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Youth earnings and labour market volatility in Europe

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Abstract. *The authors provide new evidence on youth earnings and labour market volatility, including flows into and out of employment, across Europe during the Great Recession. EU-SILC data for the period 2004–13 reveal large disparities in volatility levels and trends across European countries. As expected, the Great Recession increased youth labour market volatility, offsetting the trends observed over the previous years of economic prosperity. A variance decomposition exercise points to greater exposure to worker turnover in southern Europe. Fixed effects regression on labour market institutions relates higher unemployment benefits and more stringent employment protection legislation to lower earnings and labour market volatility.*

Individuals dislike instability because it hampers important economic outcomes related to education (Kodde, 1986; Snow and Warren, 1990), health (Caroli and Godard, 2016), consumption and savings behaviour (Guiso, Jappelli and Terlizzese, 1992; Meghir and Pistaferri, 2011), housing demand (Haurin, 1991), divorce (Becker, Landes and Michael, 1977), and well-being in general (Clark, Frijters and Shields, 2008). Economic instability is particularly relevant for youth when it comes to emancipation (Becker et al., 2010; Matsudaira, 2016), fertility (Del Bono, Weber and Winter-Ebmer, 2012 and 2015) or marriage (De la Rica and Iza, 2005). This article provides new evidence on economic instability, as measured by earnings and labour market volatility across Europe over

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the period of the Great Recession for the population group that was hardest hit by the severe economic downturn: youth.

There is a growing corpus of literature on the analysis of earnings volatility (Ziliak, Hardy and Bollinger, 2011; Venn, 2011; Cappellari and Jenkins, 2014). Most of the studies have been devoted to the analysis of prime-age men (Baker and Solon, 2003; Daly and Valletta, 2008; Shin and Solon, 2011; Shin, 2012) and have only considered women more recently (Dynan, Elmendorf and Sichel, 2012; Cappellari and Jenkins, 2014). There is, however, little evidence on earnings volatility among young people, for whom economic instability is likely to be more pronounced than for other age groups. It is also likely to condition life decisions and investments. Previous evidence focuses mostly on country studies and stops right when the Great Recession was about to begin. Our contribution complements previous evidence in two important respects: first, we provide a consistent analysis across 28 European countries; and second, our analysis covers the periods both before and after the economic turmoil of the Great Recession. Venn (2011) studies earnings volatility for a large set (though smaller than ours) of European countries, also using data from the European Union Statistics on Income and Living Conditions (EU-SILC). However, like the authors of all previous studies, she only covers the pre-crisis period and uses a rather crude measure of volatility. Sologon and O'Donoghue (2014) examine earnings volatility for a smaller set of European countries in the 1990s. They also explore the links between labour market institutions and earnings volatility; but, like most previous studies, they confine their analysis to prime-age men.

In accordance with recent literature, we use a measure of instability (labour market volatility) that allows for zero earnings, which means that our analysis is not limited to strictly positive earnings but also takes due account of entries to and exits from employment. This measure is especially suitable for the data we draw from the EU-SILC, which have a short panel component, where individuals are observed over four consecutive years, at most.

Our findings show large disparities in youth earnings volatility and especially in youth labour market volatility levels and trends across European countries, making it difficult to group the countries into meaningful clusters. As expected, the Great Recession increased overall labour market volatility among Europe's youth, offsetting the falling trend observed over the previous years of economic prosperity. With a few exceptions, volatility is found not to differ by sex, age or – perhaps more surprisingly – education. A variance decomposition exercise further allows us to analyse the discrete contributions of earnings volatility and worker turnover to overall labour market volatility variance, revealing that the former is greater in northern Europe than in southern Europe, which is more exposed to entries to and exits from the labour market.

Institutions are a salient feature of European labour markets and shape important labour market outcomes. Using fixed effects regression, we look at the relationship between labour market institutions and volatility, finding that more generous unemployment benefits and stricter employment protection

legislation are related to reduced (earnings and labour market) volatility. This is consistent with the expectation that these two institutions increase the quality of job matches and thus reduce volatility.

The remainder of this article is organized into five sections. The first presents our data set while the second section sets out our measure of volatility. The third section presents our results for earnings and labour market volatility trends across all the European countries in our sample. In this regard, a variance decomposition exercise contributes to our understanding of what accounts for the trends observed. The fourth section links volatility and labour market institutions through a multivariate analysis using a fixed effects regression model. The last section sets out our conclusions and discusses avenues for future research.

Data set

We use data from all the waves of the EU-SILC available at the time of writing, in their longitudinal form. The EU-SILC have the advantage of collecting detailed information on individual and household earnings, as well as other socio-economic and demographic characteristics. Moreover, the data are comparable across the participating European countries. In most, though, the longitudinal component only follows individuals for four consecutive waves, which implies that each year 25 per cent of the sample is replaced by a new rotational group. This means that we will be observing changes on a maximum of three occasions for each individual. Our pooled data set has been constructed by taking the information from the last file in which a given rotational group appears (Iacovou and Lynn, 2013). This is important to guarantee that changes in the way that information is collected across waves do not affect our results: the same longitudinal methodology is applied to all individual observations that appear in a file.

The period under analysis starts in 2004 and ends in 2013, and we obtain results for 28 countries. Our overall sample contains 169,385 individual observations. The smallest national sample is found in Iceland, with 2,175 observations; and the largest in Italy, with 14,450.

Our results are based on changes in individual-level earnings between two consecutive years $t-1$ and t. Our sample includes young people aged 17–29, either employed or not employed. We exclude: (i) individuals who are either 17 at t or 29 at $t-1$; (ii) individuals with missing information on labour market status at $t-1$ or at t; and (iii) full-time students at either $t-1$ or t.[1]

[1] Empirical analysis of a sample that includes students yields similar results. The most significant change is that labour market volatility shows higher levels; trends, however, remain largely unchanged. We find no significant differences for earnings volatility. Lastly, as we find for the sample without students, only the generosity of unemployment insurance and employment protection legislation account for earnings and labour market volatility. All the evidence is available from the authors upon request.

Non-random attrition may bias our measures of volatility. However, as we use volatility measures based on only two consecutive years of data, the effects of attrition are much muted – as compared, say, to measures based on longer sequences of panel data. It should also be noted that since our volatility measure (described in the next section) involves differentiating the variable of interest (i.e. finding the rate of change in earnings), the effect of attrition will be attenuated if we can assume that the probability of attrition is unobserved and time invariant (Ziliak, Hardy and Bollinger, 2011).[2] In addition, measurement error may introduce spurious volatility into our estimates, biasing them upwards (Cappellari and Jenkins, 2014). However, using (latent class) models to correct for measurement error, as in Breen and Moisio (2004), is beyond the scope of this article. Other limitations of our study derive from the actual design of the EU-SILC, which has come under some criticism. There are significant differences between "register", "survey" and "proxy" countries that can affect our cross-country comparative analysis (Krell, Frick and Grabka, 2017) either due to the different treatment that the income variables have received or because of the tracking rules that determine who is interviewed when a household splits (Iacovou and Lynn, 2013), among many other factors. Unfortunately, there is little that researchers can do to overcome these issues after the fact.

Our measure of earnings is "gross employee cash or near cash income". Earnings from second and third jobs are included in the original income variable by Eurostat and cannot be disaggregated. We, however, regard this as an advantage, given that taking additional jobs may be an important response to the threat of losing a better-paying job in difficult economic times. All the nominal amounts have been converted to 2005 prices, using the annual data of the Harmonised Indices of Consumer Prices (HICP). Given that the EU-SILC collect income data with reference to the previous calendar year, the HICP has been used accordingly. Importantly, the income variable is given in gross amounts for the great majority of countries and waves. It should be noted, however, that in the cases of Greece, Italy and Portugal for the years 2004 to 2006, Latvia for 2005 and 2006 and France for 2004, the variable is only available in net amounts. We have nevertheless decided to use this information, but we do not calculate transitions for the same individual from net to gross amounts. This explains why we have a break in the time series for the aforementioned countries (see figures 1–4 below). Lastly, in the case of Spain, in 2004 and 2005, the income information is given either in gross amounts, net or both. Again, we derive results for both years, but only for those individuals for whom we can calculate transitions either in net or in gross amounts. We

[2] Of course, if the unobserved heterogeneity which drives the attrition has a time-varying component, first differences will not eliminate the bias. Furthermore, the extent and direction of the potential bias are difficult to gauge. In their analysis of the attrition effects on poverty persistence rates in the EU-SILC data, Jenkins and Van Kerm (2017) conclude that there is substantial cross-national diversity in the characteristics of individuals lost to follow-up and that the assumptions about the poverty status of those lost to attrition have an important influence on estimates for most countries. A full assessment of attrition bias and its implications in the EU-SILC is beyond the scope of this article.

thus disregard observations when we can only calculate transitions from net to gross income or vice-versa. It would be an interesting exercise to compare levels and trends between volatility measured with gross and with net amounts in order to account for the importance of the automatic stabilization effects of the tax and transfer system during the Great Recession. We do not however have access to both income distributions for all countries and the whole period under analysis.

Methodology

Adopting the terminology used in Cappellari and Jenkins (2014), in this article we analyse "earnings volatility" and "labour market volatility". The first studies the instability in the earnings of young people who have positive incomes at the two time points under analysis, thereby capturing changes in the conditions they enjoyed while working; the second covers all potential young workers, including those with zero earnings, thus capturing not only changes in wages but also transitions into and out of employment. There are no individuals with negative earnings in our sample.

Our principal measure of earnings volatility among young people is the standard deviation of the arc percentage change in individual earnings between t–1 and t, as proposed by Dynan, Elmendorf and Sichel (2012). That is:

$$l = \sqrt{\mathrm{Var}\left[100 \times \frac{y_{it} - y_{it-1}}{\bar{y}_i}\right]} \qquad (1)$$

where $_{it}$ (y_{it-1}) is earnings for person i at time t (t–1), and $\bar{y}_i$ is the mean across the matched pair of years. The main advantage of this measure is that it can be computed even if earnings are zero in one of the two years – thus allowing for the measurement of labour market volatility as well. At the individual level, it is bounded between –200 per cent and +200 per cent and equals zero in those cases where a young person is not employed at t–1 and t. A change in earnings for those who move into work is +200 per cent, while for those who move out of work it is –200 per cent. At the aggregate level, l is bounded below by zero, when changes in earnings are exactly the same for every individual. Otherwise, the larger the dispersion, the greater the measure of volatility. We employ the standard deviation (and not the variance) for the whole descriptive analysis, except when conducting our variance decomposition exercise.

Unlike other methods that have been used to estimate the instability of earnings, such as the variance component approach developed through the pioneering contribution of Lillard and Willis (1978), the method we employ does not allow us to distinguish between transitory and permanent changes in earnings. Several authors have, however, claimed that such a distinction may not be that useful, given that both types of change are likely to influence the welfare of an individual (Shin and Solon, 2011; Dynan, Elmendorf and Sichel, 2012). Shin and Solon argue that parametric models of earnings dynamics that decompose inequality in earnings into permanent and transitory components

are sensitive to arbitrary variations in model specification, therefore sympathizing "with the inclination of several other researchers [...] to eschew complex earnings dynamics models and focus instead on transparently simple statistics that might be reasonable indexes of earnings volatility under a wide range of data-generating processes" (2001, p. 975).[3]

Indeed, earnings volatility measures based on dispersion in year-to-year earnings capture permanent and transitory shocks, but this is appropriate when the object of the research is to learn about possible increases in earnings risk. Another advantage of the method we use in this article is that it is less data intensive. On the negative side, this measure of volatility based on year-to-year changes is more subject to measurement error.

Results

Youth earnings and labour market volatility trends

Figure 1 shows the trends in earnings volatility and labour market volatility for young workers aged 17–29 across Europe over the period 2005–13. In this connection, it is important to remember that the earnings volatility measure does not include individuals with zero earnings at either of the time points, while labour market volatility also takes into account individuals who are not employed and therefore do not receive earnings from the labour market. The graphs contain confidence intervals, computed using the bootstrap method for standard errors with 1,000 replications. A vertical line has been drawn at 2008 to ease comparison between the periods before and after the start of the Great Recession. Although the slump did not start at the same time in all countries, 2008 is possibly the year when the crisis hit most of Europe the hardest.

We start examining the volatility estimates in figure 1 by classifying the countries into low-, medium- and high-volatility groups, according to the distance between the country average volatility level over the sample period, $\bar{l}_i$, and the overall average volatility level across all countries and years, $\bar{l}$. In particular, we consider that a country displays "low volatility" when $\bar{l}_i < \bar{l} - 0.5\sigma_{\bar{l}}$, where $\sigma_{\bar{l}}$ is the standard deviation of overall volatility. Likewise, countries will be said to display medium levels of volatility when $\bar{l} - 0.5\sigma_{\bar{l}} < \bar{l}_i < \bar{l} + 0.5\sigma_{\bar{l}}$, and high levels of volatility when $\bar{l}_i > \bar{l} + 0.5\sigma_{\bar{l}}$.

The countries found to display "low earnings volatility" are the Czech Republic, Greece, Luxembourg, Malta, the Netherlands, Romania, Slovakia and the United Kingdom. In fact, in 2012, Romania displayed the lowest estimate of earnings volatility across all countries and years ($l = 26$). The group with medium earnings volatility also includes a large number of countries: Belgium, Cyprus, Denmark, Hungary, Iceland, Ireland, Italy, Poland, Portugal and Slovenia. Finally, high earnings volatility levels are found in Austria, Bulgaria,

[3] For a discussion of the disadvantages of using complex decomposition models and arguments that advocate for the use of simpler measures (especially if data are close in time, for example, year to year), see Shin and Solon (2011).

Figure 1. Earnings and labour market volatility in 28 European countries for individuals aged 17–29, 2005–13

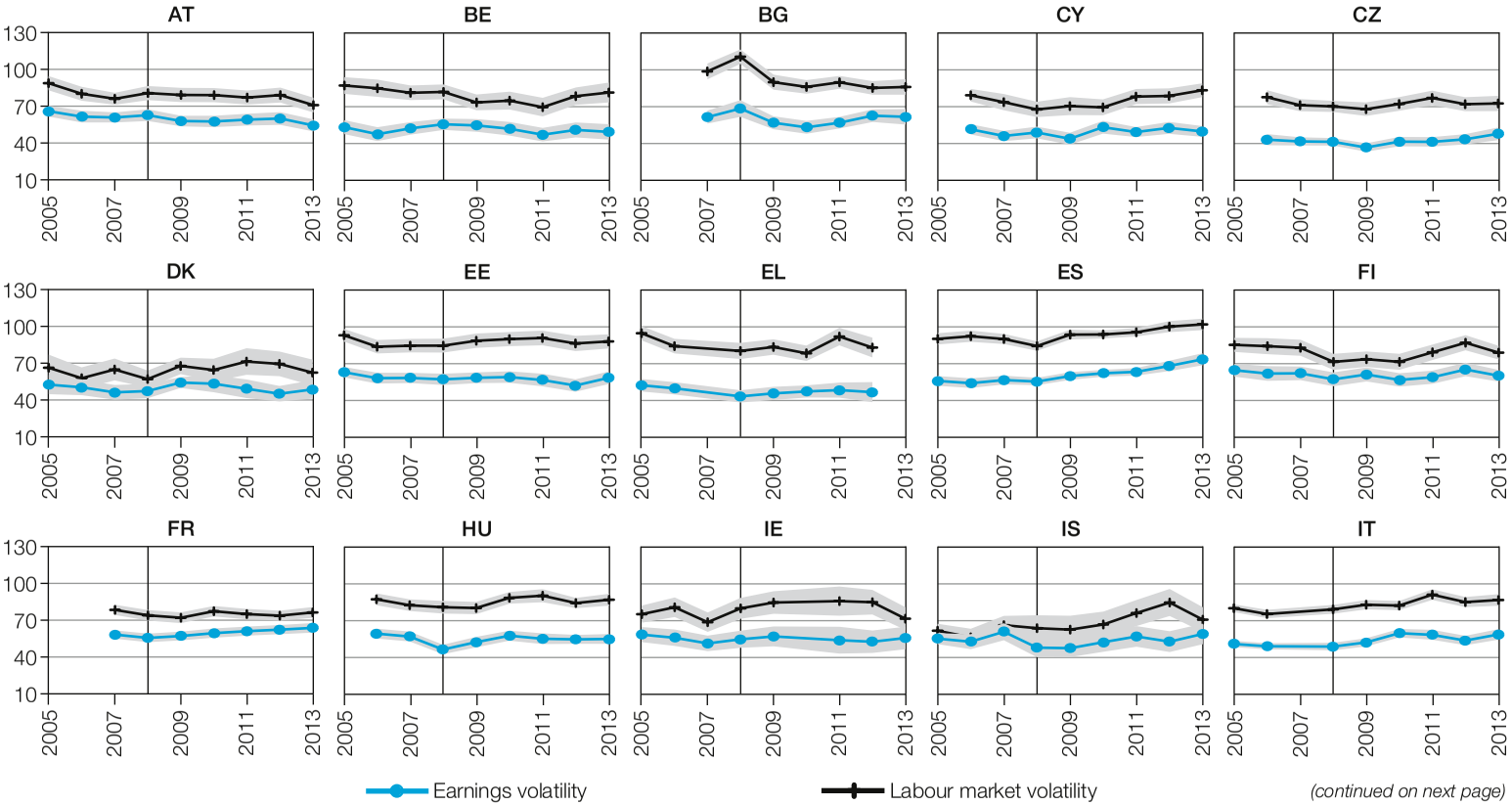

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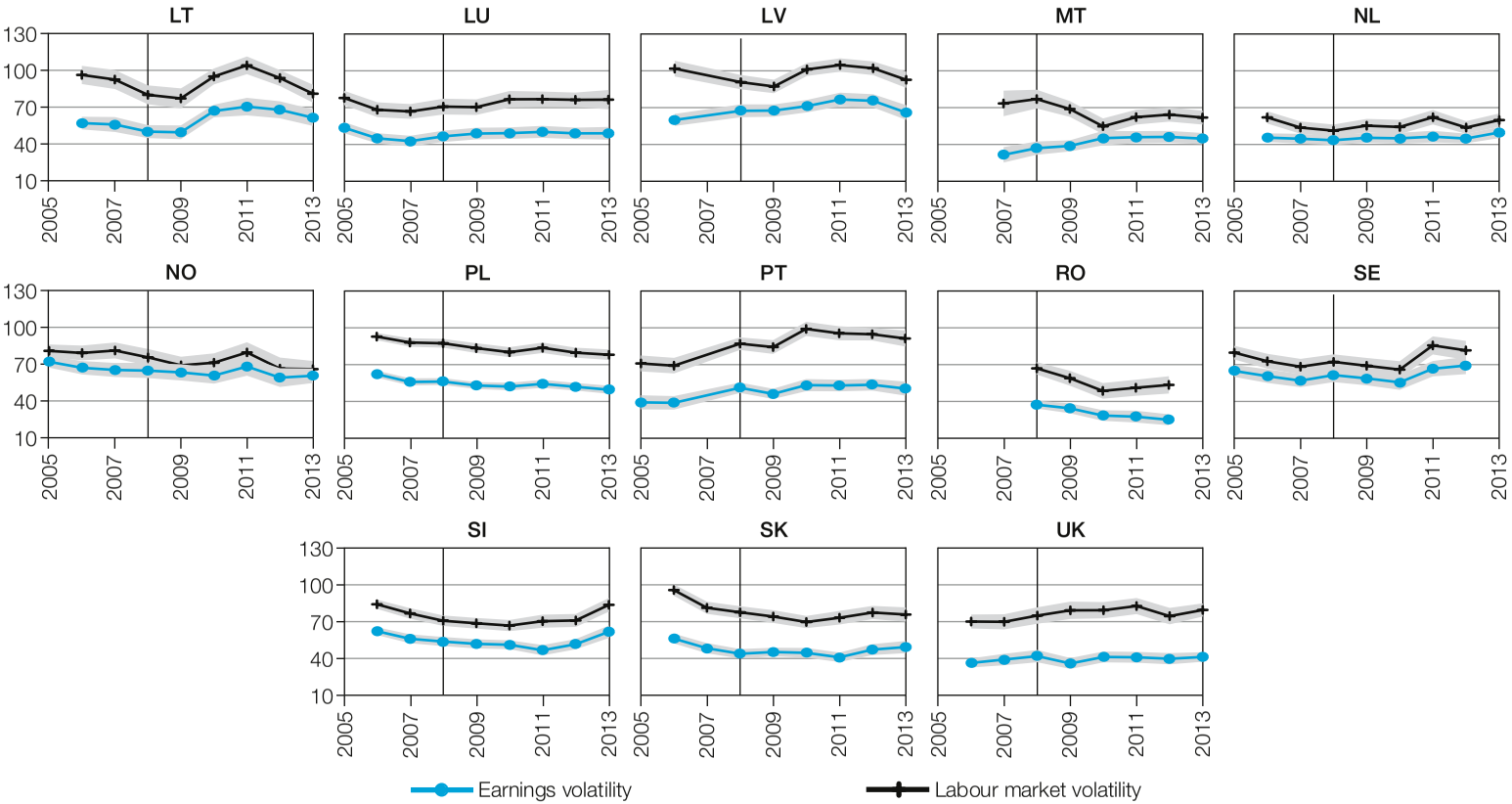
Figure 1. Earnings and labour market volatility in 28 European countries for individuals aged 17–29, 2005–13 *(concl.)*



Note: Eurostat country codes applied. The year 2008 is marked by a vertical line to ease comparison of the period before and after the start of the Great Recession. Confidence intervals (shaded areas) calculated using bootstrap standard errors with 1,000 replications.

Source: Authors' calculations based on data from the EU-SILC, 2005–13.

Estonia, Finland, France, Latvia, Lithuania, Norway, Spain and Sweden. The highest earnings volatility (l = 70) is found in Latvia for 2011. The composition of the different groups makes it difficult to come up with a variable, such as the region or welfare regime, to identify the three clusters of countries – perhaps the only exception are the Nordic countries, as they all belong to the medium- or high-volatility groups.

Over time, we find great heterogeneity in trends. Youth earnings volatility increased by more than 20 per cent between 2008 and 2013 in Iceland, Latvia, Malta and Spain. In contrast, earnings volatility decreased in eight countries, and particularly in Austria, Belgium and Poland, where it fell by more than 10 per cent. It should be noted that the value for 2013 is not available for all the countries analysed. A simple visual inspection of figure 1 shows that year-on-year changes in earnings volatility are not statistically significant for some countries and years although earnings volatility increases over the recession period in many countries. Our multivariate analysis in the fourth section of this article shows volatility increasing with the Great Recession. Most countries remain in the same low-, medium- or high-earnings volatility group when the analysis is carried out by time period (before and after 2008), the only exceptions being Cyprus, Greece and Portugal, which move from the low to the medium group; Slovakia, which goes from the medium to the low group; and Hungary, Poland and Slovenia, which change from the high to the medium group.

A somewhat different picture emerges if we turn to labour market volatility, given that on this measure many countries do not belong to the same (low/medium/high) volatility group as for earnings. In the low labour market volatility group we still find the Czech Republic, Malta, the Netherlands and Romania, but they are joined by Denmark and Iceland. The majority of countries are found in the medium labour market volatility group, while Bulgaria, Estonia, Hungary, Latvia, Lithuania and the southern European countries of Greece, Spain and Portugal fall into the high labour market volatility group. It is thus again difficult to define clear clusters of countries – except for the Nordic countries, which are all located in the low- and medium-volatility groups, and the southern European countries, which are either in the medium or the high volatility group.

As for the trends in labour market volatility, we observe large increases of more than 20 per cent from 2008 to 2013 in Spain and Cyprus, and relatively high increases also in the Netherlands (17 per cent) and Slovenia (18 per cent). Labour market volatility in Austria, Bulgaria, Ireland, Malta, Norway and Poland falls by more than 10 per cent. With the exception of only a few countries (Lithuania, Spain, Poland, Portugal and Slovakia), the changes observed between the first and the last sample years are not large enough for us to speak of a significant increase or decrease in labour market volatility across Europe. In the case of labour market volatility, when we do the analysis by period, the number of countries that change from one group to another is larger than in the case of earnings volatility. Belgium, Finland, Poland and Slovakia move

from high to medium; Italy from medium to high; the Czech Republic, Malta, Norway and Slovenia from medium to low; and Luxembourg and the United Kingdom from low to medium. However, our multivariate analysis shows U-shaped year effects over the period, with a minimum between 2008 and 2009.

Earnings and labour market volatility trends are close to each other in northern European countries and in the Netherlands, indicating that much of the labour market volatility can be accounted for by earnings volatility, rather than by entries into and exits from the labour market. By contrast, where the two volatility measures are far apart, as in Greece, Spain and Portugal, our estimates suggest that labour market volatility is much more affected by worker turnover, and that earnings changes play a less important role.

We also analyse earnings and labour market volatility trends when accounting for certain socio-demographic characteristics, in particular, sex, age and educational attainment.[4] Trends by sex indicate that there is no difference between men and women, as their respective curves clearly overlap for the majority of countries analysed; the rest of our analysis therefore considers males and females together. We also consider earnings and labour market volatility by distinguishing between a younger age group (17–23) and an older age group (24–29). Once again, the curves overlap for most years and countries, indicating that overall the two age groups experience similar levels of volatility. When considering the highest level of education attained (according to the International Standard Classification of Education), we also find an overlap between the curves that show the volatility measure for individuals with tertiary education and for the rest. Only in Finland, France, Spain and the United Kingdom do we observe some years where labour market volatility is higher for those with only primary or secondary education than for those with a university degree.

A decomposition exercise

As a second stage in our analysis, to better understand the volatility trends observed, we decomposed our measure of labour market volatility. As explained in Cappellari and Jenkins (2014), the fact that we have mutually exclusive groups in the labour market (employed or not employed at different points in time) means that we can compute the variance of the arc percentage change as the weighted sum of the "within" and "between" group variances. The "within-group" variance is the sum of the variance of each group, weighted by the sample share of each group. In total, there are four groups, depending on whether individuals have positive earnings at t–1 and at t (P_{11}), positive earnings only at t–1 (P_{10}), positive earnings only at t (P_{01}), or no earnings from the labour market in either of the periods (P_{00}). The "between-group" variance is the variance of a counterfactual distribution, in which each individual is assigned the mean value of his or her group.

[4] All figures are available from the authors upon request.

Using the same notation as in Cappellari and Jenkins (op. cit.), the sample mean arc percentage earnings change, M, can be decomposed as follows:

$$M = M_{11}P_{11} + M_{10}P_{10} + M_{01}P_{01} + M_{00}P_{00} \quad (2)$$

where $M_{00} = 0$, $M_{01} = +200$, $M_{10} = -200$ and P_{11}, P_{01}, P_{10} and P_{00} are the sample shares that add up to 1. Thus M can be written as:

$$M = M_{11}P_{11} + 200(P_{10} - P_{01}) \quad (3)$$

Moreover, since $V_{10} = V_{01} = V_{00} = 0$, the within-group variance is equal to the variance in the always-employed group, V_{11}, weighted by its sample share P_{11}. Therefore, the overall variance ($V = l^2$) can be computed as the sum of the within-group variance and the four components of the between-group variance, expressed as:

$$V = l^2 = V_{11}P_{11} + P_{00}M^2 + P_{01}(200 - M)^2 + P_{10}(200 + M)^2 + P_{11}(M_{11} - M)^2 \quad (4)$$

Figure 2 shows the importance of the different components of the labour market volatility variance for each country over time. It indicates great cross-country variability in the share of earnings volatility variance relative to overall labour market volatility variance. In northern Europe, earnings volatility accounts for the largest share of the labour market volatility variance – the maximum being found in Iceland in 2006, where 85 per cent of the total variance is accounted for by changes in earnings. This means that in these countries, and in Slovenia and the Netherlands, young people are more likely to face changes in the wages that they receive from the labour market than in the opportunities that they are given to enter the labour market.

However, in the southern European countries and in the United Kingdom and Romania, earnings volatility variance plays the least significant role – less than 30 per cent of the variance is due to earnings changes – which implies that entries to and exits from the labour market have a greater impact. For example, entries and exits respectively represented 41 per cent and 31 per cent of the total volatility variance in Spain in 2005. Thus, even in a period of economic growth, the Spanish youth labour market is characterized by high worker turnover. Greece, Portugal, Italy and Belgium show similar patterns.

With the onset of the Great Recession, the share of overall volatility variance that is accounted for by the components of transitions into and out of the labour market increases in many countries. In order to illustrate these changes, figure 3 shows trends in the absolute value of volatility variance and its three main components. In particular, note should be taken of the parallelism between the line representing the "exits" component ($P_{10}(200 + M)^2$), and the line showing the total volatility variance (V) in Greece, Norway and Portugal. Again, taking Spain as an example, we find that 26 per cent of total volatility variance is accounted for by exits from employment in 2008, while this increases to 39 per cent in 2011, when the consequences of the economic crisis were still much in evidence. For Greece, the corresponding figures are 28 per cent and 46 per cent.

Figure 2. Decomposition of labour market volatility variance (within- and between-group) for individuals aged 17–29, 2005–13

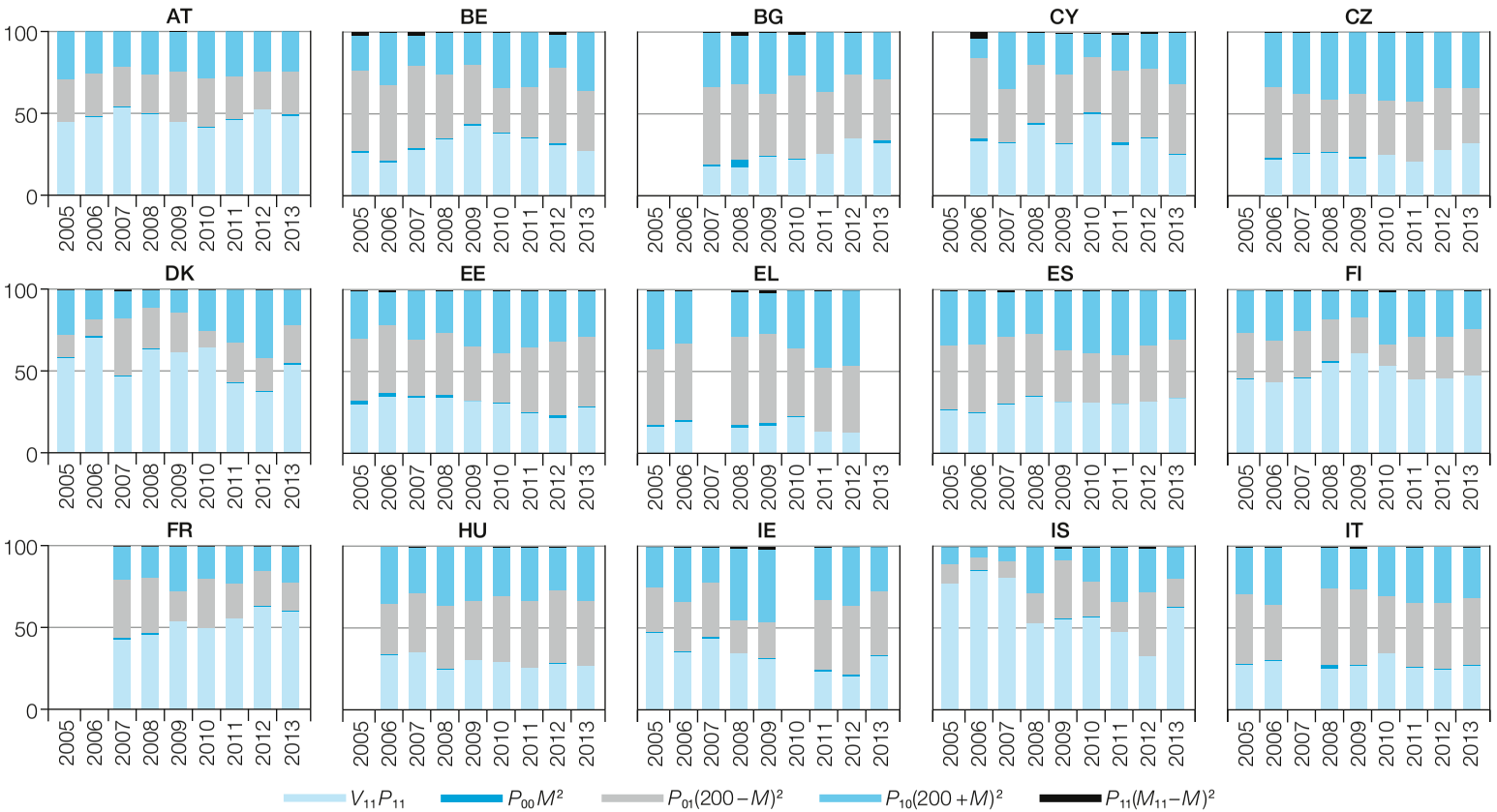
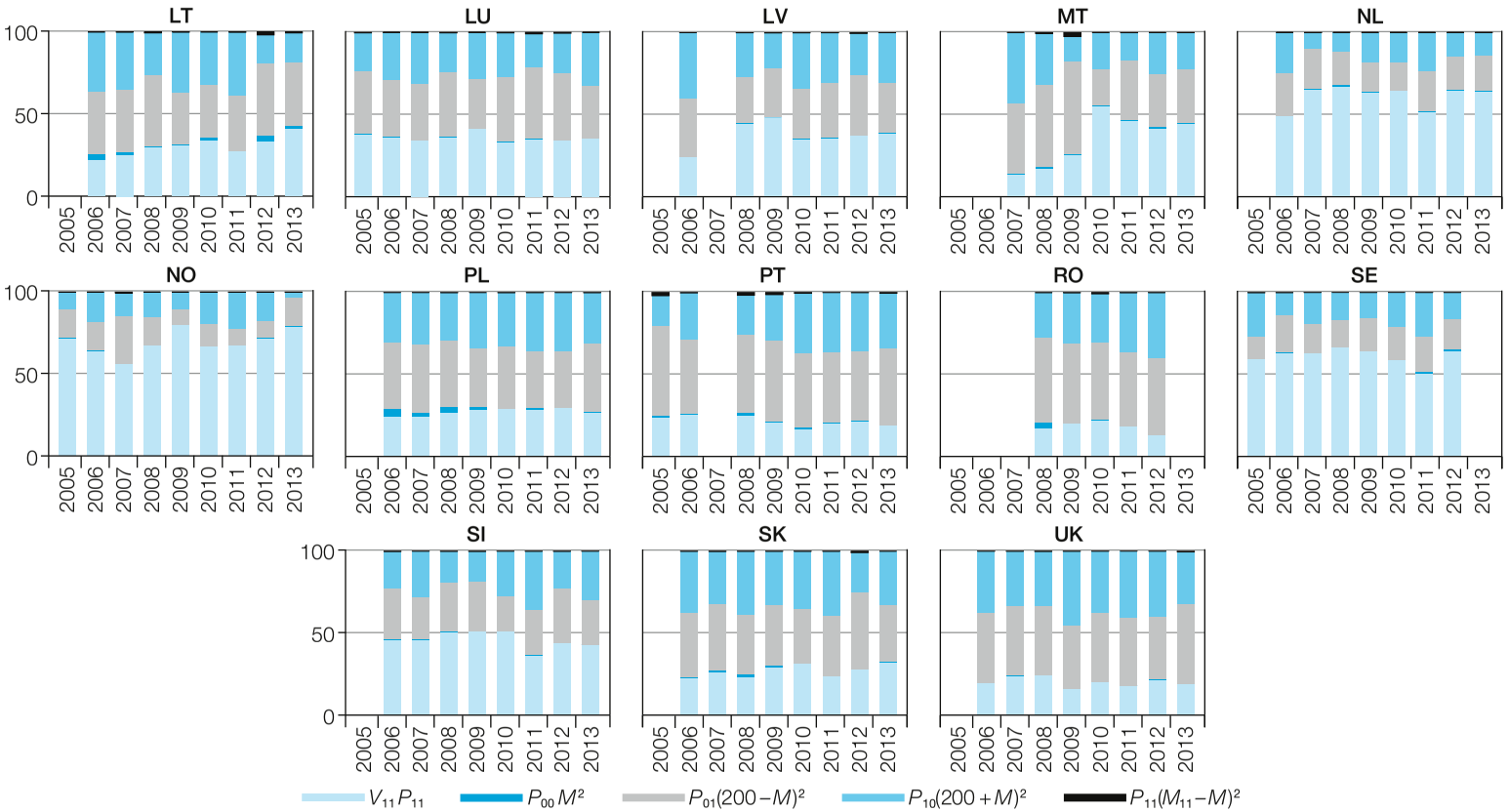


Figure 2. Decomposition of labour market volatility variance (within- and between-group) for individuals aged 17–29, 2005–13 *(concl.)*



Note: Eurostat country codes applied. $V_{11}P_1$ = within-group variance; $P_{01}(200-M)^2$ = between-group component due to entries into the labour market; $P_{10}(200+M)^2$ = between-group component due to exits from the labour market; $P_{00}M^2$ = between-group component of the group with no earnings at both matched years; $P_{11}(M_{11}-M)^2$ = between-group component of the group with earnings at both matched years.

Source: Authors' calculations based on data from the EU-SILC, 2005–13.

Figure 3. Trends in the absolute values of volatility variance and its three main components, 2005–13

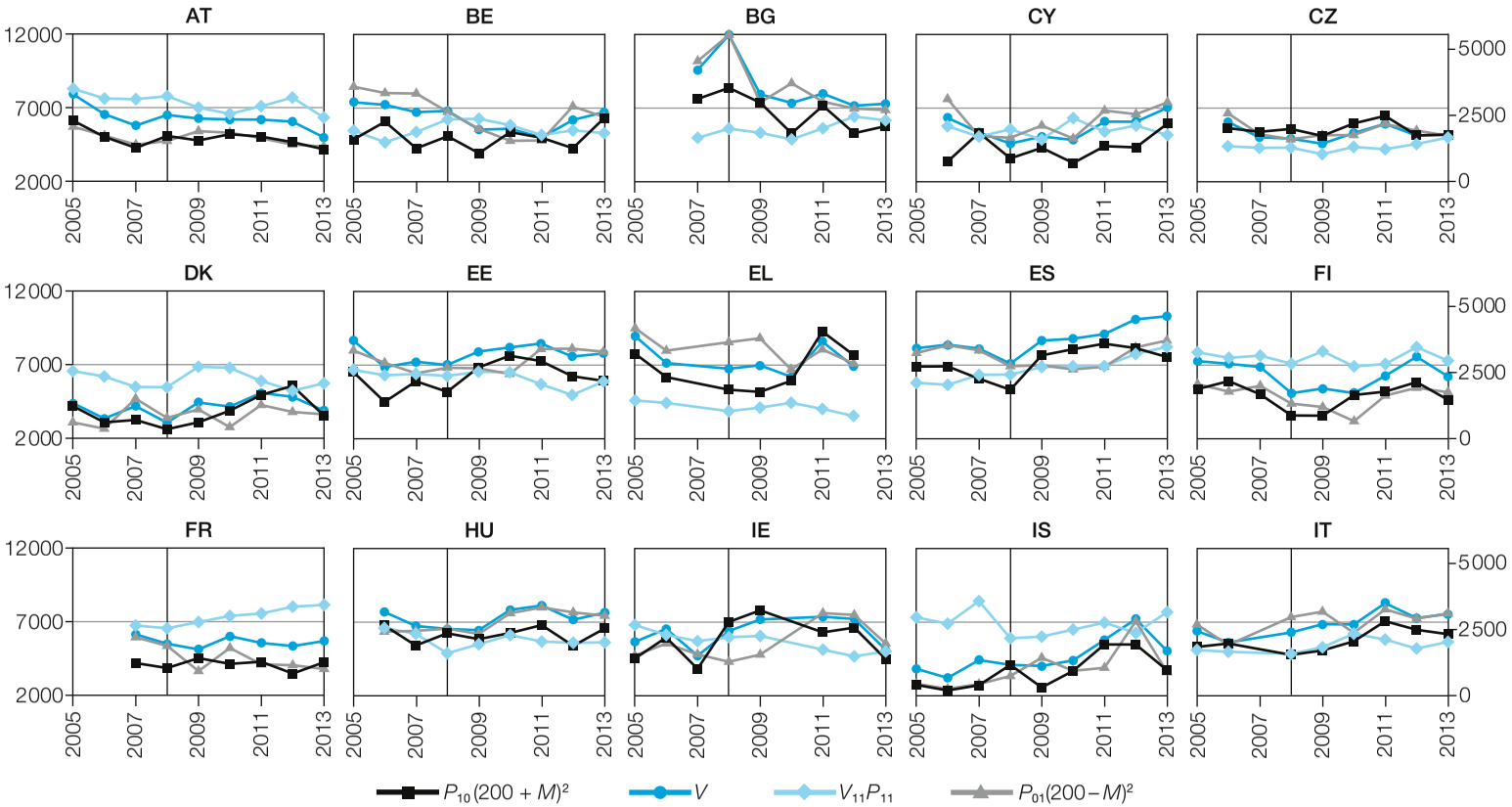
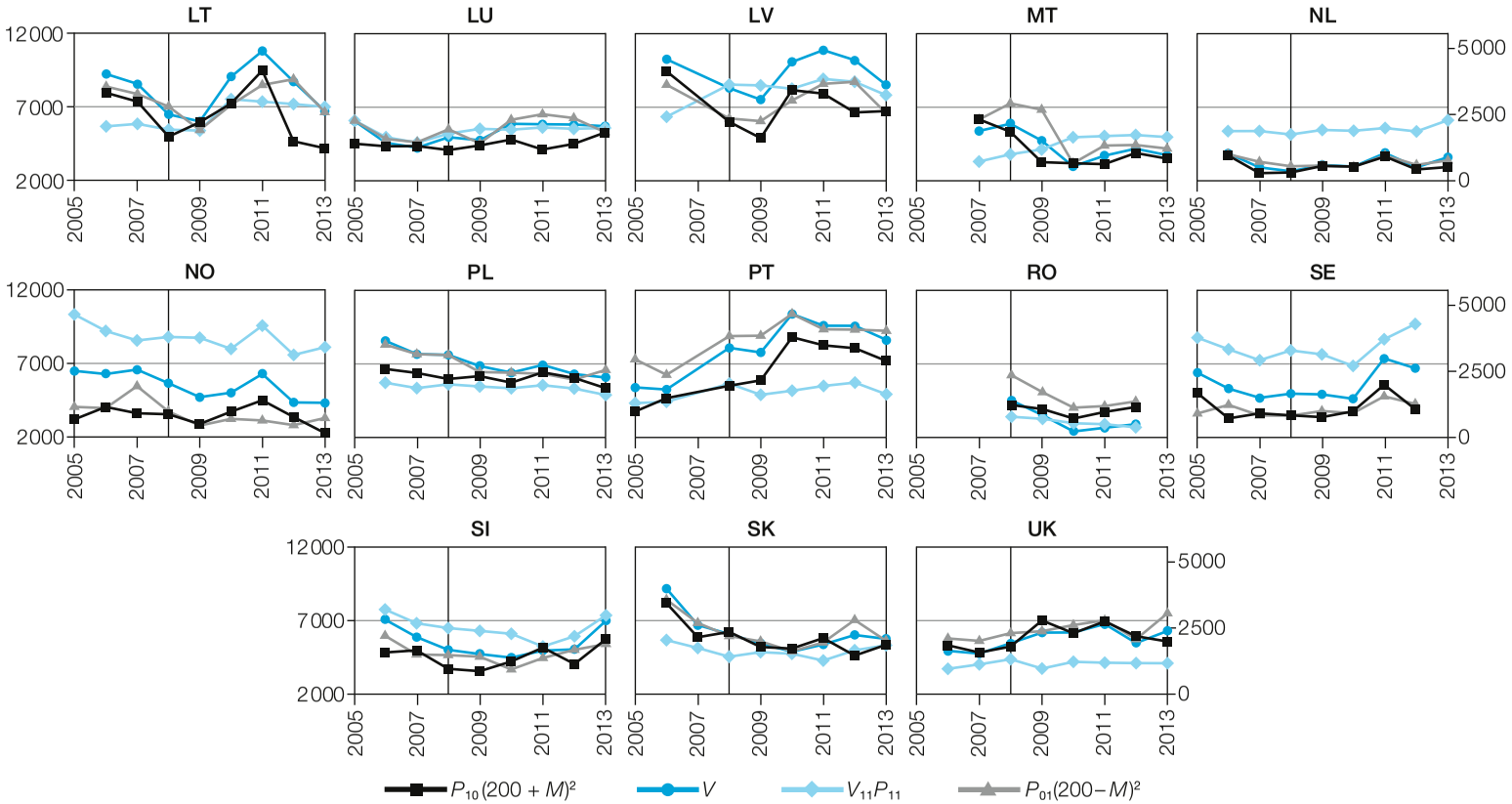


Figure 3. Trends in the absolute values of volatility variance and its three main components, 2005–13 *(concl.)*



Note: Eurostat country codes applied. The primary axis refers to overall volatility, while the secondary axis refers to the components of volatility. V = total volatility variance; $V_{11}P_{11}$ = within-group variance; $P_{01}(200-M)^2$ = between-group variance due to entries into the labour market; $P_{10}(200+M)^2$ = between-group variance due to exits from the labour market.

Source: Authors' calculations based on data from the EU-SILC, 2005–13

Figure 4. Evolution in the share of subgroups of individuals according to their employment status at *t*–1 and *t* (percentages), 2005–13

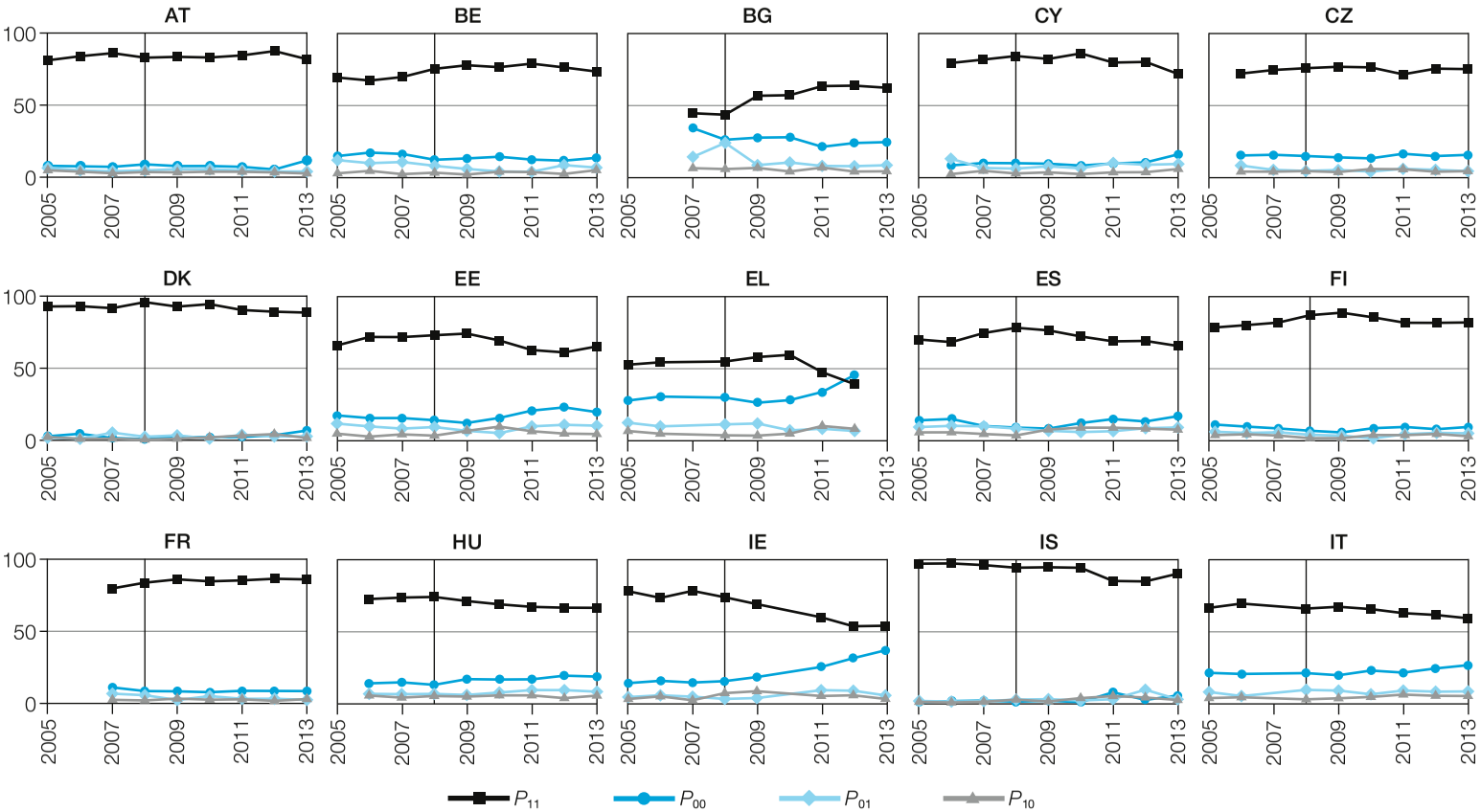
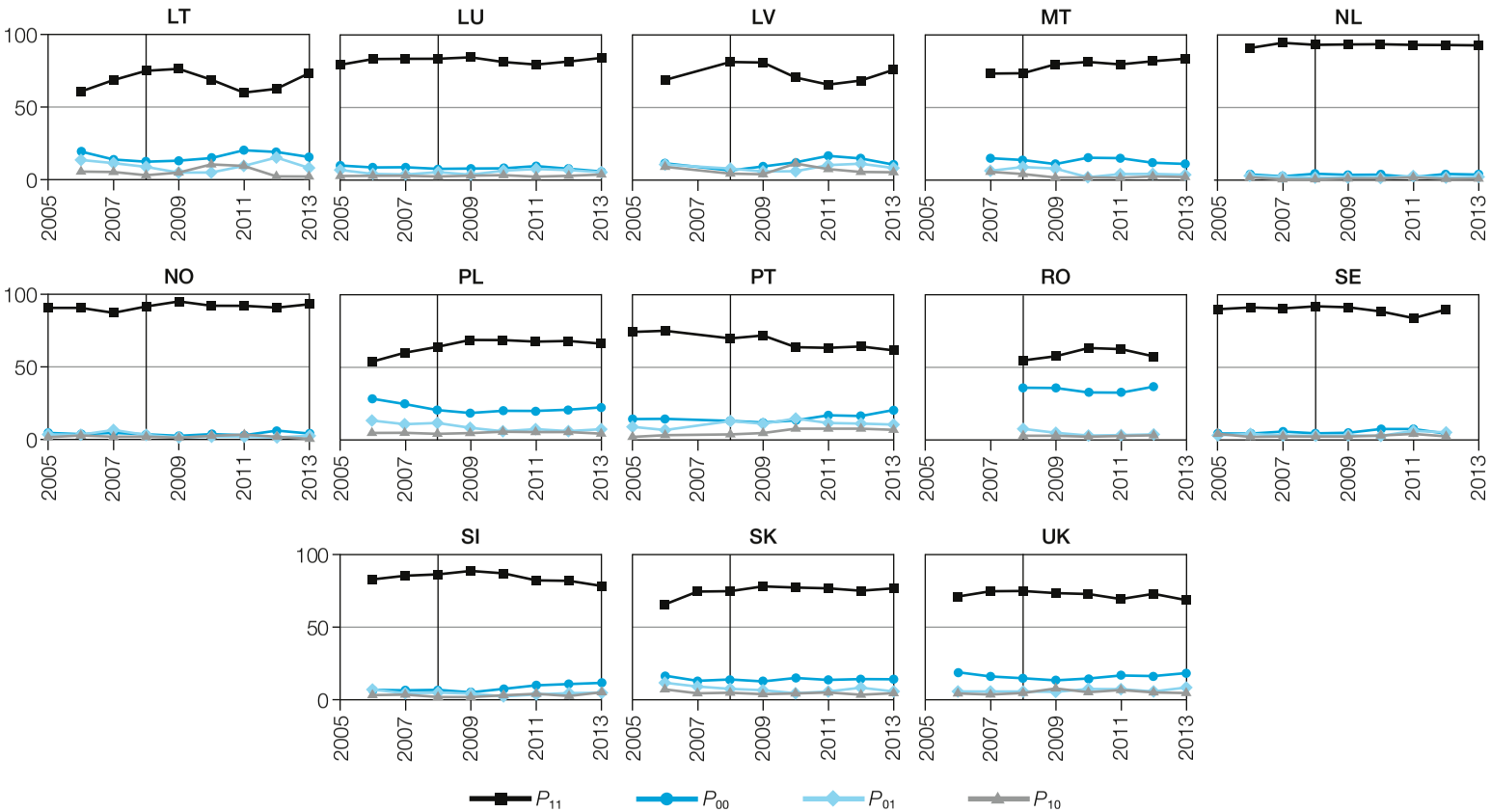


Figure 4. Evolution in the share of subgroups of individuals according to their employment status at *t*–1 and *t* (percentages), 2005–13 *(concl.)*



Note: Eurostat country codes applied. P_{00} = no earnings from the labour market in either year; P_{01} = positive earnings only at *t*; P_{10} = positive earnings only at *t*–1; P_{11} = positive earnings at *t*–1 and *t*.

Source: Authors' calculations based on data from the EU-SILC, 2005–13.

The rise in the importance of the variance component due to exits is offset by decreases either in the component due to entries or in the component due to earnings changes. For instance, in Finland the "exits" component increased its share from 17 per cent to 28 per cent between 2008 and 2012; the "earnings change" component decreased its share from 56 per cent to 46 per cent; and the "entries" component remained constant. Results show similar patterns for Denmark and Sweden. Unlike Finland, the increase in the "exits" component in Greece was offset by a decrease in the "entries" component from 56 per cent to 41 per cent, while earnings changes again remained constant.

The relative sizes of the four earning status groups (P_{11}, P_{10}, P_{01}, P_{00}) are important in understanding the trends in the volatility components shown in figure 2. To this end, figure 4 shows the evolution of the shares of the four sample subgroups. First, note should be taken of the large disparity across countries in the sample shares of group P_{11}. For instance, at the beginning of the period, P_{11} is as high as 90 per cent in the northern European countries (except Finland), but as low as 53 per cent in Greece. This helps to explain why earnings volatility is the main driver of labour market volatility in northern Europe, and why it is so low in southern Europe, Romania and Poland. Second, the percentage of individuals entering or exiting the labour market (and thus contributing to labour market volatility) is rather low even in countries with sky-high unemployment rates. The percentage of individuals exiting the labour market reached the highest values around 2011 in Spain, Greece and the three Baltic countries (with figures between 9 and 11 per cent). This brings us to a third piece of evidence: those countries hardest hit by the Great Recession show a high percentage of individuals in group P_{00} even before the economic crisis. This result helps us to understand why we do not find greater labour market volatility: young people who are out of the labour market remain so for long periods of time, and therefore do not contribute to measured volatility.

Accounting for volatility

This section examines the institutional factors that may shape both earnings and labour market volatility. First, we draw on existing theoretical work and empirical evidence to outline briefly how relevant institutions are thought to influence volatility; we then report our findings on the relationship between estimated labour market and earnings volatility and labour market institutions on the basis of a fixed effects regression model. In our empirical analysis, we consider the following institutions: employment protection legislation or EPL (using two indices of strictness of EPL for temporary and permanent contracts), minimum wages (relative to the median wages of full-time workers), unemployment insurance (through its replacement rates), openness to trade (by means of a globalization index), trade unions (density) and active labour market policies (expenditure as a percentage of GDP). In addition, we consider

the percentage of young people aged 15–29 who are not in employment, education or training (NEET),[5] the unemployment rate, and GDP level and growth.

What impact should we expect institutions to have?

Since the main difference between our two measures of earnings and labour market volatility lies in entries to and exits from paid employment, we first examine the expected impact of these six institutions on worker turnover, after which we discuss the possible effects on the variability of individual earnings growth.

Labour market volatility

Employment protection legislation: It is generally accepted that restrictions on hiring and firing (and associated costs) increase the cost of worker turnover and are likely to reduce the flow of workers. This finding is often analytically derived from matching models (Mortensen and Pissarides, 1994). For instance, Blanchard and Portugal (2001) argue that greater employment protection increases a firm's costs and workers' bargaining power, leading directly to fewer layoffs and longer unemployment duration. Longer unemployment duration in turn inhibits quits. Pries and Rogerson (2005) also find that, as it becomes more expensive to terminate matches, workers and firms need greater assurance that their match is a good one; firms find it less profitable to create new vacancies, lowering the flow of workers.

Minimum wages: Consistent with job search models with endogenous separations, minimum wage increases have been found to have a negative effect on worker turnover, by reducing separations and accessions. Using data on two high-impact demographic and industry groups (teenage and restaurant workers in the United States), Dube, Lester and Reich (2016) find that turnover falls following a minimum wage increase, especially affecting workers with shorter tenure, which is a salient feature among young workers. Similarly, using Canadian data, Brochu and Green (2013) find that hires, quits and layoffs of low-skilled teenage workers fall as a result of a minimum wage rise. Portugal and Cardoso (2006) find that a selective rise in the minimum wage for teenagers in Portugal lowered worker turnover by reducing separations.

Unemployment insurance: Unemployment insurance or benefit schemes have two key features that may influence worker turnover: benefit levels and potential benefit duration (Tatsiramos and van Ours, 2014). We focus on benefit levels, because the data available to us for our empirical analysis are confined to this feature – which is unfortunate, since empirical evidence shows that potential benefit duration has a greater impact on unemployment duration, and thus on exit rates to employment (ibid.). According to search theory, which has become the dominant approach to examining unemployment insurance, benefit levels affect worker turnover in at least three ways, but the effects are

[5] This is used as a proxy for the quality of the educational system and school dropout rates, for which there is no consistent information covering all our sample countries over our sample period.

ambiguous. First, since wage employment may provide entitlement to future unemployment insurance, the so-called "entitlement effect" increases the appeal of employment to those not employed who do not qualify for benefits. This channel then increases turnover, by increasing accessions of individuals who do not qualify for benefits. The second channel has an ambiguous effect: higher benefit levels may induce insured and newly unemployed workers to increase their reservation wage, which reduces the chances of them accepting a new job; but more generous benefits are also likely to promote a reduction in the reservation wages of unemployed workers who are close to benefit exhaustion, thus increasing rates of exit from unemployment. The third channel brings about a turnover reduction: higher benefit levels are likely to promote higher quality job matches, higher productivity (Acemoğlu and Shimer, 2000) and wages, promoting longer employment duration, which will in turn decrease turnover.

Labour market institutions have usually been studied in isolation, paying much less attention to the likely interactions that different institutions may have in determining outcomes. As Blanchard and Tirole (2008) argue, such interaction may be especially pertinent for unemployment insurance and EPL. For instance, the negative effect of EPL on accessions identified by Pries and Rogerson (2005) may be greater in the presence of low benefit levels, which induce workers to accept poorer quality job matches. The likely negative effect of stricter EPL for temporary jobs may also depend on the generosity of unemployment insurance, which allows (unemployed) workers to await better matches, possibly in terms of a permanent job.

The empirical evidence for continental European countries seems to suggest a positive effect of benefit levels on turnover. On the one hand, benefit levels are normally found to have a weak (or no) effect on exit rates from unemployment into employment in continental European countries (Holmlund, 1998; Tatsiramos and van Ours, 2014). In contrast, they are found to have a negative impact in the United Kingdom and the United States, with a positive elasticity of unemployment duration with respect to benefit levels lower than 1, on average. This elasticity is usually higher than 1 for the short-term unemployed. On the other hand, benefit levels are found to have a significant positive effect on inflow into unemployment (Winter-Ebmer, 2003; Lalive and Zweimüller, 2004). Lastly, Rebollo-Sanz (2012) finds the effects of unemployment insurance outlined above – i.e. longer unemployment spells and increased (employer-driven) exit rates from employment – to be especially relevant for workers with a more marginal attachment to the labour market. She examines temporary workers and women, but much the same should apply to young workers.

Openness to trade: Trade openness has an ambiguous effect on job turnover and wage inequality (Coşar, Guner and Tybout, 2016). On the one hand, it increases the sensitivity of a firm's revenues to its productivity and employment levels, which in turn increases job turnover. More successful firms are also likely to reap larger rents in more open economies, which widens the wage

dispersion across firms. On the other hand, lower trade friction increases the concentration of workers in larger, more stable firms, which tends to reduce turnover and wage inequality. Coçar, Guner and Tybout (op. cit.) examine the impact of trade liberalization in Colombia in the 1980s and find that the sensitivity effect dominates over the distributive effect, which implies higher turnover and greater earnings inequality.

Trade unions: In so far as trade unions are an effective means by which discontented workers may negotiate better conditions, they may reduce exits from employment (which is the alternative means of escaping from dissatisfaction). In other words, trade unions may provide a voice for workers, which may lead to a lower level of separations (Freeman, 1980). The higher wage pressure generally related to trade union presence is also likely to help reduce turnover. However, unionized firms have also been found to increase the use of lay-offs, firstly, by reducing quits and discharges and, secondly, by limiting the elasticity of wage (growth) and hours worked relative to changing demand conditions (Medoff, 1979; Dustmann and Schönberg, 2009). While the former may be regarded as a perfect substitute for lay-offs and thus has no effect on overall separations, the latter leads to an increase in worker turnover. The net effect is a priori ambiguous. Existing empirical evidence mostly supports the argument of negative union-density effects on turnover, as suggested by the voice hypothesis.[6]

Active labour market programmes: Youth employment is especially sensitive to economic fluctuations (Verick, 2011), and the most recent economic crisis was no exception. According to Eurostat figures, the unemployment rate is still substantially higher for youth than for adults – twice as high in some countries. Active labour market programmes seek a fast reintegration of unemployed workers into employment. Evidence from a recent meta-analysis points to positive (albeit limited) effects. In particular, job-search assistance and training programmes are generally found to have positive effects, though the latter mostly in the medium term. In contrast, public sector employment programmes are much less effective (Card, Kluve and Weber, 2010). These findings seem to hold for youth unemployment (Caliendo, Künn and Schmidl, 2011). Hence, such programmes may be expected to contribute to an increase in accessions and turnover.

Earnings volatility

Employment protection legislation: By increasing tenure, as well as the bargaining power of protected workers, stricter EPL is likely to reduce earnings volatility. Given the lack of direct evidence of the effect of EPL on wage volatility, the most suggestive evidence is provided indirectly by tenure. Conditional on employment, stricter EPL brings about longer tenure, which in turn

[6] See, for example, Antcliff and Saundry (2009) on the United Kingdom; Drago and Wooden (1991) on Australia; García-Serrano and Malo (2002) on Spain; Hirsch, Schank and Schnabel (2010) on Germany; or Lucifora (1998) on Italy.

has been found to have a negative effect on earnings volatility in Italy (Cappellari and Leonardi, 2016).

Minimum wages: Higher minimum wages tend to compress wages at the lower end of the distribution (Holmlund, 2014; Autor, Manning and Smith, 2016). However, there is no theoretical or empirical guidance regarding their effect on earnings volatility. In the midst of the Great Recession, minimum wages most likely contributed to reducing earnings volatility by providing non-negative earnings growth rates at the lower end of the distribution, at least for those countries that opted to adjust the economy via prices rather than quantities.

Unemployment insurance: Unemployment insurance is unlikely to have a direct influence on earnings volatility, but it may have the indirect effect of inducing job matches of higher quality and longer tenure, which will in turn decrease earnings volatility (Cappellari and Leonardi, 2016).

Openness to trade: As outlined above, trade openness is likely to increase wage inequality (Coşar, Guner and Tybout, 2016), as is trade liberalization (Traca, 2005).

Trade unions: Trade unions compress the wage distribution (Card, 1996; Lemieux, 1998; Card, Lemieux and Riddell, 2004; Dustmann and Schönberg, 2009) and limit firms' capacity to adjust to demand shocks through wage growth (Medoff, 1979; Dustmann and Schönberg, op. cit.). Hence, we expect earnings volatility to be lower in countries with higher unionization.

Active labour market programmes: We do not have theoretical insights regarding the effect of such programmes on individual wage growth variability, and empirical studies so far have not paid much attention to their impact on wages, let alone to wage growth and its variability (Card, Kluve and Weber, 2010).

Data on institutions

In order to examine the relationship between institutional features and our volatility estimates at the country level, we gathered information from different sources on salient features of the six institutions referred to above and on other controls (i.e. NEET rate, GDP and unemployment rate) for the 28 European countries over the nine years covered by our sample period. We next provide a brief description of each variable below.

EPL includes many provisions that regulate both monetary and non-monetary aspects of hiring and firing for both permanent and temporary jobs. To capture the most salient of these aspects, we use the OECD composite index of employment protection regulation of temporary contracts, which provides a score measured on a scale of 0–6, with higher values representing stricter regulation; this is built on the basis of eight items and considers the regulation of fixed-term contracts and of temporary work agencies.

Our measure of minimum wages is the commonly used minimum relative to the median wages of full-time workers, as reported by the OECD.

Unemployment insurance or benefit schemes have two key features that may influence volatility: benefit level and potential benefit duration. Given the lack of harmonized and consistent data on potential benefit duration, we use information on benefit levels. Specifically, our variable is the unemployment insurance replacement rate. Since actual replacement rates depend on personal and household characteristics, we use OECD estimates for a single person with no children and average worker earnings.

To capture openness to trade, we use Dreher's (2006) index of actual flow, which measures trade liberalization through achieved outcomes, instead of using other aspects of trade openness, such as legal and economic restrictions and barriers (e.g. tariffs). This measure is a weighted sum of four components: trade, foreign direct investment, portfolio investment and income payments to foreign nationals (all expressed as a percentage of GDP). The index ranges from 0 (no openness) to 10 (complete openness). Trade union density corresponds to the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners, as taken from the OECD Labour Force Statistics.

The variable on active labour market programmes is expenditure on such programmes, expressed as a percentage of GDP, as reported by the OECD. It includes expenditure on placement and administration, training, employment incentives, sheltered and supported employment and rehabilitation, direct job creation and start-up incentives. We do not use passive labour market policies, as they include programmes that are not so relevant for youth, such as expenditure on early retirement.

Finally, our control variables – the NEET rate, GDP and the unemployment rate – are also drawn from the OECD.

Due to limited data availability, we have an unbalanced panel, since we lack some institutional data for certain years and countries. The countries for which the lack of data is the most severe include some eastern European countries, such as Bulgaria, Romania and Lithuania, and Cyprus and Malta.

What institutions account for volatility?

To gain a first insight into the raw impact of each of the institutional features, table 1 reports coefficient estimates of separate fixed effects regressions of labour market and earnings volatility on each variable, with year dummies and a constant term.

According to simple correlations, three institutions show a significant and negative effect on youth earnings volatility. The negative relationship between the unemployment insurance replacement rate and earnings volatility is consistent with the expectation that higher benefit levels induce job matches of higher quality and longer tenure. The negative association with the strictness of EPL (for temporary and permanent jobs – though our results on the latter are not displayed) is also consistent with the hypothesis that longer tenures are brought about by stricter EPL. Active labour market programmes, for which we do not have any prior hypothesis, also correlate negatively with earnings

Table 1. Raw effect of institutional and control variables on youth earnings and labour market volatility, 2005–13

	Earnings volatility	Labour market volatility	*N*
GDP per capita	–0.0001	–0.0006***	225
GDP growth	0.1475	0.2817*	225
Unemployment rate	0.5567***	0.8058***	225
NEET rate	0.3213*	0.7926***	225
Unemployment insurance replacement rate	–0.2443***	–0.2250***	218
Trade openness	0.1717	0.4160**	200
Trade union density	–0.2354	0.0622	178
EPL temporary	–7.8859***	–11.4620***	174
Active labour market programmes	–32.5857**	–57.6533***	169
Minimum wage	5.9937	–13.1082	142

*, ** and *** indicate significance at the 10, 5 and 1 per cent levels, respectively.

Notes: NEET = youth not in employment, education or training. Each row reports the coefficient estimate of a separate fixed-effect regression that also includes year dummies and a constant term.

Source: Authors' calculations based on data from the EU-SILC, 2005–13.

volatility. Turning to the control variables, earnings volatility shows a positive correlation with the unemployment rate and with the proportion of youth not in employment, education or training.

The same three institutions that correlate with earnings volatility also correlate, and in the same direction, with labour market volatility. Contrary to our findings for earnings volatility, though, trade openness shows a positive relationship to labour market volatility. This is consistent with the empirical evidence for Colombia provided by Coşar, Guner and Tybout (2016), and suggests a sensitivity effect that dominates over the distributive effect.

The simple correlations in table 1 ignore possible correlations between variables that capture relevant aspects of the institutional setting, and between these institutional variables and other controls. Table 2 reports the coefficient estimates of a fixed effects regression that includes a set of institutional variables, N, a set of controls, X, and year dummies, t, according to the following equation:

$$l_{it} = \alpha + N'_{it}\beta + X'_{it}\gamma + t'\tau + \varepsilon_i + \upsilon_{it} \quad (5)$$

where the vector β collects our parameters of interest, ε_i denotes the country fixed effects, and υ_{it} is an independent and identically distributed error term.

Column (1) in table 2 is concerned with youth earnings volatility. It presents the results of our preferred model, which includes the variables that show a statistically significant raw correlation in table 1.[7] Two institutions seem to

[7] These results are robust to including the two GDP-related variables, which are also included in column (2) for labour market volatility. The large coefficients on EPL and active labour market programmes are due to the scaling of those variables.

Table 2. What accounts for youth earnings and labour market volatility, 2005–13

	Earnings volatility		Labour market volatility			
	(1)	Standard error	(2)	Standard error	(3)	Standard error
GDP per capita			–0.0004*	0.0002	–0.0004**	0.0002
GDP growth			0.07	0.21		
Unemployment rate	0.68**	0.28	0.36	0.41		
NEET rate	–0.37	0.34	–0.0002	0.50		
Unemployment insurance replacement rate	0.43***	0.17	0.90***	0.24	0.73***	0.22
Active labour market programmes	–4.02	14.33	–15.00	21.63		
EPL temporary	16.05***	7.03	40.41***	10.93	28.25***	8.76
Trade openness			–0.37	0.27		
Unemployment insurance replacement rates*EPL temporary	–0.34***	0.11	–0.79***	0.17	–0.61***	0.14
Year						
2006	–1.87	1.36	0.12	1.99	–1.16	1.91
2007	–3.08**	1.43	–1.94	2.36	–3.62*	2.08
2008	–3.20**	1.35	–2.64	2.25	–4.30**	1.97
2009	–3.72***	1.35	–4.14	2.52	–4.94***	1.84
2010	–3.24**	1.38	–2.31	2.26	–3.60*	1.95
2011	–2.88**	1.36	1.88	2.24	1.63	1.99
2012	–2.55*	1.39	0.30	2.68	0.26	2.04
2013	–2.04	1.45			–0.79	2.07
Constant	39.43***	11.13	81.43***	27.82	65.22***	14.23
N	156		140		174	

*, ** and *** indicate significance at the 10, 5 and 1 per cent levels, respectively.

Notes: NEET = youth not in employment, education or training. Fixed effects regression. Column (1) shows results for variables that present a statistically significant correlation with earnings variability in table 1; column (2) shows estimates using a specification that includes variables presenting significant correlations with labour market volatility in table 1; column (3) excludes non-significant variables in column (2).

Source: Authors' calculations based on data from the EU-SILC, 2005–13.

be associated with earnings volatility: unemployment insurance and EPL. As suggested above, our findings corroborate the importance of the possible interaction between these two institutions. The effect of either of the institutions on earnings volatility thus depends on the value of the other variable. Since the estimated coefficients for unemployment insurance and EPL are positive and the estimated coefficient for the interaction term is negative, the impact of either institution will be positive where the values of the other variable are sufficiently low, while it will be negative where the values of the other variable are sufficiently high. In other words, the effect of the two institutions offset each other. In particular, the degree of generosity of unemployment insurance has a negative effect on earnings volatility for levels of EPL that are

higher than 1.275 (recalling that the EPL variable takes values from 0 to 6), which corresponds to the 28th percentile of the EPL distribution in our sample. Stricter EPL also has a negative effect on earnings volatility for unemployment insurance replacement rates higher than 49.6 per cent, which corresponds to the tenth percentile of the sample distribution. Accordingly, both variables correlate negatively with earnings volatility over most of their value ranges. As outlined above, the negative relationship between these two variables and earnings volatility is consistent with the premise that high benefit levels and strict EPL induce job matches of higher quality and longer tenure, which in turn reduces earnings volatility.

It is also worth noting that while earnings volatility increases in line with the unemployment rate for the whole sample, it is not sensitive to changes in the percentage of youth who are not in employment, education or training.

Columns (2) and (3) in table 2 refer to labour market volatility. Column (2) displays the estimates of a specification that includes variables showing statistically significant raw correlations with labour market volatility in table 1, while our preferred model in column (3) keeps only the significant covariates from the previous column and shows that our estimates are stable to the excluded variables and to the slight change in sample size that this exclusion implies. Estimates in column (3) tell a similar story to that of earnings volatility: only unemployment insurance and EPL seem to affect labour market volatility. The interaction between the two institutions is also important. The relationship between the two institutions, on the one hand, and labour market volatility, on the other, is negative over most of their value ranges – the degree of generosity of unemployment insurance has a negative effect on earnings volatility for levels of EPL higher than 1.20, which corresponds to the 29th percentile of the EPL distribution in our sample, while stricter EPL also has a negative effect on earnings volatility for unemployment insurance replacement rates higher than 47.8 per cent, which corresponds to the 14th percentile of the sample distribution. A comparison of Spain and the Netherlands provides a good illustration of how the interaction between EPL and the replacement rate works. Spain displays high earnings and labour market volatility. High unemployment insurance replacement rates (approximately 60 per cent) and strict EPL – which includes high dismissal costs for permanent workers and leads to a dual labour market – are partly responsible for this. The Netherlands, by contrast, presents far lower earnings and labour market volatility. Its unemployment insurance is more generous than the Spanish system (some 10 per cent higher) but employment protection is also much laxer. The negative effect of the interaction between EPL and unemployment insurance implies that increasing the generosity of Spanish unemployment insurance to Dutch levels would decrease volatility, as presumably (unemployed) workers would have the opportunity to search for better job matches. Unlike earnings volatility, labour market volatility decreases as GDP per capita grows.

Conditional on all the other covariates, year effects show a U-shaped pattern, reaching a minimum in 2009. This indicates that the Great Recession

increased the volatility of earnings and labour markets for Europe's youth, offsetting the falling trend observed over the previous years of economic prosperity.[8]

Conclusions

This article studies youth earnings and labour market volatility across 28 European countries over the period 2004–13. Using data from the EU-SILC on young people between the ages of 17 and 29, we compute the standard deviation of the arc percentage change in individual earnings between $t-1$ and t. This indicator measures earnings volatility when only year-to-year changes in positive wages are considered and labour market volatility if we include zero wages, in other words, transitions into and out of employment.

Our findings show large disparities in youth earnings across European countries, and in labour market volatility levels and trends in particular, preventing us from grouping countries into clusters. As might be expected, the Great Recession increased the volatility of earnings and labour markets for Europe's youth, offsetting the falling trend observed during the preceding period of economic prosperity. Volatility is, however, found not to differ across certain characteristics, such as sex, age or education.

We examine the extent to which overall labour market volatility is due to earnings changes and to worker flows into and out of employment through a variance decomposition exercise. This reveals that changes in earnings account for a large share of overall labour market volatility in northern Europe. By contrast, employment flows have a stronger role in southern Europe. This suggests that a one-size policy would not fit all countries. Instead, different policies are required to address the differential nature of labour market volatility across Europe. It should also be noted that this differential nature is consistent with the ways in which different labour markets adjusted to the shocks that came with the Great Recession.

Our analysis of the influence of the most relevant labour market institutions on volatility singles out unemployment insurance and EPL. Our interpretation is that these institutions contribute to reducing volatility by increasing the quality of job matches. Accomplishing good job matches is complex in so far as it is unlikely to be fully achieved by demand- or supply-side policies alone – the fact that volatility does not differ across education levels seems to bear this out. Rather, it calls for a balanced mix of supply- and demand-side policies. If, as we assume, job matches are important, this means that heterogeneity is relevant, and this has implications both for academic research and for policy making.

[8] Other specifications provide the same evidence. For instance, the U-shaped pattern of year dummies is also obtained from: (i) a regression with time dummies only, and no covariates; (ii) a regression with the year variable entered linear and squared; and (iii) a regression where the linear year variable is interacted with a post-recession dummy, taking a value of 1 for the post-recession years.

Our article has several limitations. On the one hand, we were not able to determine how much of the earnings shocks translates into economic risk. This link will necessarily depend on the tax and transfer system in place in each country and on the extent to which young people can rely on intra-household transfers to buffer the impact of earnings changes. For example, Venn (2011) establishes that while disposable household income is buffered from the full impact of individual earnings volatility in most countries, it is particularly resilient in northern Europe and particularly weak in the Mediterranean countries of Europe. Blundell, Pistaferri and Preston (2008) and Cunha, Heckman and Navarro (2005) argue that more information is needed in order to assess whether changes in earnings and income are anticipated or chosen, and whether they are insured against or not. However, given that our article refers to young people in the context of the Great Recession, it is unlikely that such changes were a matter of choice. On the other hand, this article is about changes in the labour market and therefore ignores the situation of young people who are continuously unemployed. This points to a potential area for further research given that this is possibly the group that has most suffered from the Great Recession.

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