chapter, the effects of employment protection (EP) and statutory minimum wages, have also been estimated at an industry level using a reduced-form difference-in-difference version of the above model (see Bassanini, 2011). This approach is based on the assumption that the effect of a given policy on an economic variable is greater in industries where this policy is more likely to be binding – hereafter called “policy-bound industries”. For example, EP-bound industries are likely to be those where firms typically need to lay off workers to restructure their operations in response to changes in technologies or product demand and where, therefore, 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 EP for open-ended contracts can be expected to have little impact on labour reallocation. Average dismissal rates by industry in the United States, the least regulated country, are used as a benchmark to measure the layoff propensity of each industry in the absence of regulation. Similarly, minimum-wage-bound industries will be those that are more heavily reliant on low-wage labour in the absence of a minimum wage. For this policy, low-wage industries are identified based on the incidence of low-wage workers by industry in one specific country, the United Kingdom, prior to the introduction of statutory minimum wages in that country in 1999. The advantage of this estimation strategy is that it controls for policies or institutions that influence cyclical fluctuations 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 the dependent variable in policy-bound industries as in other industries can be controlled for by country-by-time dummies and by including an interaction between the output gap and the indicator identifying policy-bound industries. In addition, endogeneity issues can be more easily dealt with in the difference-in-difference framework.

### Box 3.3. Estimating amplification/mitigation and persistence effects of institutions (cont.)

An adverse shock might not only compress earnings and reduce employment. Its effects might also persist over time, and the degree of persistence is likely to be affected by policies and institutions. In order to assess amplification *versus* persistence effects of shocks, a dynamic error-correction version of the baseline model described above is also estimated, interacting policies with the coefficient of the error-correction term (see Bassanini, 2011, for more details).

\* The model presented in this box is static for simplicity. However, dynamic models have also been estimated for the chapter leading to consistent results.

Figure 3.7. **Impact of unemployment benefits and the tax wedge on the elasticity of total earnings fluctuations to the output gap**



Note: Absolute effect of a 5% increase of the policy indicator from the sample average on the elasticity to the output gap of gaps in total earnings, hourly wages and hours worked, obtained from aggregate cross-country/time-series estimates. Gaps are defined as the difference between the log of the actual and trend value of each variable.

\*\*\*: statistically significant at the 1% level.

Source: OECD estimates on the basis of EUKLEMS, STAN and EO Databases.

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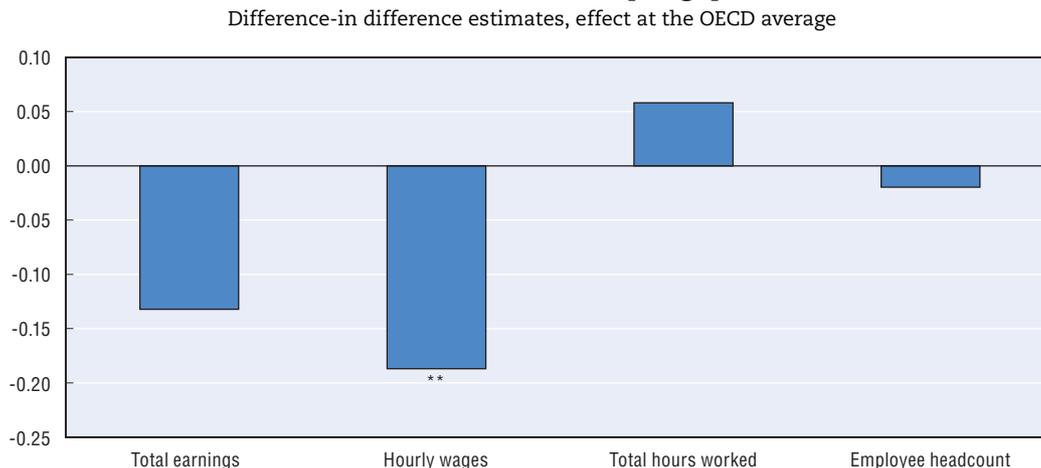
impact on employment fluctuations is detected. One possible explanation of this finding could be that average tax wedges are higher in countries where marginal tax wedges are more progressive. In turn, progressive labour taxes make labour supply more inelastic and/or the wage-setting curve steeper (see *e.g.* Guo and Lansing, 1998; Dromel and Pintus, 2008), at least when the latter is defined in terms of gross wages, thereby facilitating wage adjustments (and, possibly, restraining employment adjustments) whenever firms need to compress unit labour costs. In this interpretation, the effect of the average tax wedge would reflect the impact of the marginal tax wedge, which is omitted from the main empirical specifications due to lack of data on marginal tax rates for the whole time period under examination.<sup>25</sup>

The evidence presented here suggests that, by amplifying the effects of shocks on gross labour income, high tax wedges and generous unemployment benefits unambiguously affect fluctuations of the labour tax base and government revenues, so that they can become extremely costly for the government budget in bad times. By contrast, these findings do not imply that these measures amplify the effects of shocks on household disposable income. In fact, the evidence presented in Section 2 suggests that the tax and transfer system also mitigates the transmission of individual earnings volatility onto household disposable income.

In contrast with progressive taxes, by preventing downward adjustment at the bottom of the distribution, minimum wages can be expected to significantly constrain wage adjustments in the aftermath of an adverse aggregate shock (see *e.g.* Bertola and Rogerson, 1997). Whether the lack of wage adjustment will be reflected in stronger adjustments in employment or along other margins remain an open question that must be assessed empirically. Estimates suggest that statutory minimum wages mitigate the impact of macroeconomic shocks on the cyclicalities of hourly wages (Figure 3.8).<sup>26</sup> A ten percentage point increase in the ratio of minimum to median wages from the OECD average appears to reduce the elasticity of hourly wages to the output gap by 0.18, which is a significant effect from an economic point of view, taken into account the relatively low elasticity of wage fluctuations. However, due to the heterogeneous impact of the minimum wage on the cyclicalities of employment and hours worked, no significant impact on the transmission of GDP shocks on total earnings is detected.

Finally, the empirical analysis suggests a strong and robust role for employment protection (EP) in mitigating the earnings impact of shocks, in particular in the case of dismissal regulations (Figure 3.9).<sup>27</sup> This is consistent with a large body of theoretical literature suggesting that firms' optimal behaviour in the presence of positive firing costs is to compress both job creation and destruction, thereby reducing employment fluctuations over the business cycle (see Bentolila and Bertola, 1990; Bertola, 1990; Mortensen and Pissarides, 1999; Zanetti, 2011).<sup>28</sup> Taken at face value, the estimates suggest that in a country where the indicator of EP stringency for regular contracts is one unit below the OECD average – *i.e.* approximately the level of the United Kingdom – the elasticity of cyclical fluctuations in total annual earnings to the output gap is 25% greater than in the average OECD country. This effect appears to be entirely due to the impact of firing restrictions on employment retention during downturns (as well as on hiring restraint during booms). By contrast, no significant effect emerges as regards hourly wages or average hours per employee.<sup>29</sup>

Figure 3.8. **Impact of statutory minimum wages on the elasticity of total-earnings fluctuations to the output gap**

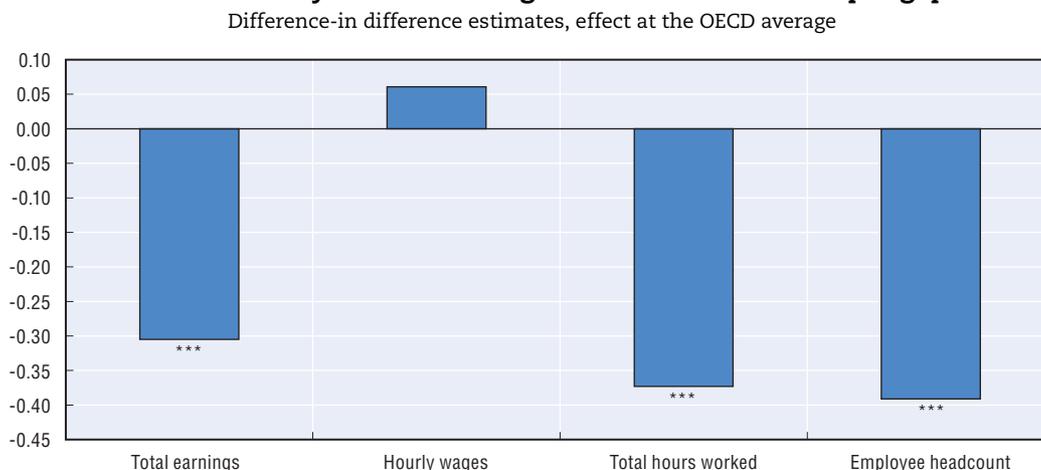


Note: Absolute effect of a 10 percentage-point increase from the OECD average of the ratio of minimum to median wages on the elasticity of industry-level gaps to the aggregate output gap, obtained from the difference-in-difference estimates (see Bassanini, 2011). Gaps are defined as the difference between the log of the actual and trend value of each variable. \*\*: statistically significant at the 5% level.

Source: OECD estimation on the basis of UK LFS, EUKLEMS and EO Databases.

StatLink <http://dx.doi.org/10.1787/888932479990>

Figure 3.9. **Impact of the employment protection for regular contracts on the elasticity of total earnings fluctuations to the output gap**



Note: Absolute effect of a one-unit increase of the indicator of EP for regular workers from the sample average on the elasticity of industry-level gaps to the aggregate output gap, obtained from the difference-in-difference estimates (see Bassanini, 2011). Gaps are defined as the difference between the log of the actual and trend value of each variable. \*\*\*: statistically significant at the 1% level.

Source: OECD estimation on the basis of Bassanini *et al.* (2010) as well as EUKLEMS, STAN and EO Databases.

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One of the effects of stringent dismissal regulations is that firms react by increasing the share of workers on *temporary* contracts (see *e.g.* Boeri, 2011). Indeed, estimates presented by OECD (2010a) and Bassanini *et al.* (2010) suggest that a one unit increase in the indicator of EP for permanent contracts raises the share of temporary contracts by at least 5 percentage points. In turn, as the experience of the OECD countries in recent years suggests, the greater the share of temporary workers, the greater is the employment adjustment in a downturn (see OECD, 2010a). Moreover, evidence presented in Section 1

suggests that earnings volatility is more prominent among temporary workers. This must induce some caution when interpreting the estimates in Figure 3.8.

Estimates obtained by including an indicator for the aggregate trend share of temporary contracts<sup>30</sup> suggest that a 5 percentage-point increase in the share of temporary contracts increases the elasticity of employment to aggregate shocks by 23% (with, however, an insignificant impact on total earnings fluctuations). Even if, conditional on the share of temporary contracts, the estimated shock-mitigation effect of dismissal regulation is still significant (and actually greater), these results suggest that stringent dismissal regulations might make the effects of recessions more unequal. In fact, stringent EP for regular workers, by reducing the share of permanent contracts, tends to shrink the number of workers that are sheltered from the cost of business-cycle fluctuations who, by contrast, enjoy an increased degree of protection and security. Thus, these estimates suggest that countries with relatively lax firing procedures could unambiguously gain in terms of shock mitigation by increasing the stringency of EP only if they manage to avoid labour market dualism. Yet, this balance might be difficult to achieve due to the difficulty of enforcing stringent regulation for temporary contracts. In fact, EP is typically enforced by individuals who consider themselves as victims and lodge a complaint with the competent tribunals or courts. In the case of dismissals, potential plaintiffs are easily identified and able to react, whereas victims of breaches of rules on temporary contracts (particularly in the case of violations of hiring restrictions under such contract) are much less likely to make a complaint (see Bassanini *et al.*, 2010, for an extensive discussion). This suggests that, even if firing restrictions tend to mitigate the average impact of adverse shocks, for equity reasons, countries should avoid excessively restrictive regulations.

### ***Institutions and the persistence of shocks over time***

An adverse shock might not only compress earnings and reduce employment. Its effects might also persist over time, and the degree of persistence is likely to be affected by policies and institutions. Improving upon Bassanini and Duval (2006), aggregate and industry-level dynamic models are estimated for this chapter where the speed of shock re-absorption is assumed to depend on policies and institutions (see Box 3.3 above). These models show that EP is the only labour market policy or institution, among those examined (see above), that significantly affects the persistence of shocks (see Bassanini, 2011, for full results). Taken at face value, these estimates imply that the time span required to reduce the effect of a temporary macroeconomic shock on total earnings by one half (the so-called *half life*) would be 13% smaller in a country where the indicator of stringency of EP for regular contracts is one unit below the OECD average, than in an average OECD country.<sup>31</sup> The estimates also suggest that firing restrictions delay the re-absorption of the initial effect of shocks on total earnings mainly through their effect on the speed of adjustment of wages, while no significant effect is found on hours or employment. This finding suggests that stringent dismissal regulations could be among the factors behind the slow reaction of wages to shocks, which is underlined in Section 3. Indeed, economic theory and the available empirical evidence support the conclusion that wage rigidity is likely to be more widespread when firing restrictions are high, since strong insiders can more easily resist real wage cuts (see *e.g.* Bertola and Rogerson, 1997; Bertola, 1999; Babecký *et al.*, 2009, 2010).

What do the counteracting effects of firing restrictions on shock amplification and persistence imply for labour-income smoothing? From the econometric estimates presented

above, it is possible to derive, the effect of EP on the *cumulated* impact of an adverse temporary shock on total earnings (see Bassanini, 2011). These estimates suggest that, in a country where the indicator of stringency of EP for regular contracts is one unit below the OECD average, the actual value of the total cumulated loss of labour income due to a one-time adverse macroeconomic shock would be about 20% larger than in the average OECD country. This effect would result from the combination of larger employment fluctuations partially compensated by a more rapid adjustment of hourly wages to the equilibrium.

## 5. Policies and institutions and cyclical fluctuations of the earnings distribution

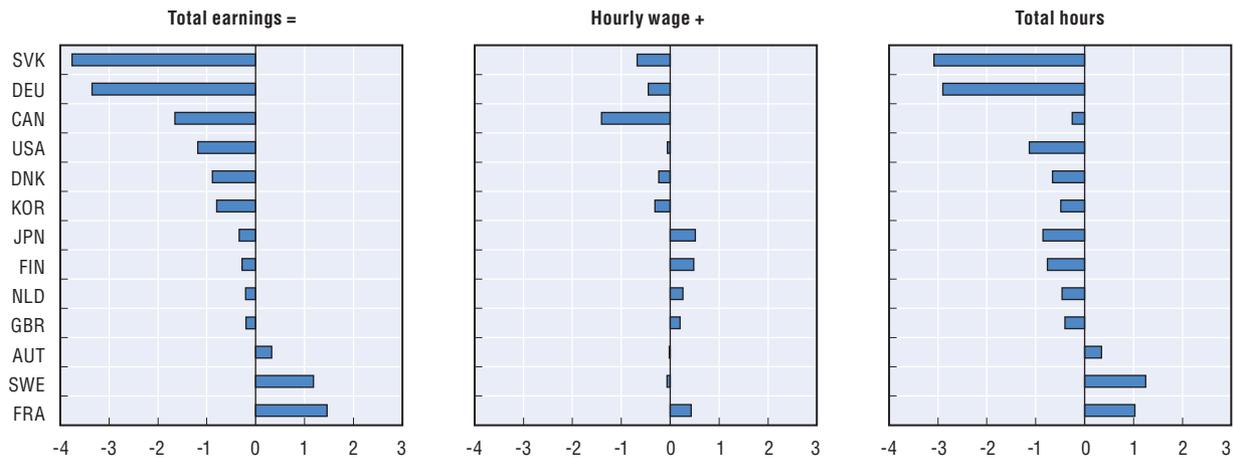
The analysis of the impact of institutions presented so far has considered average effects on earnings, hours worked, employment and wages, but these averages can hide large asymmetries in adjustment patterns, particularly in the case of employment fluctuations. Of particular policy concern, the labour income of workers at the bottom of the wage distribution appears to be particularly affected by business-cycle fluctuations. Indeed, one key finding of the recent US-based literature on earning inequality is that the dispersion of the wage and salary annual earnings (and to a minor extent of that of hourly wages) is significantly counter-cyclical (see *e.g.* Heathcote *et al.*, 2010). That is, the distribution of annual earnings becomes less equal during recessions and more equal during booms. This has been attributed to spikes in the incidence of unemployment for low-skilled (low-paid) workers around business-cycle troughs. For a given hourly wage, the longer the time an individual spends jobless, the lower his/her annual earnings. To the extent that low-paid workers appear to suffer from greater increases in the risk of joblessness in a recession, this would explain why the effect is more evident within the earnings rather than the wage distribution (see *e.g.* Robin, 2011). According to this literature, the business cycle will also exacerbate disparities in consumption and living standards insofar as workers that are typically in low-paid jobs are also less wealthy and find it more difficult to smooth consumption over time by temporarily tapping into financial assets if they are hit by negative income shocks. They may also have poorer access to financial markets to help them smooth consumption. For example, the analysis in Section 2 shows that individuals in poorer households are far more likely to experience financial stress in response to large earnings decreases than those in richer households.

Data on the earnings distribution at a relatively high frequency (at least annual) are not available for many countries, which makes it difficult to see whether this phenomenon occurs outside the United States. One alternative way to look at this issue – that is exploited here – is to examine the distribution of total gross real annual earnings of wage and salary employees by level of education using data derived from the national accounts and national labour force and earnings surveys.<sup>32</sup> In fact, to the extent that differences in employment, hours worked and pay across different educational attainment levels are among the main drivers of earnings disparities, the ratio between total gross annual earnings of the high- and low-educated workers<sup>33</sup> provides a measure of the dispersion of the earnings distribution, which compounds the impacts of relative wage and employment fluctuations. The results of this exercise are presented in Figure 3.10, which shows the elasticity of the cyclical component of this ratio with respect to the output gap.

Two main stylised facts emerge from Figure 3.10:

- First, in most countries, relative earnings by educational attainment appear to fluctuate counter-cyclically, although with important cross-country differences. In other words the

Figure 3.10. **Elasticity of the cyclical component of the earnings ratio between high and low-educated workers to the output gap**



Note: 1974-2004 for the United States; 1980-2003 for Denmark; 1982-2002 for France; 1984-2003 for Austria; 1987-2003 for the United Kingdom; 1987-2004 for Finland; 1991-2004 for Canada; 1992-2002 for Japan; 1992-2002 for the Netherlands; 1992-2004 for Germany; 1993-2004 for Sweden; 1993-2005 for Korea; and 1999-2004 for the Slovak Republic.

Source: OECD estimates on the basis of EUKLEMS and EO Databases.

StatLink  <http://dx.doi.org/10.1787/888932480028>

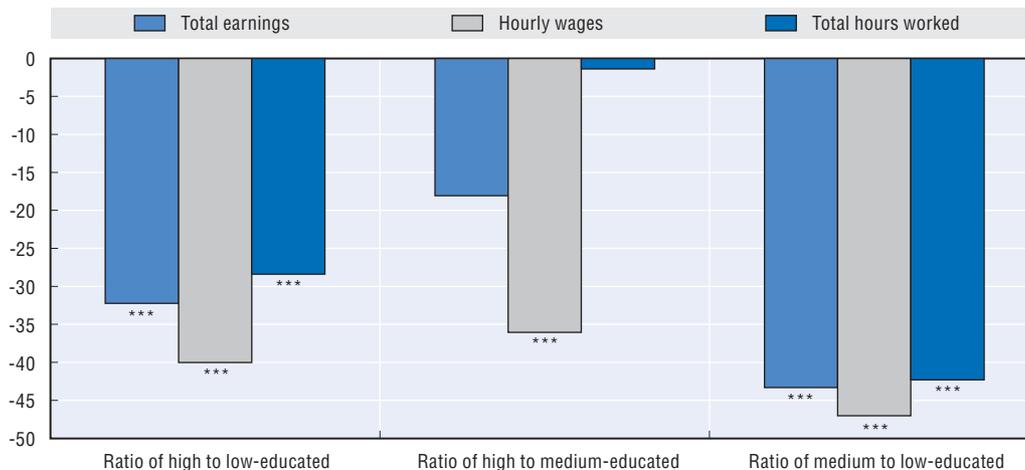
earnings distribution becomes more unequal around the troughs of the business cycle. This has important equity consequences. To the extent that low-educated/low-paid workers are less able to shield themselves against income shocks, they will suffer a greater welfare reduction in bad times than high-educated/high-paid workers, in the absence of policy interventions to compensate their loss of labour income.

- Second, cyclical fluctuations in total hours by education levels are the main driver of cyclical fluctuations of the earnings distribution (Canada being the only exception), confirming the generality of similar findings in the US literature (see above). This is true both at the top and bottom of the distribution (see Bassanini, 2011), and can essentially be explained by the fact that the lower the level of educational attainment, the greater the risk of incurring spells of joblessness – and therefore of working few or no hours in a year and having thus low labour income – in bad times.<sup>34</sup>

Aggregate and industry-level difference-in-difference analysis – based on the same methodology as in Box 3.3 – suggests that, among those policies and institutions considered in the previous section, EP is the only policy with an unambiguous effect on the output-gap elasticity of the earnings distribution by educational attainment. In fact, it appears that dismissal restrictions dampen the tendency of the earnings distribution to become more unequal around business-cycle troughs (Figure 3.11). A negative value in Figure 3.11 implies that EP reduces the tendency of the earnings ratio between high and low-educated workers to fluctuate counter-cyclically.<sup>35</sup> Taken at face value, the estimates suggest that in a country where the indicator of stringency of EP for regular contracts is one unit below the OECD average, the fluctuations of the earnings ratio between the high- and low-educated to the output gap would be 32% more counter-cyclical than in the average OECD country. This pattern appears to be almost equally due to the effects of dismissal regulations on the wage and employment distribution.

The available data also allow the effect of firing restrictions on the cyclical volatility of earnings inequality to be analysed separately in the top and bottom halves of the

**Figure 3.11. Percentage impact of EP for regular contracts on the elasticity to the output gap of the industry-level earnings ratio between high and low-educated workers**



Note: Percentage effect of a one-unit deviation of the indicator of EP for regular workers from the sample average on the absolute value of the elasticity of industry-level gaps to the aggregate output gap, obtained from the difference-in-difference estimates (see Bassanini, 2011). Gaps are defined as the difference between the log of the actual and trend values of each variable. Elasticities in the average countries are always negative.

\*\*\*: statistically significant at the 1% level.

Source: OECD estimation on the basis of Bassanini et al. (2010), as well as EUKLEMS and EO Databases.

StatLink  <http://dx.doi.org/10.1787/888932480047>

distribution. The estimates suggest that EP for regular contracts has a strong dampening impact on the counter-cyclicality of earnings inequality in the bottom half of the earnings distribution – that is of the earnings ratio of medium-educated to the low-educated – but has no significant impact on fluctuations in the top half, notably because of the lack of any effect on relative employment fluctuations in this segment of the distribution (Figure 3.11).

## Conclusions

This chapter has investigated patterns of earnings fluctuations and volatility at the individual and aggregate levels. Even in good times, many workers in OECD countries experience large fluctuations in gross labour earnings from one year to another due to changes in working hours, movements into and out of employment and changes in pay within jobs. Nevertheless, the business cycle plays an important role for individual and aggregate earnings fluctuations, particularly for those with low levels of education, who are typically also low-paid workers. The poorest households also have the least access to credit or savings to help them weather the fluctuations, thus the risk that earnings volatility – including that associated with recessions – translates into household poverty and financial stress is particularly high for this group.

There is some evidence that generous unemployment benefits and labour taxes amplify the effect of macroeconomic shocks on labour income. However, the tax and transfer system partially offsets the impact of individual earnings volatility on household disposable income. In most countries, and particularly in those countries with more progressive labour taxation, progressive income taxes account for much of this buffering effect. In countries with generous unemployment benefits and when the reduction of labour income is due to job loss, changes in transfers are also important. This suggests that moderately progressive taxes and generous benefits, if coupled with strictly-enforced

work-availability conditions and a well-designed “activation” strategy, as suggested by the restated OECD *Jobs Strategy* (OECD, 2006), provide a solid framework for reconciling labour market dynamism with adequate income security, although this is not easy to design and implement effectively.

Providing adequate income security is more difficult in a recession and this chapter sheds new light on this challenge by providing evidence that generous unemployment benefits and labour taxes may actually amplify the effect of macroeconomic shocks on labour income. By amplifying the effects of shocks on gross labour income, and therefore government revenues, these measures can be costly for the government budget, underlying the importance of countries achieving a sound fiscal stance during periods of growth, so as to have the fiscal capacity to sustain income support for vulnerable workers and households during a crisis. Care is also required to ensure that income support systems do not raise structural unemployment.

In contrast, policies that keep workers in their current jobs, such as short-time work schemes and employment protection for *regular* workers, are likely to mitigate the average loss of labour income in downturns. In the case of employment protection, the reduction in the risk of job and earnings losses appears to be particularly large for workers at the bottom of the earnings distribution. However, the evidence also suggests that these policies tend to prolong the effects of adverse aggregate shocks. Overall, the dampening effect outweighs the persistence effect, so that employment protection for regular workers is likely to reduce the total cumulated loss of labour income brought about by a downturn. This average effect may hide adverse impacts for some groups of workers, however. Notably, strict employment protection tends to exacerbate labour market duality (OECD, 2010a). This chapter shows that workers with temporary contracts are more likely to experience earnings volatility than those with regular contracts. Taken together, these findings suggest that policy makers need to strike a balance between the income-smoothing effect of higher employment protection and both the gains in efficiency associated with lower employment protection (OECD, 2007) and the need to prevent labour market duality.

## Notes

1. For most of this chapter, “earnings” refers to *gross* labour earnings, i.e. pre-tax earnings from wage employment or self-employment. Earnings may include wage or salary earnings, bonus and overtime payments. Other income concepts are introduced and explained in section “Buffers against individual earnings volatility”.
2. Following US Congressional Budget Office (2007), workers who have no labour earnings in the first year and positive labour earnings in the second year are assumed to have had an increase in labour earnings of 20% or more. Workers who have positive labour earnings in the first year and no labour earnings in the second year are assumed to have had a decrease of 20% or more.
3. In order to include a number of non-European countries in the analysis, labour earnings includes positive self-employment income. Self-employment losses are given a value of zero when calculating labour earnings. Comparison of the results for European countries using labour earnings and wage/salary income (i.e. excluding self-employment income) show that the results are very similar.
4. However, country rankings based on multi-year observations of earnings volatility, which are likely to be less prone to measurement error, are highly correlated with the year-to-year measures used in this chapter. Likewise, the results of descriptive regressions discussed in section “Who has volatile earnings?” are similar using year-to-year and multi-year measures of earnings volatility (Venn, 2011).

5. Estimates for the United States in this section use data from the Panel Survey of Income Dynamics (PSID). After 1997, the survey was conducted only once every two years, so year-to-year estimates of earnings volatility are not available for the United States after 1996. Estimates of earnings volatility based on earnings changes over a three-year window for the United States suggest that full-time earnings volatility remained relatively stable and overall earnings volatility decreased slightly since 1996 (Venn, 2011).
6. Excluding the Czech Republic, Poland and the Slovak Republic, the cross-country correlation between the incidence of large increases and the incidence of large decreases is 79% for workers who were employed full-time for the full year and 71% for all workers (both correlations are significant at 99% level).
7. The cross-country divergence in earnings volatility trends is also echoed in the findings of other researchers. Hällsten *et al.* (2010) find that earnings volatility increased in Sweden between 1985 and 2003, while Beach *et al.* (2006) show overall volatility in Canada was relatively stable over a similar period.
8. The cross-country correlation between the job-to-job reallocation rate and the incidence of large increases in full-time earnings is -62% (significant at 99% level), while for decreases, the correlation is -36% (significant only at 85% level).
9. The United States also appears to have relatively high earnings volatility coexisting with relatively high labour mobility. However, this may be due to measurement errors: the data used to calculate earnings volatility for the United States are from the mid-1990s while the data used to calculate worker reallocation rates are for 2000-06. For this reason, the United States is not shown in Figure 3.2.
10. Looking at the average incidence of earnings volatility for men and women (without controlling for job and personal characteristics) shows that, while men are more likely than women to have volatile year-to-year earnings within full-time work, women are more likely to move into and out of work and from full-time to part-time jobs and so have greater overall earnings volatility. This is not evident once job characteristics are taken into account because women are concentrated in jobs that have greater volatility. Notably, women are more likely than men on average to hold temporary jobs.
11. Data on work experience are not available for all countries. Models run on a reduced sample including a control for experience show that less-experienced workers have more earnings volatility, but younger workers are still significantly more likely than prime-age workers to have volatile earnings.
12. The results are similar if health problems are defined using alternative variables such as self-defined chronic health problems or if workers say that they have a health problem that limits their activities. These alternative variables are not used in the main analysis shown in Figure 3.3 because they are missing for a large proportion of respondents from some countries. The results for year-to-year earnings increases shown in Figure 3.3 are not found using the alternative measures, but those for multi-year earnings increases using the alternative measures are the same as in Figure 3.3.
13. Define  $\Delta HY_{net} = \Delta(HY_{net} - HY_{gross}) + \Delta(HY_{gross} - HY_{labour}) + \Delta(HY_{labour} - IY_{labour}) + \Delta IY_{labour}$  where  $HY$  is household income/earnings,  $IY$  is individual earnings and the subscripts denote *net* income, *gross* income and *labour* earnings. The first bracket on the right-hand side is equal to the component due to changes in taxes, the second bracket is the component due to changes in transfers and other non-earned household income, the third bracket is the component due to changes in the labour earnings of other household members and the last term is the component due to changes in individual labour earnings.
14. The exception is for large increases in earnings in the Slovak Republic.
15. One notable exception is Diaz-Serrano (2004) who examines the impact of household income volatility (measured by the coefficient of variation in net household annual income over time) on the likelihood of mortgage delinquency. He finds that volatility significantly increases the risk of mortgage delinquency and also reduces the likelihood of being a homeowner rather than a renter.
16. Those households that do not have a mortgage or do not pay rent are assumed to have not missed a rent or mortgage payment.
17. An alternative specification which includes the whole sample but controls for the experience of poverty or financial stress in the year before the earnings shock gives qualitatively similar, but slightly larger, estimates than those reported in this chapter (Venn, 2011).

18. Long-run effects should also take into account the effect of business-cycle fluctuations on the length of non-employment spells and wage levels at re-employment (e.g. OECD, 2009; Jacobson *et al.*, 1993; Farber, 2005; Krebs, 2007).
19. Total earnings and hourly wages in this and the following sections are gross and expressed in real terms and refer to wage and salary employees unless otherwise specified. In principle, the private consumption deflator and the consumer price index can be used to deflate these variables. Figures presented in this chapter are based on the private consumption deflator because it is available for more countries and years than the consumer price index. All results are robust, however, to changes in the deflator.
20. These figures must be treated with caution, however, since they do not refer to the same number of countries, insofar as longer time series are required for obtaining reliable estimates when many lags are included.
21. This compositional effect tends to raise the average wage and thus offsets downward adjustments in the wages of workers remaining employed. During the 2008/09 recession, the response of average wages was particularly small (and even of opposite sign in some countries) in comparison with the figures reported here (see OECD, 2010a), possibly because the severity of the employment contraction exacerbated compositional effects.
22. These are: the tax wedge between labour cost and take-home pay (for a single-earner couple with two children, at average earnings levels); a summary measure of unemployment benefit generosity (a cross-country comparable measure of average net replacement rates would be more appropriate, but this is only available since 2001; therefore, it is used only as a robustness check); the degree of stringency of employment protection (EP); collective bargaining coverage rates; and the degree of centralisation/co-ordination of wage bargaining, a proxy for the concept of “corporatism” which has received widespread attention in the comparative political economy literature. The statutory minimum wage, available for fewer countries, is separately analysed. The average degree of stringency of product market regulation (PMR) across seven non-manufacturing industries is also included, essentially because of the close correlation between product and labour regulations (see Annex 3.A1 for details on data construction and sources). By contrast, other labour market policies, including short-time work schemes that played a key role in the 2008/09 recession (see Hijzen and Venn, 2010), are not analysed here, due to limited data availability, except as a further control in certain specifications (see Bassanini, 2011).
23. Estimates in Figure 3.7 imply that a 5% increase in average replacement rates from the OECD average – that is, about one standard deviation of the distribution, considering only time-series variation – raises the elasticity of the total earnings gap to the output gap by about 0.11. The percentage effect can be obtained by dividing it by the corresponding average elasticities (see Bassanini, 2011).
24. Recent findings suggest that one needs to be cautious about the interpretation of the empirical relationship between benefit generosity and the duration of unemployment spells. For example, using Austrian data, Card *et al.* (2007) argue that unemployment exit spikes at benefit exhaustion are mainly due to leaving the unemployment system and becoming inactive rather than to job-finding. Using US time-use data, Krueger and Mueller (2010) show that there is not much difference in average job-search effort between UI-eligible and non-eligible job seekers, but the profile of job-search intensity of the former depends on time to benefit exhaustion. Moreover, the effect of unemployment insurance on search effort seems to be confined only to those job seekers that are liquidity-constrained, whom UI enables to smooth consumption and thus reduces the pressure to rush back to work (Chetty, 2008). By contrast, those with access to a secondary income source are more likely to maintain consumption during a spell of unemployment and thus are less responsive to unemployment benefits.
25. Bassanini (2011) shows on a more limited sample that the estimated effect of the average tax wedge that is presented in Figure 3.7 is entirely due to its correlation with marginal tax wedges on middle-to-high labour incomes.
26. The effects of statutory minimum wages on the transmission of aggregate shocks are estimated using only industry-level data and a difference-in-difference approach (see Box 3.3). The reason is that comparable time-series on minimum wages are available for only the subset of countries where they are imposed by law or regulation, rather than being set by collective bargaining among social partners (these include Australia, Belgium, Canada, Czech Republic, France, Greece, Japan, Korea, the Netherlands, Poland, Portugal, Slovak Republic, Spain, the United Kingdom and the United States). Minimum wages are measured as the economy-wide ratio of the gross statutory minimum wage to the median wage.

27. This finding is based both on aggregate cross-country/time-series estimates and difference-in-difference industry-level estimates (see Box 3.3). Figure 3.8 presents the effect on industry-level fluctuations but qualitatively similar results are obtained for aggregate fluctuations.
28. To the extent that EP shelters insiders against the risk of job loss, they can also resist downward adjustment of wages after an adverse shock (Bertola and Rogerson, 1997; Bertola, 1999). In fact, there is evidence that, in countries with restrictive dismissal regulations, firms with a large share of permanent workers and/or a greater share of blue-collar and low-skilled white-collar workers tend to have more rigid wage-setting schemes (Babecký *et al.*, 2009, 2010).
29. See Bassanini (2011) for detailed results and robustness checks.
30. Trends are obtained with a standard HP filter. They are used here instead of actual values to avoid endogeneity problems due to the cyclical fluctuation of the share of temporary contracts.
31. These estimates also appear robust to changes in model specifications, excluding countries one-by-one and including additional controls (see Bassanini, 2011). Moreover, there is no evidence that the share of temporary workers has any significant effect on persistence, or that its inclusion affects the impact of EP for regular contracts on persistence.
32. The source is the *EUKLEMS Database* (see Annex 3.A1).
33. The term “high-educated” identifies here those with more than upper secondary education, the “low-educated” are those with less than upper secondary education, while “medium-education” denotes those with upper-secondary education.
34. These findings appear consistent with the few available studies in the literature (see, for example, Dustmann *et al.*, 2010). They are also independent of the number of lags included in the model.
35. The elasticity of fluctuations of the earnings ratio between the high- and low-educated to the output gap is negative in the average country, suggesting that earnings inequalities fluctuate counter-cyclically (see Figure 3.10).

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## ANNEX 3.A1

## Data Construction and Sources

### Trend and cyclical components

In this chapter, the non-cyclical component of any given variable is disentangled from the cyclical component through a band-pass filter. Band-pass filters are statistical tools that retain fluctuations at specified frequencies and sweep out or attenuate those at other frequencies. The two most commonly used band-pass filters are the Hodrick-Prescott (HP) filter and the Baxter-King (BK) filter (see Hodrick and Prescott, 1997; and Baxter and King, 1999). The HP filter is derived by minimising a weighted average of the square of the growth of the trend component and its quadratic difference from the actual series. The relative weight of the growth term is usually set to 100 for annual data. One problem with the HP filter is that it performs poorly around the beginning and the end of each time series. The BK filter, by “passing” only frequencies between a low and high thresholds (reflecting the idea that business cycles are fluctuations of a certain frequency), performs better but at the cost of eliminating a few observations around the endpoints. Usual thresholds for the BK filter are two and eight years. In order to preserve sample size, the HP filter is mainly used in this chapter, but all results are qualitatively robust to the use of a BK filter.

### Data for the aggregate and industry-level analysis

#### **Industry-level data**

Earnings and hourly wage data refer to total gross annual earnings and average hourly wages, respectively of wage and salary employees. Employment and hours worked refer to annual averages for wage and salary employees. Real value added is obtained by deflating nominal value added in each industry with the industry-specific double deflator. Data are from the *EUKLEMS Database* except for Norway, where they come from the *OECD STAN Database* and refer to total employment. *EUKLEMS* data obtained through interpolation and/or estimated on the basis of conjectures, identified from Timmer *et al.* (2007), Baldwin (2009) and the related *EUKLEMS* documentation, were removed from the sample to avoid artificial compression of business-cycle fluctuations. Data are aggregated at the level of the business sector to be used in aggregate regressions. In the industry-level analysis the business sector is disaggregated in 23 industries.

The distributions by educational attainment of earnings, wage, and hours also come from the *EUKLEMS Database*. Again, data obtained through interpolation and/or on the basis of conjectures were removed from the sample. Education is divided into three categories: low-education (less than upper secondary); medium education (upper

secondary); and high education (more than upper secondary). The business sector, in this case, is partitioned in 9 industries for reasons of data reliability.

The industry-specific US dismissal rate is from Bassanini *et al.* (2010; [www.oecd.org/dataoecd/28/30/46825863.zip](http://www.oecd.org/dataoecd/28/30/46825863.zip)) and is derived from various waves of the CPS Displaced Workers Supplement (2000-06, even years). An individual is considered to have been dismissed if he/she lost his/her job in the most recent year covered by each survey, because of plant closing or moved, insufficient work, or position or shift abolished. Only wage and salary employees in the private-for-profit sector are considered.

The share of low-paid workers in the United Kingdom prior to the introduction of the minimum wage in 1999 is the average share of low-pay workers in each industry over all available quarters between 1994 and 1998. In each quarter, low-paid workers are defined as those with gross hourly wages less than two-thirds of the median wage of the quarter for the whole economy. The source is the *UK Labour Force Survey*.

### **Institutional variables**

EP indicators come from the OECD Indicators of Employment Protection ([www.oecd.org/employment/protection](http://www.oecd.org/employment/protection)). All indicators vary from 0 to 6 from the least to the most stringent. In aggregate regressions, data are extended backward by making them constant between 1978 and 1985.

UB generosity is measured on the basis of average replacement rates (in per cent of pre-displacement wage), defined as the average unemployment benefit replacement rate across two income situations (100% and 67% of average worker 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). Net benefits, available between 2001 and 2007, are net of taxes and transfers, but exclude means-tested social assistance. The source is the *OECD Benefits and Wages Database* ([www.oecd.org/els/social/workincentives](http://www.oecd.org/els/social/workincentives)).

The indexes of anti-competitive product market regulation come from the *OECD Regulatory Database* ([www.oecd.org/document/1/0,3746,en\\_2649\\_37421\\_2367297\\_1\\_1\\_1\\_37421,00.html](http://www.oecd.org/document/1/0,3746,en_2649_37421_2367297_1_1_1_37421,00.html)). They vary from 0 to 6 from the least to the most restrictive.

Minimum wages are measured as the ratio of the statutory minimum wage to median wage of full-time workers. For exogeneity tests, the deviation of the logarithm of the real minimum wage in 2000 USD purchasing power parities from the OECD average of each year is used as an instrument. The source of all these variables is the *OECD Employment Database* ([www.oecd.org/els/employment/database](http://www.oecd.org/els/employment/database)).

The average tax wedge considered in this chapter is the wedge between the labour cost for the employer and the corresponding net take-home pay of the employee for single-earner couples with two children earning 100% of average worker earnings. It is expressed as the sum of personal income tax and all social security contributions as a percentage of total labour cost. Data are retroplated using tax wedges for average production workers between 1978 and 1982 for most countries. The source is the *OECD Taxing Wages Database* ([www.oecd.org/ctp/taxingwages](http://www.oecd.org/ctp/taxingwages)).

Collective bargaining coverage is the share of workers covered by a collective agreement, in percentage. Data were averaged or interpolated when information is not available at the annual level. The degree of corporatism is proxied by the ICTWSS index of

coordination, which takes values from 1 to 5 from the least to the most coordinated. The source of both variables is the *ICTWSS Database* ([www.uva-aias.net/207](http://www.uva-aias.net/207)).

### **Other aggregate variables**

The output gap is the OECD measure of the gap between actual and potential output as a percentage of potential output. In the case of Korea, due to the lack of data on the OECD measure of the output gap, an HP filter of GDP in volume terms is used to derive the output gap. The source is *OECD Economic Outlook (EO) Database*.

Earnings and wage data are deflated using the private consumption deflator, drawn from the *OECD EO Database*.

The aggregate share of temporary workers is drawn from labour force surveys. Missing years were interpolated. Temporary workers are those whose job's termination is determined by objective conditions such as reaching a certain date, completion of an assignment or return of another employee who has been temporarily replaced. Included in these groups also are: a) persons with a seasonal job; b) persons engaged by an employment agency or business and hired out to a third party for the carrying out of a "work mission" (unless there is a work contract of unlimited duration with the employment agency or business); and c) persons with specific training contracts. The source is the *OECD Employment Database* ([www.oecd.org/els/employment/database](http://www.oecd.org/els/employment/database)).