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Abstract:
This article explores the main determinants of youth unemployment rates in Europe in the period 2002-2014, by estimating panel data models on a unique dataset for 28 EU member countries. Taking into account heterogeneity among EU countries, models are also estimated on two different subsamples: high and low youth unemployment rate. The results suggest that for better understanding of the determinants of youth unemployment in Europe it is not only relevant to focus on traditional macroeconomic variables, but it is also important to consider different structural and institutional factors. Hence, main empirical results suggest that youth unemployment in the EU is more pronounced in countries with poor GDP growth, low share of construction and high public debt. Low share of temporary employment and high perceived corruption also matter. Less mobility due to homeownership, high remittances from abroad, low work intensity of other household members or less possibilities for young people to live outside parental homes are also meaningful, at least for EU countries with comparatively high youth unemployment rates. These results could be of high importance, especially when determining and evaluating different measures taken in order to mitigate (high) youth unemployment rates in Europe.

Key words: labour market, youth unemployment, panel data models, recession, Europe
JEL Classification: J21, J64, C23

Što pokreće nezaposlenost mladih u Europi?

Sažetak:
Ovaj članak istražuje glavne odrednice stopa nezaposlenosti mladih u Europi u razdoblju 2002.-2014., ocjenom panel modela na jedinstvenom skupu podataka za 28 članica EU-a. Uzimajući u obzir heterogenost zemalja EU-a, modeli su dodatno procijenjeni na dva poduzorka: uzorku visokih i uzorku niskih stopa nezaposlenosti mladih. Rezultati upućuju na to da za bolje razumijevanje odrednica nezaposlenosti mladih u Europi nije dovoljno razmatrati samo tradicionalne makroekonomske varijable, već je važno u obzir uzeti i različite strukturne i institucionalne čimbenike. U tom kontekstu, glavni empirijski rezultati pokazuju da je nezaposlenost mladih u EU-u izraženija u zemljama sa slabim rastom BDP-a, niskim udjelom građevine i visokim javnim dugom u gospodarstvu. Nizak udio privremenog zapošljavanja i visoka razina korupcije također su važni u objašnjavanju visoke stope nezaposlenosti mladih. Manja mobilnost zbog vlasništva nad nekretninama za stanovanje, visoki udio doznaka iz inozemstva, nizak intenzitet rada ostalih članova kućanstva ili manje mogućnosti za život izvan roditeljskog doma također su važni, barem za zemlje EU-a s relativno visokim stopama nezaposlenosti mladih. Ovi rezultati mogli bi biti vrlo važni, posebice prilikom dizajniranja i evaluacije različitih mjera za ublažavanje (visokih) stopa nezaposlenosti mladih u Europi.

Ključne riječi: tržište rada, nezaposlenost mladih, panel modeli, recesija, Europa
JEL klasifikacija: J21, J64, C23

Introduction[1]

The financial crisis that erupted in 2007/2008, followed by a Great Recession in 2008/2009, hit some European countries more than others. Countries such as Greece, Croatia or Spain experienced the strongest and the longest setback whereas countries such as Germany recovered very quickly. The consequences of the recession are strongly demonstrated on the labour markets of European countries. Regardless of the overall unfavourable economic conditions, some groups of the population have been hit by the recession much more than the others. Among them, young people are particularly affected, which is evidenced in high rates and long-term unemployment ever since the beginning of the crisis in many European countries.

More than 5 million young people under 25 were unemployed in the EU-28 in 2014, which represents almost 10 percent of the entire population of that age and more than 20 percent of the entire EU-28 unemployed population. Although youth unemployment rate is generally higher than the overall unemployment rate, even in periods of economic growth, after the outbreak of the crisis, youth unemployment rate has been growing more rapidly than the overall rate. On average, the unemployment rate for the population aged 15-24 increased by 6.6 percentage points between 2008 and 2014 (from 15.6 to 22.2 percent) in the EU as a whole, whereas the "adult" (25-64) unemployment rate increased by merely 3.1 percentage points, amounting to 9.1 percent in 2014.[2] The differences between countries are striking. In countries such as Croatia, Cyprus, Greece, Italy and Spain the youth unemployment rate increased by more than 20 percentage points in the same period, reaching over 50 percent in Greece and Spain in 2014. In Germany, on the other hand, youth unemployment rate actually decreased in the observed period, by 2.7 percentage points, amounting to 7.7 percent in 2014.

Risk of unemployment for youths is typically higher than for adults for several different reasons. These include the lack of work experience, relatively short or incomplete education, greater instability of the contractual relationship, and fewer contacts for job search. There is also a problem of difficult transition from education to the world of work due to skills mismatch. All this can cause long-lasting negative effects for the youth population, or indirect costs for the unemployed individuals, in the form of the so-called "scarring effect" (Scarpetta et al., 2010; Bell and Blanchflower, 2011; Eichhorst et al., 2013a). Namely, even when they get employed youths are usually "trapped" at the bottom of the labour market; they have less on-the-job training; lower wage levels; weaker prospects for long-standing employment and career advancement, which reduces their lifetime earnings; higher risk of income poverty and deterioration of their human and social capital; risk of long-term unemployment; high risk of social exclusion and even risk of engaging in criminal activities (O'Higgins, 2015). Nevertheless, not only does high youth unemployment cause costs for individuals but it can also bring costs for the society as a whole (Eichhorst et al., 2013a; O'Higgins, 2015). These come in the form of reduced efficiency of

[1] This paper received the 2015 *Olga Radzyner Award* from the Austrian Central Bank (OeNB).
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The paper reflects the views only of the author and none of the institutions or persons cited above cannot be held responsible for any use which may be made of the information contained therein.
[2] Based on official Eurostat data.

investment in education and training, shrinking taxation base, higher welfare costs, but also in the form of possible protests or social unrests and the so-called "brain drain" or emigration of highly skilled young people which reduces future potential economic growth in a specific country. Therefore, it is no surprise that youth unemployment is highlighted as one of the most pressing problems of the European society nowadays.

The problem of youth unemployment can be tackled at different levels and in different ways. However, before establishing which programs and measures have the best outcome, deeper analysis of the problem should be conducted. The existing literature covers the issues of youth unemployment in Europe rather well (Chung et al., 2012; ILO, 2012a; Eichhorst et al., 2013a; Eurofound, 2014). Still, most of the (empirical) literature is focused on the impact of the recent recession on the youth unemployment (Bell and Blanchflower, 2011; O'Higgins, 2012; Banerji et al., 2014), often neglecting the fact that some countries are struggling with this phenomenon for a longer period of time. Therefore, this article tries to fill in this gap by examining the main determinants of youth unemployment in European countries in a longer perspective, including the Great Recession. The analysis uses data for 28 EU countries in the period 2002-2014, and by panel data models explores what are the main features that cause high youth unemployment rates, as well as their persistence, in many EU countries. Since cross-country comparisons in previous studies (Brada and Signorelli, 2012; Boeri and Jimeno, 2015) show that there are considerable differences between countries within the EU, we take this into account by estimating models on two different subsamples: *high youth unemployment rate* countries and *low youth unemployment rate* countries. Additionally, besides the generally accepted (macro) indicators that have proved to be important in explaining high (youth) unemployment rates, we assess whether larger set of data, including different institutional and structural factors, could bring some new insights into the subject of youth unemployment in Europe. Variables such as corruption perception or family work history legacies could provide additional information when trying to solve the problem of youth unemployment in a specific country or group of countries. The share of home ownership or living in a parental home for a longer period further suggest that cultural differences between countries within the EU could also have an impact on the level of youth unemployment.

Thus, the contribution of this paper is threefold. First, the paper examines longer-term determinants of youth unemployment among EU member states, including the recent crisis, in order to explore the extent of the persistence of the problem in some of the countries. Second, the paper acknowledges heterogeneity between countries, and especially their labour markets, by estimating the models separately for countries that have experienced long periods of high youth unemployment and countries that had much less to worry regarding this issue in the last 13 years. Third contribution comes from the acknowledgement that specific, non-economic, characteristics could help to explain high youth unemployment rates in some of the EU countries. Hence, the results of the paper are of policy relevance as well. Taking into account different economic and non-economic characteristics of each country and acknowledging that they behave in a different manner, together with the recognition that this issue is not only crisis-related, should help design the policy measures to combat this problem on both EU and national level.

The structure of the article is as follows. After introduction, the second section briefly reviews relevant studies, covering main issues regarding youth unemployment in Europe, especially

after the start of the recent recession. The next section describes the sample of the data used as well as the variables used in the empirical analysis, building up on the findings from the literature. After that, the fourth section gives a short discussion of the main empirical strategy, i.e., panel data model estimation. Fifth section presents the results of the econometric estimation, including the robustness tests that assess the model on different dependent variables. It also includes a more detailed discussion of the obtained results, putting them in the context of the existing literature but also providing some new insights on this matter. Finally, concluding section provides a summary of the main results and points to areas where the obtained results could be of great value.

Literature review

The problem of youth unemployment has been on the agenda in the labour economics literature for a long time (for instance, Freeman and Wise, 1982 or O'Higgins, 2001). However, after the start of the recent recession there have been many studies investigating the size and the scope of high youth unemployment in different EU countries (Chung et al., 2012; ILO, 2012a; Eichhorst et al., 2013a; Caporale and Gil-Alana, 2014; Eurofound, 2014; Dolado, 2015), the impact of the recession on youth unemployment movements (OECD, 2010; O'Higgins, 2010, 2012; Bell and Blanchflower, 2011; Bruno et al., 2014; Chung et al., 2012; Banerji et al., 2014; van Ours, 2015), the impact of ALMPs and other measures to mitigate this phenomenon (Scarpetta et al., 2010; Biavaschi et al., 2012; Chung et al., 2012, Eichhorst et al., 2013a; Banerji et al., 2014; Caliendo and Schmidl, 2015), or studies that try to establish some patterns which could explain why this problem exists in the first place (Choudhry et al., 2012).

For example, Choudhry et al. (2012) evaluate the impact of financial crises on youth unemployment rate in the period 1980-2005 and conclude that financial crises have an impact on youth unemployment rates that goes beyond the impact resulting from GDP changes, as well as that the effect on the youth unemployment rate is greater than the effect on overall unemployment. Caporale and Gil-Alana (2014) further show that youth unemployment is highly persistent in all of the 15 European countries studied in the period from 1980 to 2005, with GDP and inflation coming out as the most important factors in explaining it. Eichhorst et al. (2013b) show that youth unemployment rates have increased twice as strongly as the rates of older workers between 2008 and 2011, especially in countries where unemployment for older workers also increased strongly, countries with large construction sectors, and countries that have implemented two-tier reforms of employment protection.

When trying to define factors behind high youth unemployment in European countries the literature suggests different theories and empirical evidence. Brada et al. (2014), for instance, review key theories and some new empirical evidence on youth unemployment and state that there are three groups of determinants behind it: (i) cyclical conditions, (ii) demographic, individual, social and structural conditions, and (iii) policies and institutions. They emphasize how youth unemployment is more sensitive to cyclical movements than the adult one, mostly because of the lower qualifications, less experience and weaker work contracts among young workers. Out of the second group, they point to migration flows, preference of workers, including longer stay or return to education during recession, ties with parents, barriers to regional mobility, and structure of the economy (industry vs. services) as the most important

determinants of youth unemployment. Besides labour taxes, unemployment benefits, education system, employment protection legislation and active labour market policies, they stress out the importance of the minimum wages and the extent of temporary contracts among the third group of youth unemployment determinants.

O'Reilly et al. (2015) go even further and name five main categories, characteristic for the current period and different from those in earlier periods of high youth unemployment in Europe: (i) universality of labour market flexibility, preventing young people to secure stable employment trails; (ii) skills mismatch, i.e., immense expansion of education in Europe that has not been aligned to the changing structure of the demand for skills by employers; (iii) youth migration within the EU that has been "more extensive, selective, and diversified than in previous recessions"; (iv) family work history legacies which bring new forms of polarization for younger generations; and (v) increased EU policy initiatives and investments that depend on the ability of national actors to implement them effectively.

Biavaschi et al. (2012), while explaining differences in youths' transition into employment, emphasize the importance of demographic factors and economic growth, but also long-standing institutional arrangements, especially the degree of flexibilization on the labour market and education and training policies. Bertola et al. (2013) also stress the importance of the institutional characteristics, explaining how they significantly affect the level and the cyclical sensitivity of youth unemployment, with a relatively greater impact on rigid labour markets. O'Higgins (2012), on the other hand, argues that labour market flexibility contributed significantly to the loss of employment for youths on the labour market during recent recession. Bell and Blanchflower (2011) emphasize the lack of demand as the primary cause behind the recent rise in unemployment. Also, they show that polarization of the labour market, by changing the structure of labour demand, may negatively affect young people's labour market prospects.

Aside from determining main causes of high youth unemployment in Europe a large strand of the literature proposes different policy measures to deal with this issue or to evaluate measures already in place (Scarpetta et al., 2010; Bertola et al, 2013; Eichhorst et al. 2013a; Brada et al., 2014). Namely, the European Union pays a lot of attention to youth unemployment (and inactivity) by initiating different sets of programs and measures. These include, for example, *Youth on the Move* initiative, the *Youth Guarantee* or the *Youth Employment Initiative* (EC, 2013). Although these policy initiatives are of a newer date, they mainly arise from different sets of ALMP measures that were in place years before the recent crisis. However, their success was highly questioned in many studies (for example, Kluve, 2006; Card et al. 2015; Caliendo and Schmidl, 2015). Also, these programs cost, while their final impact is not entirely known. For example, ILO (2012b), in its publication on Eurozone job crisis, reports that the total estimated cost of establishing *Youth Guarantee* schemes in the Eurozone is €21bn per year, or 0.22 percent of GDP.[3] Eurofound (2012), on the other hand, estimates that young people not in employment, education or training (NEET) cost the EU €153bn or 1.21 percent of GDP per year – in benefits and foregone earnings and taxes.

[3] Eichhorst et al. (2013a) and Bergin et al. (2015) are some of the studies that question the effectiveness of the *Youth Guarantee*.

Thus, programmes and measures initiated to combat problems of youth unemployment at both EU and national levels have not proved to be entirely efficient. It might be that this is because the measures and programmes are not well targeted, i.e., they do not "attack" the root of the problem. As evident in this section, the literature suggests that different kind of factors could be held responsible for the level of youth unemployment in Europe, as well as its immense growth in the recent recession. Depending on the period and set of countries observed, different determinants of (high) youth unemployment appear. Hence, this paper tries to fill in the gap in the literature by combining different sets of possible determinants of youth unemployment stemming from the existing literature into one model. Besides the commonly accepted determinants of youth unemployment in European countries, this paper also empirically tests youth unemployment rate in EU member states on additional variables that could have been responsible for high youth unemployment rates in many European countries, but are not usually examined in the literature. These include, for instance, perceived corruption, homeownership, high remittances, or work intensity of other household members. Thus, not only (macro)economic factors are examined as those responsible for high youth unemployment rates in Europe, but institutional and even cultural variables are also investigated. Moreover, we do not focus only on the impact of recent crisis on the movements on youth unemployment in Europe, but also take into account a period before and after the Great Recession.

Sample selection and data description

Sample selection

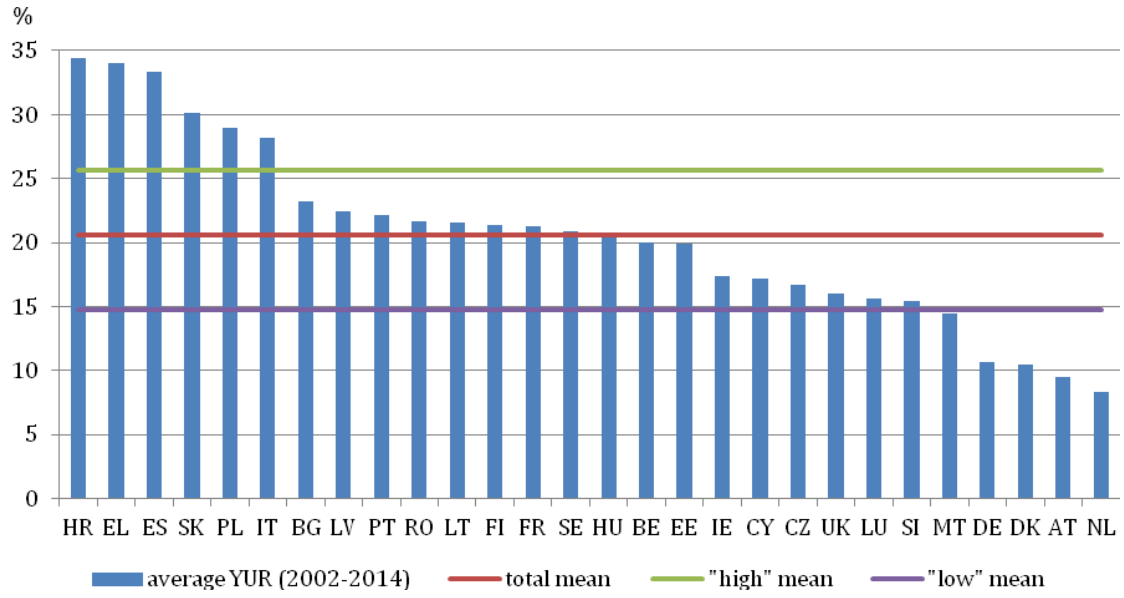
Our sample consists of EU-28 member countries in the period of 13 years, i.e., from 2002 to 2014. The main reason for this is the rather abundant data availability for these countries, which cannot be said for most of the other European countries, especially EU candidate and other countries belonging to the south-eastern part of Europe. This specific time-period is chosen for the same reason; during this period most of the data used in the empirical estimation were available in case of the majority of EU member countries. Besides, the goal of the paper is not the evaluation of the situation only after the start of the crisis, but the search for factors that influence (high) youth unemployment rates for a longer period of time.

Still, it is hard to expect the "one-size-fits-all" situation, or that all of these countries behave in the same way regarding their youth unemployment. Although the youth unemployment rate recently rose in almost all European countries, the situation is still quite heterogeneous (Figure 1). In order to test the hypothesis that different (groups) EU countries behave in a different way regarding their youth unemployment rates, we further divided our entire sample into two subsamples: (i) *high youth unemployment rate countries* and (ii) *low youth unemployment rate countries*. The criteria for this were the average youth unemployment rates during a longer period (2002-2014) which should indicate whether these countries have been struggling with this issue for a longer time or whether this is just a short-term consequence of the recent recession.[4] The first, or *high youth unemployment rate*, group consists of 15 countries: Croatia,

[4] The mean youth unemployment rate for the age group 15-24 in EU-28 in the analysed period (2002-2014) is 20.6 percent (Figure 1 and Table 1). Calculating the average youth unemployment rates in the observed period for each country separately, the sample of the so-called *high youth unemployment rate countries* is obtained, with mean youth unemployment rate of 25.6 percent. The sample of the so-called *low youth unemployment rate countries* has the mean youth unemployment rate of 14.7 percent; below the mean for the entire sample (Figure 1).

Greece, Spain, Slovakia, Poland, Italy, Bulgaria, Latvia, Portugal, Romania, Lithuania, Finland, France, Sweden, and Hungary, while the second, or *low youth unemployment rate*, group consist of 13 countries: Belgium, Estonia, Ireland, Cyprus, Czech Republic, United Kingdom, Luxembourg, Slovenia, Malta, Germany, Denmark, Austria and Netherlands. Evidently, in both groups there is a mix of the "old" and the "new" member states, Eurozone and non-Eurozone member states, Mediterranean and non-Mediterranean countries, etc. The main thing that connects countries within a group is their average youth unemployment rate in the period 2002-2014.

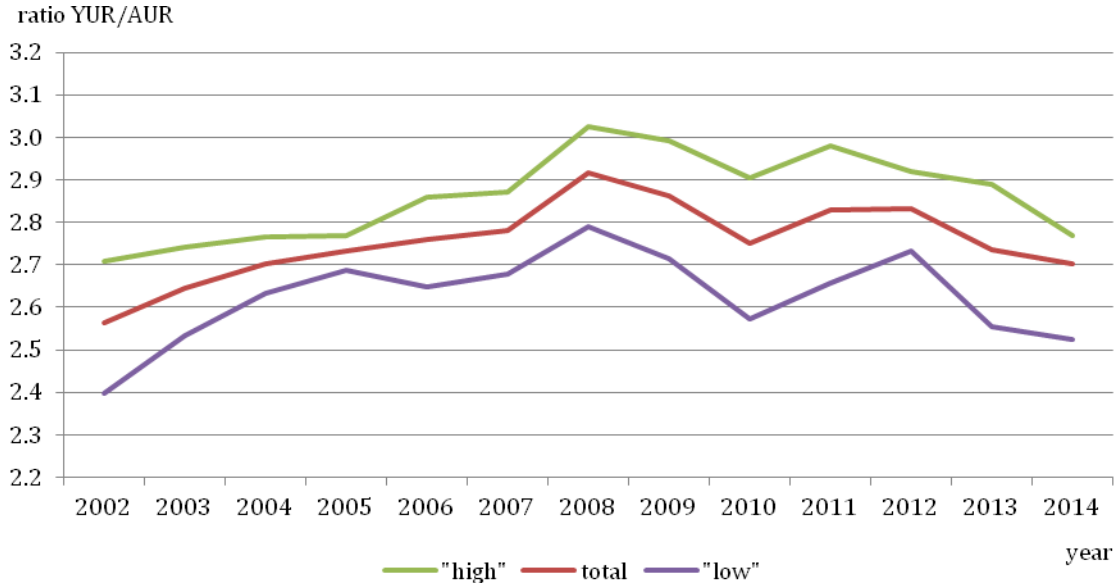
Figure 1 *Average youth (15-24) unemployment rates in the EU (2002-2014)*



Source: Author's calculations based on Eurostat data.

Additionally, not only are these two groups of countries differentiated by their average youth unemployment rate in the period 2002-2014, but also by other aspects of their labour markets. For instance, they also differ by the ratio of youth (15-24) and adult (25-64) unemployment rate, as well as the dynamics of this ratio in the observed period (Figure 2). The average ratio in *high youth unemployment rate countries* was 2.9 in the observed period, with a peak of 3.0 in 2008. In *low youth unemployment rate countries*, on the other hand, the average ratio amounted to 2.6, with a peak of 2.8, again in 2008. These differences might not seem pronounced, but the test of statistical differences between mean values of the ratio in each group (t-test) shows that difference of this ratio between two groups of countries is significant at one percent level, the same as the difference between youth unemployment rates. The movement of the ratio seems rather similar to the one for the overall EU-28 sample, indicating its fall back towards its 2002-level in 2014 for both "high" and "low" subsample. However, these levels indicate that youth unemployment rate is, on average, still more than 2.5 times higher than the adult unemployment rate, while in the crisis (2008) this was closer to 3 times, especially in *high youth unemployment rate countries*.

Figure 2 *Average ratio of youth (15-24) and adult (25-64) unemployment rates in the EU*



Notes: YUR – youth (15-24) unemployment rate; AUR – adult (25-64) unemployment rate.
Source: Author's calculations based on Eurostat data.

Data description

As already mentioned, our dataset includes annual observations stretching from 2002 to 2014. The main dependent variable is youth unemployment rate for the age group 15-24,[5] while the adult (25-64) unemployment rate and youth NEET rate on the same set of independent variables are also estimated. As for the independent variables, variables that were selected from the literature as those that affect unemployment, and especially youth unemployment rates, are used, but with the addition of some supplementary variables in order to test more specific characteristics of the countries in question that might lie behind high youth unemployment rates.

First, overall economic situation in the country is proxied by real GDP growth rate. Naturally, it is expected that positive (and high) GDP growth rates lead to a decrease of unemployment rates, as well as youth NEET rate. However, the effect on youth unemployment rate should be stronger than the one on the adult rate given that youth unemployment is strongly procyclical (Eichhorst et al. 2013b; Banerji et al., 2014; Brada et al. 2014; Bruno et al., 2014; Hutengs and Stadtmann, 2014). Also, this effect is expected to be stronger in countries with higher average youth unemployment rates. In a way, this variable captures the effect of the recession, as well as labour demand. Moreover, one should control for the structure of the economy, which is done by using the following variables: share of exports in GDP, share of agriculture in GVA, share of industry in GVA, and share of construction in GVA. Brada et al. (2014) emphasise that the structure of the economy (industry vs. services) is very important in explaining youth unemployment. It has already been mentioned (Eichhorst et al., 2013b) that youth unemployment rate is shown to be higher, at least in the recent period, in countries with higher share of the construction sector. Banerji et al. (2014) even explain how youth employment is usually concentrated in cyclically

[5] The most commonly accepted definition of youth unemployment (see Eurostat).

sensitive sectors of the economy, such as construction, which could additionally explain why youth unemployment is almost three times more sensitive to growth than adult unemployment. Similar applies for industrial sector. Higher share of exports should work in the opposite direction, whereas high share of agriculture should indicate the backwardness of the country and probably higher youth unemployment rates.[6]

We are using the share of public debt in GDP as a control variable for the state of public finances, namely the proxy for the capability of the government to fight (high) unemployment. As stated by O'Reilly et al. (2015), increased EU policy initiatives and investments are highly dependent on the ability of national actors to implement them effectively, which is also under the influence of the total burden the government has. Additionally, labour costs are proxied by tax rate which should have a negative impact on youth unemployment. It is generally perceived that labour taxes should impede the growth of employment (Tomić and Grdović Gnip, 2011); however, this could be even more present in the case of youths. Given that young workers are relatively unskilled, even when highly educated, if the cost of their hiring is deemed to be too high, the employers will be reluctant to employ them. This is especially true in those countries that have rather high tax rates at relatively low level of wages.[7] Skills structure of the labour should affect unemployment as well, so we also control for the share of highly educated population within the entire labour force (15-64).

As for the institutional obstacles, the rigidity of the labour legislation is most frequently used in the literature when explaining high unemployment in Europe (Siebert, 1997; Layard and Nickell, 1999; Boeri et al., 2012; Bertola et al. 2013; Biavaschi et al., 2012). As the most commonly used proxy for the rigidity of labour legislation – employment protection legislation index (EPL) - is not available for all EU countries and since it alters only with legislation changes, in order to control for the "flexibility" of the labour market in each country we used the share of temporary employment contracts among the total employment (15-64). It is assumed that larger share of temporary contracts among the employed population indicates more flexible labour market and thus easier employment of younger people. However, this indicator could also suggest that the country has had two-tier labour market reforms and that it functions as a dual labour market which should work against the decrease of both the youth and adult unemployment rate.[8] Furthermore, non-labour income is generally used as an obstacle to higher employment, especially for youths (Banerji et al., 2014). Usually, unemployment benefits are considered as the culprit for longer spells and higher rates of unemployment. However, young people are typically not entitled to unemployment benefits (Scarpetta et al., 2010; Chung et al., 2012) so in

[6] However, this does not have to hold, as in some countries with high share of agricultural activities in the economy, such as Albania or Romania; the official unemployment rates are not very high. However, there is probably high share of underemployment in these countries.

[7] Although minimum wage is often considered to have a highly negative effect on youth unemployment (Banerji et al., 2014; Brada et al., 2014), we do not use the minimum wage (as a proportion of the average wage) in our model estimations due to the fact that some countries (such as Austria, Cyprus, Denmark, Germany, Finland, Italy, or Sweden) do not have the institution of the minimum wage at all or during most of the observed period and thus would be left out of the analysis. Correlation coefficients between the share of the minimum wage in the average wage (for those EU countries that do have minimum wage) and youth unemployment, adult unemployment and NEET rate for the entire sample are: -0.25, -0.26, and -0.28, respectively. The same correlation coefficients for the "high" sample are: -0.17, -0.15, and -0.21, and for the "low" sample: -0.16, -0.22, and -0.19.

[8] O'Higgins (2012), for example, argues that youths have been particularly strongly hit during the recent recession and that temporary contracts have become the dominant contract type for newly established contracts of young people, with the problem of segmented labour markets being particularly severe in Mediterranean countries.

this case we use personal remittances (as % of GDP) as an indicator that should serve as a proxy for non-labour income.[9] Finally, in order to control for demographic trends, we use the median age of the population. Both the level and the rate of youth unemployment should depend on the overall age structure of the population (Biavaschi et al., 2012). Obviously, some European countries are facing demographic ageing, whereas others have higher share of younger population. Median age of the population is expected to negatively influence youth unemployment. In countries with higher median age of the population there is a lower number of young people and thus their unemployment rate could be higher. In case of the adult unemployment rate, median age of the population should have the opposite effect.

Besides these, generally accepted factors behind high youth unemployment rates, additional variables that could be responsible for high youth unemployment rates in many European countries, but are not usually examined in the literature are used in this paper. First, institutional variables, i.e., Corruption Perception Index (CPI); Economic Freedom Index for regulation and two dummy variables indicating policy change: a change within the retirement legislation that limited/decreased eligibility for early retirement, i.e., should have prolonged the working life, and a change within the employment protection legislation that increased the EPL index are included. Apart from those, we also include additional variables that should further control for specific characteristics of each country, particularly related to youth unemployment. These include: share of young people (15-24) living in households with very low work intensity; share of home ownership within a population and the share of young people (20-29) still living with their parents.

The effect of corruption on unemployment is not that straightforward, but the effects of corruption on other economic indicators are examined rather well in the literature (for example, in Tanzi, 1998; Lambsdorff, 2006; Swaleheen, 2007; or Budak and Vizek, 2015). It is thus expected that the corruption has a negative effect on employment, i.e., that the estimated coefficient associated to perceived corruption will have a negative sign, suggesting that the smaller the CPI score (the larger the perceived corruption), the higher the unemployment rate. Also, there are some indications (Arandarenko and Nojkovic, 2010) that youth unemployment rate is higher in countries with higher share of the public sector. We could not test for that in the paper due to data unavailability for all the countries, but the size of the corruption, even as a subjective measure, could control for this effect as well. As mentioned previously, it is difficult to evaluate institutional or policy deficits since they are not something that changes on a regular (yearly) level. In this instance, we use the data from the Fraser Institute on the sub-index for regulation of the so-called Economic Freedom Index. It is expected that (youth) unemployment will be higher in countries with more regulatory obstacles on credit and labour markets, as well as business practices.[10] More regulation in general means more costs for the business and, thus, fewer incentives to hire new (young) people. Additional policy variables are obtained from the LABREF database[11] on some of the reforms conducted in EU-member states, namely, an indication of the decreased eligibility for early retirement and a change in labour legislation that should have increased the rigidity of the labour market. It is expected that both of these variables increase youth unemployment rate. The effect of the dummy variable indicating

[9] Additionally, this variable controls for migration effects.
[10] Besides labour market and overall business regulations, credit constraints are also mentioned in the literature as one of the culprits for high youth unemployment (for instance, Kolev & Saget, 2005).
[11] More on the LABREF database see in Turrini et al. (2015).

increasing rigidity on the labour market is already motivated, however; the effect of the dummy variable showing decreased eligibility for early retirement is somewhat puzzling. It is assumed that since older workers are required to stay on the labour market for a longer time, there will be no replacement demand, i.e., no new workplaces for the younger generation. All these variables represent institutional characteristics of a specific country. Although often cited as the main obstacles in increasing employment, they are rarely tested in empirical analyses, mostly due to measurement issues. That is why we try to overcome this gap by adding these specific institutional variables in our estimation of youth unemployment determinants in EU member states.

Finally, young people whose parents or other household members are unemployed (for various reasons) will generally find it much harder to get employment or even be willing to search for one. The negative impact of home ownership on the level (and rate) of unemployment is a hypothesis present in the literature for a long time (Oswald, 1996, 1999; Blanchflower and Oswald, 2013), although the empirical results are mixed. In general, higher home ownership should increase the level of unemployment, and not only for the reason of sustained mobility of workers. Namely, it is argued that high share of home ownership leads to the lack of rental housing sector which means that the unemployed cannot easily move into the regions/cities where there are jobs, which especially affects young people (Oswald, 1996, 1999). Using the share of young people (20-29) still living with their parents as a control variable could be questionable from the standpoint of simultaneity effect. However, we argue that, when explaining "mentality" or cultural differences between European countries, this variable is just as important as the home ownership variable. Hence the expectation is that it should have a stronger effect in countries with higher average youth unemployment rate.

Most of the data used in this paper are provided by Eurostat (Table 1). Exceptions are personal remittances for which the source is the World Bank database – World Development Indicators; dummy policy variables are obtained from the LABREF database provided by the European Commission; the CPI score from the Transparency International; and Economic Freedom Index for regulation is obtained from the Fraser Institute. Table 1 shows details of all the data we have used, for the total sample, as well as for the two subsamples based on the height of their average youth unemployment rate. Due to some missing values, the panel of all samples is unbalanced.

At first sight, one can observe higher average real GDP growth rates in countries that exhibit higher average youth unemployment rates (Table 1). However, these countries also have much lower share of exports of goods and services in their GDP and higher shares of non-service activities (agriculture, industry and construction[12]) in gross value added. On average, tax rate is lower in countries with higher youth unemployment rates, whereas the share of those skilled among the labour force is expectedly lower. On the other hand, the share of temporary employment contracts and received personal remittances is significantly higher in countries with higher average youth unemployment rate. Median age of the population is only slightly higher in these countries as well.
Comparing the *high youth unemployment rate countries* with *low youth unemployment rate countries* one can see that *high youth unemployment rate* countries have, on average, higher share of young people living in households with very low work intensity; higher share of home

[12] Although one could argue that the construction sector is not entirely non-service activity, it is most-commonly perceived as a wider part of the industrial sector, i.e., strictly separated from the service sector (see Eurostat).

ownership within a population; and higher share of young people (20-29) still living with their parents. Also, they have lower value for CPI score, i.e., higher perception of corruption; lower Economic Freedom Index for regulation, i.e., more regulation within credit and labour markets, as well as within business practices; and more reforms within both the retirement legislation and the employment protection legislation. The use of these variables is an additional reason for dividing the entire sample into two subsamples since it is expected that some of the variables are irrelevant for the amount of youth unemployment in some countries but could be of high importance in other countries.[13] Unfortunately, not all of the data were available for all the countries in all observed years, and thus, the estimated sample becomes smaller when adding these supplementary variables into estimation.

[13] Naturally, there are other variables that affect the youth unemployment, but the data availability for use in a comparative manner precludes us from using more extensive dataset.

Table 1 *Summary statistics and data sources*

Variable	Total			High YUR			Low YUR			Description	Source
	Obs.	Mean	St. Dv.	Obs.	Mean	St. Dv.	Obs.	Mean	St. Dv.		
youth unemployment rate (15-24) (%)	364	20.57	(9.62)	195	25.62	(9.23)	169	14.75	(6.18)	Young people (15-24) not employed but actively searching for a job (unemployed) as % of total active (employed + unemployed) population in that age group.	*Eurostat*
adult unemployment rate (25-64) (%)	364	7.72	(3.95)	195	9.40	(4.21)	169	5.79	(2.50)	Adults (25-64) not employed but actively searching for a job (unemployed) as % of total active (employed + unemployed) population in that age group.	*Eurostat*
ratio of youth and adult unemployment rate	364	2.76	(0.69)	195	2.87	(0.65)	169	2.63	(0.71)	Ratio of youth (15-24) and adult (25-64) unemployment rate.	*Author's calculation based on Eurostat data*
NEET rate (15-24) (%)	364	11.88	(4.66)	195	13.94	(4.38)	169	9.51	(3.77)	Young people (15-24) neither in employment nor in education and training as % of total population in that age group.	*Eurostat*
real GDP growth rate (%)	364	1.95	(3.74)	195	2.07	(4.11)	169	1.81	(3.27)	To measure the growth rate of GDP in terms of volumes, GDP at current prices is valued in the prices of the previous year and thus computed volume changes are imposed on the level of a reference year.	*Eurostat*
share of exports in GDP (%)	362	57.66	(34.10)	193	43.00	(18.29)	169	74.39	(39.85)	Exports of goods and services as % of GDP.	*Eurostat*
share of agriculture in GVA (%)	364	2.81	(1.94)	195	3.80	(2.05)	169	1.67	(0.89)	Share of agriculture gross value added in total gross value added (%).	*Eurostat*
share of industry in GVA (%)	364	20.70	(5.66)	195	21.39	(4.74)	169	19.89	(6.48)	Share of industry (except construction) gross value added in total gross value added (%).	*Eurostat*
share of construction in GVA (%)	364	6.48	(1.81)	195	6.81	(1.82)	169	6.10	(1.72)	Share of construction gross value added in total gross value added (%).	*Eurostat*
share of public debt in GDP (%)	364	55.30	(32.04)	195	57.36	(34.52)	169	52.92	(28.83)	Share of general government debt in GDP (%).	*Eurostat*
tax rate (%)	357	27.53	(7.20)	195	26.38	(4.67)	162	28.92	(9.21)	Income tax on gross wage earnings plus the employee's social security contributions less universal cash benefits, expressed as a % of gross wage earnings.	*Eurostat*
skilled labour force (15-64) (%)	364	26.42	(8.13)	195	24.34	(7.47)	169	28.81	(8.23)	Share of active population (15-64) with tertiary education (ISCED levels 5-8) in total active population (15-64).	*Eurostat*
temporary employment (15-64) (%)	364	11.22	(6.70)	195	12.67	(7.84)	169	9.54	(4.57)	Temporary employees as % of the total number of employees (15-64).	*Eurostat*

Variable	Total			High YUR			Low YUR			Description	Source
	Obs.	Mean	St. Dv.	Obs.	Mean	St. Dv.	Obs.	Mean	St. Dv.		
personal remittances (% of GDP)	353	1.26	(1.26)	187	1.57	(1.44)	166	0.92	(0.90)	Personal remittances comprise personal transfers and compensation of employees made or received by resident households to or from non-resident household. Data are the sum of two items.	*WB, World Development Indicators*
median age	364	39.62	(2.29)	195	39.94	(2.06)	169	39.25	(2.50)	Median age of the population.	*Eurostat*
CPI score	361	6.30	(1.85)	195	5.48	(1.82)	166	7.27	(1.34)	Corruption perception index (CPI) by Transparency International. The CPI currently ranks countries "on a scale from 10(100) (very clean) to 0 (highly corrupt). Scores for the period 2012-2014 were adjusted to fit the scale from 1 to 10.	*Transparency International*
economic freedom index - regulation	336	7.22	(0.58)	180	7.09	(0.53)	156	7.37	(0.60)	Economic freedom index covering regulation. Other areas include: Size of Government; Legal System & Property Rights; Sound Money and Freedom to trade internationally. Regulation sub-index includes: Credit market regulations; Labour market regulations and Business regulations (Gwartney et al., 2015).	*Fraser Institute*
early retirement decrease	364	0.29	(0.45)	195	0.32	(0.47)	169	0.25	(0.43)	Dummy variable indicating change within the retirement legislation that limited/decreased eligibility for early retirement, i.e., should have prolonged the working life. Valued at the time (year) of implementation.	*LABREF database, DG EMPL, European Commission*
EPL increase	364	0.10	(0.31)	195	0.14	(0.35)	169	0.06	(0.24)	Dummy variable indicating change within the employment protection legislation that increased the EPL index. Valued at the time (year) of implementation.	*LABREF database, DG EMPL, European Commission*
low work intensity HH (15-24) (%)	257	8.22	(3.72)	134	8.25	(3.01)	123	8.18	(4.38)	Young people (15-24) living in households with very low work intensity.	*Eurostat*
home ownership (%)	265	76.14	(9.83)	140	79.94	(9.55)	125	71.88	(8.28)	% of home ownership within a population.	*Eurostat*
living with parents (20-29) (%)	257	55.91	(18.96)	134	59.04	(20.10)	123	52.49	(17.05)	Share of young people (20-29) living with their parents as % of total population in that age group.	*Eurostat*
	EU-28: BE, BG, CZ, DK, DE, EE, IE, EL, ES, FR, HR, IT, CY, LV, LT, LU, HU, MT, NL, AT, PL, PT, RO, SI, SK, FI, SE, UK			**EU-15**: HR, EL, ES, SK, PL, IT, BG, LV, PT, RO, LT, FI, FR, SE, HU			**EU-13**: BE, EE, IE, CY, CZ, UK, LU, SI, MT, DE, DK, AT, NL				

Notes: YUR – youth (15-24) unemployment rate.

Empirical strategy

Empirical strategy in this paper is based on rather simple panel data model estimation:

$$YUR_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \quad (1)$$

where YUR_{it} is the youth (15-24) unemployment rate of country i in year t, and X_{it} is a set of control variables described in the previous section: real GDP growth rate, share of exports in GDP, share of agriculture, industry and construction in GVA, share of public debt in GDP, tax rate, share of skilled among the total labour force (15-64), share of temporary employment (15-64), personal remittances received as percentage of GDP and median age of the population in the basic model specification, with additional variables in the supplementary model specification: Corruption Perception Index (CPI) score, Economic Freedom Index for regulation, dummy variables indicating policy change within the retirement legislation that limited eligibility for early retirement and policy change within the employment protection legislation that increased the EPL index, the share of young people (15-24) living in households with very low work intensity, the share of home ownership within a population, and the share of young people (20-29) still living with their parents.[14]

However, in order to disentangle factors that may affect only the youth unemployment, we separately estimate the model for the adult (25-64) unemployment rate:

$$AUR_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \quad (2)$$

where AUR_{it} is the adult (25-64) unemployment rate of country i in year t, and X_{it} is the same set of control variables as in the original model (1), apart from those variables that are presumed to be strictly connected with youth labour market, i.e., the share of young people (15-24) living in households with very low work intensity, the share of home ownership within a population, and the share of young people (20-29) still living with their parents.[15]

Also, in order to test whether the model works for different specifications of youth unemployment, we use the NEET (not in employment, education, and training) rate for the age group 15-24 as a dependent variable in additional robustness check:

$$NEET_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \quad (3)$$

where $NEET_{it}$ is the youth (15-24) NEET rate of country i in year t, and X_{it} is the same set of control variables as in the previous two model specifications (1 and 2).

We estimate all three models for all three samples, with further inclusion of the ratio of youth and adult unemployment rate as the dependent variable during robustness checks. This means that we estimate 30 different models in total, using both fixed and random effects estimators. In order to establish which estimator is more appropriate for the specific model we use the Hausman test. The null hypothesis of the Hausman test says that the random effects estimator is inconsistent which means that the fixed effects estimator is consistent and preferred, although it is usually less efficient.

[14] For additional information please refer to Table 1.

[15] The same applies if instead of the adult unemployment rate we use the ratio of youth (15-24) and adult (25-64) unemployment rate.

There is also a possibility that the panel data exhibit a non-stationary time trend. Thus, we employ panel unit root tests to determine whether the main variables in our models are stationary or not. Panel-based unit root tests are performed for each variable and the results for dependent variables are shown in Table 2.[16] The null hypothesis states that all panels contain unit roots; whereas the alternative hypothesis claims that at least one panel is stationary. In all cases, except in one case of the adult unemployment rate, the hypothesis of non-stationarity is rejected at conventional statistical significance levels.

Table 2 *Panel Unit Root Tests*

		YUR		AUR		RATIO		NEET	
		Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value
Inverse chi-squared(56)	Total	128.76	0.00	71.74	0.08	110.65	0.00	144.43	0.00
Inverse chi-squared(30)	"High"	70.82	0.00	40.76	0.09	49.84	0.01	48.14	0.02
Inverse chi-squared(26)	"Low"	57.95	0.00	30.99	0.23	60.81	0.00	96.29	0.00

Notes: YUR – youth (15-24) unemployment rate; AUR – adult (25-64) unemployment rate; RATIO – ratio of youth (15-24) and adults (25-64) unemployment rate; NEET – NEET youth (15-24) rate. Fisher-type unit-root test based on augmented Dickey-Fuller tests.
Source: Author's calculations.

Empirical results and discussion

The estimation results for the youth unemployment rate as the dependent variable are presented in Table 3, for both the entire sample and subsamples for the *high youth unemployment rate* and *low youth unemployment rate* countries. In each case three different model specifications are estimated. Hausman test suggests the use of the fixed-effects estimator in all our model specifications.[17] This means that we control for the unobserved time-invariant characteristics of each country in our models. Also, the 'rho' indicator, or the interclass correlation, suggests that more than 90 percent of the variance is due to differences across panels whereas the *within* R^2 further suggests the use of the fixed-effects estimator. Both time and country effects appear to be jointly statistically significant in all estimated models, except the year effects in one model specification.[18] Let us start with the results for the total EU-28 sample (Table 3).

As expected, real GDP growth rate has a negative effect on the height of youth unemployment rate. As for the structure of the economy, only the share of construction sector in GVA strongly negatively affects youth unemployment rate, i.e., in countries with higher share of the construction sector the unemployment rate is lower. This is a somewhat surprising result given

[16] The results for other variables are not presented owing to space limitations but can be obtained upon request.
[17] This article reports only the results of the models estimated with the more "appropriate" estimator, as suggested by the Hausman test. All the remaining estimates can be obtained upon request.
[18] They are not presented owing to space limitations but can be obtained upon request.

that, on average, Spain, Romania and Slovakia, along with Cyprus, have the highest share of the construction sector in GVA and exhibit high average (youth) unemployment rates (Figure 1). On the other hand, the lowest share of the construction sector, besides Hungary, is found in Germany, Denmark and Netherlands, which have rather low youth unemployment rates (Figure 1). Apparently, when examining a longer period and adding other control variables in the model the construction sector shows to be important in lowering youth unemployment rate. This result is noteworthy given that there are some studies (Eichhorst et al., 2013b) suggesting the opposite, i.e., that the higher share of the construction sector in the economy increases youth unemployment. Actually, this might have happened in some of the countries during recent recession, but since we controlled for that in our models, it seems that construction sector actually boosts employment in a longer period. Namely, the construction sector share in GVA (GDP), together with employment, was booming in most of these countries until the start of the crisis whereas in many countries it recovered rather well after the crisis and certainly could employ younger workforce (Banerji et al., 2014).

Although insignificant in the first two model specifications, it seems that higher share of exports of goods and services in GDP brings down youth unemployment rates. Similar applies to the share of agriculture in GVA, whereas the share of industry (except construction) in GVA seems to increase youth unemployment rate. The share of the public debt in GDP also increases youth unemployment rate. Tax rate, or labour costs, as expected, lead to higher youth unemployment rate as well. Although insignificant, higher share of the skilled among the labour force leads to a decrease of youth unemployment rate. Flexibility of the labour legislation, proxied by the share of temporary employment contracts, leads to lower unemployment rates. This result is expected, since youths are more often employed on temporary contracts (O'Higgins, 2012). For example, the average share of temporary contracts for the employed youths (15-24) is 32 percent in EU-28 in the observed period (2002-2014), while for the employed working-age population (15-64) this amounts to only 11 percent. Personal remittances, although insignificant, seem to increase youth unemployment rates; while the median age of the population decreases it insignificantly.

Adding supplementary policy or institutional variables brings some interesting results. For example, the effect of personal remittances becomes significant, and still positive in explaining youth unemployment rate. It also seems that in countries with higher perceived corruption there is higher youth unemployment. Similarly, countries with stronger regulation appear to have higher youth unemployment rates, although not significantly. Although expected, these results are highly important given that they are not usually empirically confirmed in the literature on youth unemployment in Europe. Moreover, (dummy) policy variables, while insignificant, show that the decreased eligibility for early retirement lowers youth unemployment rate whereas policy variable indicating an increase of the EPL index increases youth unemployment rate. The former result could seem surprising given that the general perception is that more older workers on the labour market means more younger workers who are not able to get a job. However, recent literature actually suggests that there is no competition between younger and older workers on the labour market (Eichhorst et al., 2013b).

The last model specification for the entire EU sample suggests that the effects of the structure of the economy, i.e., the share of exports of goods and services in GDP and share of industrial sector in GVA become statistically significant, and the same is true for the effect of the policy variable indicating the decreased eligibility for early retirement. The effect of the corruption perception

loses its statistical significance, while the effect of the regulation changes its direction of impact. However, it seems that countries where youths live in households with low work intensity, where there is high percentage of home ownership or where high share of the population aged 20-29 still lives with their parents have higher youth unemployment rate. Apparently, additional characteristics of EU countries, mainly related to youth population and perhaps even taking family and cultural legacies in different countries into account, are highly important in explaining (high) youth unemployment rates in Europe.

However, previous results should be taken only as a starting point for further evaluation of the factors that affect youth unemployment in Europe. In this paper we proceed by estimating the same model specifications on two different subsamples: subsample with high average long-term youth unemployment rate and the subsample with low average long-term youth unemployment rate. In order to preserve space, we will comment only on the results that differ from the original estimations presented in the first three columns of Table 3.

In the case of *high youth unemployment rate* sample real GDP growth rate is important (significant) for explaining youth unemployment rate only in the last model specification. Out of the variables explaining the structure of the economy, only the share of construction in GVA lowers youth unemployment rate with statistical significance. The same, with the opposite direction of influence, is true for the share of public debt in GDP. Tax rate has lost its statistical significance, while in the case of the last model specification for *low youth unemployment rate* countries, the share of the skilled labour force actually increases youth unemployment rate. This is probably the consequence of the uneven distribution of the skilled labour force among EU countries in comparison to their (youth) unemployment rate. Also, high share of the skilled labour force among active population accompanied with high (youth) unemployment rate could suggest that skills mismatch is present on the labour market (Quintini et al., 2007; Brada et al., 2014; O'Reilly et al., 2015). Additionally, the share of temporary contracts among total employment seems to increase, rather than decrease, youth unemployment rate in countries with low average youth unemployment rate. This is in accordance with the study by O'Higgins (2012) who argues that the employment loss for youths, after the recession, was smaller in countries with stronger, not weaker, employment protection legislation index. Also, in these countries the effect of the population age becomes significant – on average, the older the population, the lower the youth unemployment rate.

An even more interesting result appears when we look at the coefficient for personal remittances. While in the model specification for the total sample as well as for *high youth unemployment rate countries* this variable has a significant and rather strong negative effect on youth unemployment rate (by increasing it), in the case of *low youth unemployment rate countries* it mostly loses its significance, but has a negative sign. This result suggests the importance of emigration in the case of *high youth unemployment rate* countries, where high transfers from abroad seem to hold back employment serving as an income cushion in the case of unemployment without the right to other welfare benefits, which is especially present on the youth labour market. In *low youth unemployment rate countries* this does not seem to be very important and it works in the opposite direction, by decreasing unemployment rates. This suggests that the emigration in these countries serves more to decrease the base of the active

population, and probably of the total unemployment,[19] but also that the income received is used for better purposes, such as education or starting a business, that increase the prospects of employment.

However, the most visible differences between the *high* and *low youth unemployment rate* countries appear in the model specifications with additional variables. As is seems, corruption perception index is significantly increasing youth unemployment rate only in the former set of countries. However, the direction of impact, although insignificant, is the same in *low youth unemployment rate* countries. Even though the variable used here is a subjective measure, i.e., it measures the perceived level of corruption in a country, it seems that no matter the economic structure, geographical position, or the population structure, higher level of corruption increases unemployment. This should be no surprise given that higher level of corruption reduces productivity and investment efficiency, increases prices, and distorts the allocation of resources in general (Tanzi, 1998; Lambsdorff, 2006; Swaleheen, 2007; Budak and Vizek, 2015). This variable potentially indicates the importance of the public sector within a country, which is often closed to "outsiders", including younger workers, and thus can further increase youth unemployment rate. It could also indicate the possibility of a fairly high share of the informal sector on the labour market which again could indicate higher youth unemployment. Dummy variable for early retirement has the same effect in *high youth unemployment rate* sample as in total sample, whereas in *low youth unemployment rate* sample it loses its statistical significance and seems to lead to an increase in youth unemployment rates. Similar holds true for the labour legislation reform.

In both subsamples the variable indicating work intensity of the youth households lost its statistical significance, whereas share of home ownership within a population, and the share of young people still living with their parents increases youth unemployment rate only in the case of *high youth unemployment rate* countries. These two variables are insignificant in *low youth unemployment rate* sample but seem to decrease youth unemployment rate, which is a rather unexpected result. Namely, the exiting literature (O'Reilly et al., 2015) points to family legacies of long-term unemployment as an important factor to be taken into account when examining youth unemployment. Yet, our results suggest that this is not the same in every country. Apparently, in countries that experience high youth unemployment it is important to look at the wider picture that includes the labour market status of the household members, possibilities for young people to live outside their parental home, as well as what subdues their mobility within the country, with home ownership being one of the possibilities. Sometimes, this is not even in the domain of the economic policy, but different actors should be included in dealing with these specific issues. As already mentioned, these variables could also reflect cultural differences between different EU countries.

[19] See Kelly et al., 2014 for the case of Ireland.

Robustness checks

Model consistency on different dependent variables

Although previous results suggest that there are some common variables that explain youth unemployment rates in EU member states, one has to wonder if these indicators are responsible for the explanation of the overall unemployment as well. Thus, we have also tested our first two model specifications presented in Table 3 on the adult (25-64) unemployment rate.[20]

As expected, the results resemble those in Table 3. However, most of the statistically significant variables have stronger effect on youth (15-24) than on adult (25-64) unemployment rate (Table 4). For instance, the effect of the real GDP growth rate is of the same direction of impact in both cases, but with a higher (negative) coefficient in the case of youth unemployment rate. This again points to stronger procyclicality of youth unemployment rate. The main difference can be found in the second model specification where the effect of policy variable indicating the increase of EPL index suggests statistically significant positive effect on the adult unemployment rate (it increases it) for both the total and *low unemployment rate countries* sample.

Given that the effect of our variables is similar in the case of youth and adult unemployment rate, perhaps it would be worth checking how the models work in the case of the ratio between youth (15-24) and adult (25-64) unemployment rate, i.e., does the same set of determinants that affects the youth unemployment rate affect the relationship between unemployment rates between different age groups (Figure 2). These results are presented in Table 5.

As it seems, apart from different "appropriateness" of the estimator, in the case of the ratio of youth (15-24) and adult (25-64) unemployment rate as the dependent variable, most of our variables from previous model specifications lost their statistical significance. It appears that only variables indicating the "structure" of the economy have an effect on this ratio. Namely, both the share of industry as well as the share of the construction sector in GVA increase the ratio between youth (15-24) and adult (25-64) unemployment rate. Apparently, although the share of the construction sector in the economy decreases both the youth and adult unemployment rate, it tends to increase the ratio between the two suggesting again that youths are probably disproportionately employed by this sector. In *low youth unemployment rate countries*, the ratio also increases with the share of public debt in GDP, while it decreases with the share of skilled labour force, median age and policy variables indicating early retirement decrease and EPL increase.

[20] The third model specification is left out in this instance since these additional variables are associated explicitly with youth population.

Table 3 *Estimation results for youth unemployment rate (YUR)*

	Total						**"High"**						**"Low"**					
	(FE)		(FE)		(FE)		(FE)		(FE)		(FE)		(FE)		(FE)		(FE)	
real GDP gr. rate (%)	-0.257**	(-2.26)	-0.288**	(-2.47)	-0.349***	(-3.59)	-0.144	(-0.86)	-0.170	(-1.00)	-0.311**	(-2.22)	-0.233**	(-2.64)	-0.317***	(-4.12)	-0.362***	(-3.23)
exports in GDP (%)	-0.081	(-1.13)	-0.060	(-0.83)	-0.149**	(-2.76)	-0.011	(-0.13)	0.027	(0.45)	-0.114	(-0.92)	-0.069	(-1.15)	-0.056	(-0.73)	-0.079	(-0.66)
agriculture in GVA (%)	-0.039	(-0.09)	-0.148	(-0.31)	-1.138	(-1.12)	-0.294	(-0.41)	-0.663	(-0.85)	-1.713	(-1.50)	0.432	(0.52)	0.570	(0.63)	0.885	(0.80)
industry in GVA (%)	0.027	(0.07)	0.155	(0.42)	0.561*	(2.00)	0.325	(0.50)	0.631	(1.08)	0.608	(1.52)	0.152	(0.54)	0.241	(1.00)	0.618	(1.74)
construc. in GVA (%)	-2.009***	(-3.93)	-1.984***	(-3.73)	-1.880***	(-4.38)	-1.585*	(-2.02)	-1.171	(-1.65)	-1.733**	(-2.78)	-1.439**	(-2.68)	-1.539**	(-2.59)	-1.733*	(-1.90)
public debt in GDP (%)	0.171***	(3.75)	0.148***	(2.86)	0.131***	(2.85)	0.260***	(4.81)	0.249***	(5.08)	0.171**	(2.63)	0.111**	(2.59)	0.083	(1.73)	0.138***	(3.64)
tax rate (%)	0.552**	(2.58)	0.387*	(1.97)	0.506**	(2.06)	0.185	(0.63)	0.002	(0.01)	0.577	(1.53)	0.404	(1.74)	0.243	(0.85)	0.378	(0.84)
skilled labour force (15-64) (%)	-0.170	(-0.81)	0.004	(0.03)	-0.323	(-1.61)	-0.836	(-1.33)	-0.228	(-0.53)	0.492	(0.65)	-0.184	(-1.30)	-0.165	(-1.11)	-0.604**	(-2.75)
temporary employ. (15-64) (%)	-0.730**	(-2.26)	-0.817**	(-2.74)	-0.801**	(-2.60)	-0.950**	(-2.64)	-0.975***	(-2.98)	-0.983**	(-2.85)	0.558*	(1.98)	0.585	(1.71)	0.481	(1.45)
personal remittances (% of GDP)	0.686	(1.70)	0.797**	(2.13)	2.124**	(2.56)	1.104**	(2.28)	1.216**	(2.92)	3.096***	(3.66)	-1.606*	(-2.07)	-1.035	(-1.47)	0.019	(0.02)
median age	-0.791	(-1.15)	-0.590	(-0.77)	-0.569	(-0.59)	-1.186	(-1.52)	-1.351	(-1.60)	-1.095	(-0.74)	-2.920***	(-4.71)	-3.111***	(-3.09)	-3.903**	(-2.61)
CPI score			-1.424*	(-1.96)	-1.352	(-1.60)			-3.314***	(-3.26)	-3.025*	(-1.87)			-1.587	(-1.53)	-2.264	(-1.23)
EFI – reg.			-0.033	(-0.02)	0.681	(0.49)			-0.063	(-0.03)	1.187	(0.77)			-0.463	(-0.27)	1.808	(0.61)
early retir. decrease			-0.184	(-0.40)	-0.839**	(-2.19)			-0.122	(-0.18)	-1.254**	(-2.37)			0.156	(0.42)	0.180	(0.33)
EPL increase			1.275	(1.56)	0.648	(0.69)			1.415	(1.48)	0.987	(1.02)			0.337	(1.07)	-0.190	(-0.26)
low work intensity HH (15-24) (%)					0.553**	(2.47)					0.513	(1.54)					-0.173	(-1.33)
home ownership (%)					0.356***	(3.32)					0.506**	(2.78)					-0.043	(-0.28)
living with parents (20-29) (%)					0.246**	(2.72)					0.355*	(1.92)					-0.012	(-0.11)
N	346		325		226		187		178		123		159		147		103	
sigma_u	12.130		10.903		13.676		14.178		14.514		18.012		10.750		9.495		12.571	
sigma_e	3.653		3.541		2.817		4.020		3.793		2.960		2.227		2.098		1.986	

	Total			**"High"**			**"Low"**		
	(FE)	(FE)	(FE)	(FE)	(FE)	(FE)	(FE)	(FE)	(FE)
rho	0.917	0.905	0.959	0.926	0.936	0.974	0.959	0.953	0.976
R^2 within	**0.713**	**0.730**	**0.833**	**0.783**	**0.804**	**0.886**	**0.768**	**0.811**	**0.868**
R^2 between	0.004	0.001	0.201	0.000	0.012	0.071	0.107	0.040	0.016
R^2 overall	0.042	0.089	0.238	0.121	0.150	0.160	0.000	0.031	0.027
F-test for joint sign. (panel)	37.151***	32.201***	23.458***	28.143***	24.094***	10.573***	23.185***	19.810***	6.934***
F-test for joint sign. (year)	2.665***	2.578***	3.446***	2.011**	1.976**	0.985	4.846***	5.266***	3.909***
Hausman test	101.14***	51.20***	110.54***	79.49***	56.73***	562.94***	389.62***	98.60***	224.63***

Notes: FE- fixed effects; RE – random effects. *t* statistics in parentheses. Heteroscedasticity-robust standard errors. * p<0.10, ** p<0.05, *** p<0.01; A constant is also included but not reported.

Source: Author's calculations.

Table 4 *Estimation results for adult unemployment rate (AUR)*

	Total				**"High"**				**"Low"**			
	(FE)		(FE)		(FE)		(FE)		(FE)		(FE)	
real GDP gr. rate (%)	-0.090*	(-1.74)	-0.113**	(-2.21)	-0.029	(-0.36)	-0.062	(-0.86)	-0.083*	(-1.94)	-0.102***	(-4.37)
exports in GDP (%)	-0.015	(-0.65)	-0.009	(-0.42)	-0.003	(-0.08)	0.003	(0.11)	-0.006	(-0.24)	0.003	(0.13)
agriculture in GVA (%)	-0.061	(-0.31)	-0.081	(-0.35)	-0.105	(-0.43)	-0.193	(-0.66)	-0.579	(-1.53)	-0.563	(-1.13)
industry in GVA (%)	-0.092	(-0.72)	-0.029	(-0.21)	0.093	(0.41)	0.254	(1.18)	-0.021	(-0.13)	0.001	(0.01)
construc. in GVA (%)	-1.135***	(-5.62)	-1.122***	(-5.53)	-0.974**	(-2.68)	-0.791**	(-2.65)	-0.852***	(-3.51)	-0.904***	(-3.72)
public debt in GDP (%)	0.069***	(3.10)	0.055**	(2.49)	0.110***	(3.68)	0.098***	(5.81)	0.033	(1.27)	0.015	(0.50)
tax rate (%)	0.247**	(2.17)	0.162*	(1.75)	0.126	(0.88)	0.039	(0.28)	0.050	(0.58)	-0.041	(-0.48)
skilled labour force (15-64) (%)	-0.062	(-0.76)	0.008	(0.14)	-0.301	(-1.31)	-0.050	(-0.33)	-0.058	(-0.74)	-0.056	(-0.62)
temporary employ. (15-64) (%)	-0.366***	(-3.12)	-0.406***	(-3.91)	-0.470***	(-3.30)	-0.489***	(-3.91)	0.211	(1.37)	0.196	(1.18)
personal remittances (% of GDP)	0.374**	(2.09)	0.434**	(2.64)	0.462*	(1.97)	0.552***	(2.98)	-0.381*	(-1.89)	-0.205	(-1.21)
median age	-0.165	(-0.45)	-0.082	(-0.22)	-0.241	(-0.68)	-0.225	(-0.77)	-1.198*	(-1.94)	-1.111	(-1.52)
CPI score			-0.694**	(-2.27)			-1.729***	(-3.96)			-0.412	(-1.16)
EFI – reg.			0.084	(0.13)			0.314	(0.34)			-0.570	(-0.66)
early retir. decrease			0.016	(0.08)			-0.021	(-0.07)			0.154	(0.74)
EPL increase			0.541*	(1.73)			0.405	(1.16)			0.703***	(4.08)
N	346		325		187		178		159		147	
sigma_u	5.755		5.175		7.068		7.270		3.525		3.383	
sigma_e	1.490		1.401		1.609		1.445		1.007		0.918	
rho	0.937		0.932		0.951		0.962		0.925		0.931	
R^2 within	**0.747**		**0.768**		**0.816**		**0.844**		**0.747**		**0.803**	
R^2 between	0.060		0.013		0.065		0.001		0.046		0.035	
R^2 overall	0.010		0.043		0.035		0.079		0.034		0.076	
F-test for joint sign. (panel)	42.505***		35.988***		43.903***		36.761***		11.845***		6.698***	
F-test for joint sign. (year)	1.721*		2.036**		0.913		1.124		2.698***		3.836***	
Hausman test	-5845.19†		263.18***		-23.39†		404.98***		136.62***		87.09***	

Notes: FE- fixed effects; RE – random effects. *t* statistics in parentheses. Heteroscedasticity-robust standard errors. * p<0.10, ** p<0.05, *** p<0.01. A constant is also included but not reported. †- chi2<0 ==> model fitted on these data fails to meet the asymptotic assumptions of the Hausman test.

Source: Author's calculations.

Table 5 *Estimation results for the ratio of youth (15-24) and adult (25-64) unemployment rate*

	Total				**"High"**				**"Low"**			
	(RE)		(RE)		(FE)		(FE)		(FE)		(FE)	
real GDP gr. rate (%)	-0.008	(-0.85)	-0.005	(-0.58)	-0.005	(-0.65)	-0.002	(-0.27)	-0.025	(-1.50)	-0.027	(-1.50)
exports in GDP (%)	-0.004	(-0.66)	-0.003	(-0.54)	-0.002	(-0.48)	-0.001	(-0.34)	-0.007	(-1.10)	-0.006	(-0.87)
agriculture in GVA (%)	0.011	(0.51)	0.011	(0.60)	-0.008	(-0.26)	-0.016	(-0.60)	0.314*	(1.89)	0.265	(1.58)
industry in GVA (%)	0.033*	(1.72)	0.028*	(1.95)	0.025	(0.90)	0.016	(0.71)	0.039**	(2.60)	0.038*	(1.90)
construc. in GVA (%)	0.078**	(2.47)	0.070***	(2.85)	0.048*	(1.84)	0.046*	(1.94)	0.106**	(2.38)	0.116**	(2.45)
public debt in GDP (%)	0.002	(0.58)	0.001	(0.44)	-0.003	(-0.94)	-0.002	(-0.81)	0.008**	(2.68)	0.010***	(3.15)
tax rate (%)	-0.007	(-0.47)	-0.003	(-0.21)	-0.019	(-1.12)	-0.015	(-0.86)	0.074**	(2.67)	0.083**	(2.64)
skilled labour force (15-64) (%)	0.000	(0.05)	-0.002	(-0.24)	0.020	(1.51)	0.020	(1.01)	-0.029***	(-3.74)	-0.036**	(-2.96)
temporary employ. (15-64) (%)	0.009	(0.76)	0.010	(0.86)	0.016	(0.96)	0.018	(1.09)	0.037	(1.13)	0.050	(1.24)
personal remittances (% of GDP)	-0.026	(-1.19)	-0.029	(-1.47)	-0.002	(-0.08)	-0.012	(-0.49)	-0.115	(-1.07)	-0.098	(-1.07)
median age	-0.051	(-1.17)	-0.032	(-0.61)	-0.008	(-0.15)	-0.028	(-0.60)	-0.167	(-1.70)	-0.219*	(-1.91)
CPI score			0.083	(1.58)			0.095	(1.60)			-0.038	(-0.34)
EFI – reg.			-0.113	(-0.95)			-0.048	(-0.29)			0.055	(0.36)
early retir. decrease			-0.016	(-0.57)			0.025	(1.04)			-0.056*	(-1.86)
EPL increase			0.007	(0.11)			0.073	(0.83)			-0.177**	(-2.78)
N	346		325		187		178		159		147	
sigma_u	0.723		0.867		0.741		0.759		1.500		1.502	
sigma_e	0.262		0.262		0.222		0.218		0.270		0.274	
rho	0.884		0.916		0.917		0.923		0.969		0.968	
R^2 within	0.239		0.245		0.346		0.372		0.422		0.439	
R^2 between	0.017		0.024		0.040		0.002		0.494		0.442	
R^2 overall	0.001		0.002		0.005		0.002		0.302		0.272	
F-test for joint sign. (panel)	68.376***		61.689***		35.586***		33.139***		35.853***		32.553***	
F-test for joint sign. (year)	2.382***		1.958**		0.744		0.525		3.364***		3.290***	
Hausman test	13.49^		7.47^		-56.79†		266.92***		-50.04†		-245.55†	

Notes: FE- fixed effects; RE – random effects. *t* statistics in parentheses. Heteroscedasticity-robust standard errors. * p<0.10, ** p<0.05, *** p<0.01. A constant is also included but not reported. ^ - Breusch and Pagan Lagrangian multiplier test for random effects suggests the use of random effects estimator instead of OLS estimator. † - chi2<0 ==> model fitted on these data fails to meet the asymptotic assumptions of the Hausman test.

Source: Author's calculations.

Despite rather high youth unemployment rates (Figure 1), participation of youths (15-24) on the labour market is still rather low. In case of most EU countries the activity rate for youths (15-24) is below 40 percent, while the employment rate is usually below 30 percent. In light of this, measures such as the youth unemployment ratio (the number of those unemployed in the age group 15-24 divided by the total population aged 15 to 24) or the rate of young people "not in employment, education or training" - NEET rate - might map a better picture of the actual situation for youths on the labour market.[21] That is why it is important to look at different indicators of the position of youths on the labour market, and not only on the unemployment rate. Since we have already controlled for the demographic situation of the country in our models, in order to check whether our model specification explains some other measure of the position of youths on the labour market, we have tested all our model specifications on the youth (15-24) NEET rate.[22] Results are presented in Table 6.

In the case of youth NEET rate, the "appropriateness" of the models is not the same as in the case of both youth and adult unemployment rate. Namely, the Hausman test gives preference to random effects estimation in three of the model specifications, while for one model specification "the model fitted on these data fails to meet the asymptotic assumptions of the Hausman test". Apparently, explanatory variables in the case of youth unemployment and NEET rates are somewhat different, although the NEET rate is composed of the unemployed population as well.[23] However, it seems that inactive population within the youth age-range (15-24), which is not a part of formal education system, cannot be explained with the same set of data as the one defined as unemployed. The only inferences from the model in this paper, as presented in Table 6, are that, in general, higher real GDP growth rate, higher share of exports of goods and services and higher share of the construction sector in GVA lower the NEET rate, whereas higher share of agriculture in GVA, higher share of public debt in GDP and higher perceived corruption increase it. Also, this is mostly true for the total EU sample and *high youth unemployment rate countries*, whereas *low youth unemployment rate countries* exhibit somewhat different results. Among the structural characteristics, share of homeownership seems to increase NEET rates in *the total sample and high youth unemployment rate* subsample. Evidently, new set of explanatory variables should be added to the model if we want to explain the youth NEET rate across the EU.

[21] Even though the youth unemployment rate might be high in one country, both the NEET rate and youth unemployment ratio could be higher in some other country, due to different age structure of the population or because of the high share of those inactive, but not in education.

[22] More on the concept of the NEET population is available in Elder (2015), while more on the NEET population in Europe can be found in Eurofound (2012) or in Sissons and Jones (2012).

[23] Eurofound (2012) reports that the largest subgroup of the NEET population are those who are conventionally unemployed. Other subgroups include the sick and disabled and young carers, as well as those taking time out and those constructively engaged in other activities such as art, music and self-directed learning.

Table 6 *Estimation results for youth NEET rate*

	Total						**"High"**						**"Low"**					
	(RE)		(RE)		(FE)		(RE)		(FE)		(FE)		(FE)		(FE)		(FE)	
real GDP gr. rate (%)	-0.114***	(-2.78)	-0.123***	(-2.76)	-0.096***	(-2.95)	-0.101*	(-1.68)	-0.109*	(-1.88)	-0.138***	(-3.09)	-0.136	(-1.66)	-0.133*	(-1.87)	-0.050	(-1.31)
exports in GDP (%)	-0.042**	(-2.12)	-0.033*	(-1.91)	-0.054*	(-1.95)	-0.080**	(-2.06)	-0.080**	(-2.15)	-0.042	(-0.82)	-0.054	(-1.53)	-0.006	(-0.28)	-0.044	(-1.21)
agriculture in GVA (%)	0.747***	(3.83)	0.572***	(2.75)	0.234	(0.81)	0.854***	(3.10)	0.795*	(2.09)	0.085	(0.35)	-0.032	(-0.07)	-0.196	(-0.28)	0.016	(0.02)
industry in GVA (%)	0.084	(0.89)	0.083	(1.16)	0.183*	(2.01)	0.181	(1.62)	0.343**	(2.56)	0.273**	(2.22)	0.323	(1.04)	0.157	(0.84)	0.059	(0.29)
construc. in GVA (%)	-0.408**	(-2.08)	-0.491***	(-2.66)	-0.772***	(-4.08)	-0.337*	(-1.71)	-0.141	(-0.58)	-0.500*	(-1.82)	-0.205	(-0.65)	-0.349	(-1.65)	-0.892***	(-4.23)
public debt in GDP (%)	0.060***	(4.51)	0.043***	(3.44)	0.048***	(3.11)	0.049**	(2.54)	0.061**	(2.15)	0.027	(1.12)	0.065**	(2.66)	0.028	(1.23)	0.045*	(2.12)
tax rate (%)	-0.093	(-1.23)	-0.120*	(-1.92)	0.115	(1.22)	-0.124	(-0.95)	-0.171	(-1.29)	0.176**	(2.29)	0.147	(0.85)	-0.039	(-0.25)	0.101	(0.56)
skilled labour force (15-64) (%)	-0.042	(-0.66)	0.050	(1.00)	-0.091	(-0.94)	-0.143	(-1.20)	-0.012	(-0.07)	-0.106	(-0.40)	-0.140	(-1.47)	-0.150	(-1.71)	-0.271***	(-6.21)
temporary employ. (15-64) (%)	-0.169***	(-3.39)	-0.170***	(-3.47)	-0.055	(-0.48)	-0.253***	(-3.50)	-0.348***	(-3.96)	-0.225**	(-2.18)	0.602**	(2.56)	0.479*	(2.04)	0.239	(1.57)
personal remittances (% of GDP)	0.011	(0.06)	-0.002	(-0.01)	0.355	(1.56)	-0.045	(-0.20)	-0.079	(-0.25)	0.789**	(2.66)	-0.038	(-0.07)	0.435	(0.92)	0.253	(0.67)
median age	-0.307	(-1.02)	-0.037	(-0.14)	-0.436	(-0.88)	0.223	(0.66)	0.169	(0.47)	0.328	(0.64)	-1.662**	(-2.39)	-0.974	(-1.57)	-2.241***	(-6.40)
CPI score			-0.768***	(-2.85)	-0.388	(-1.11)			-1.254**	(-2.62)	-1.154**	(-2.15)			-0.562	(-0.82)	-0.950	(-1.30)
EFI – reg.			-0.607	(-1.12)	0.047	(0.09)			0.216	(0.34)	0.899*	(1.88)			-2.254***	(-3.27)	-0.112	(-0.12)
early retir. decrease			0.003	(0.02)	-0.251	(-1.50)			0.167	(1.02)	-0.276	(-1.59)			-0.049	(-0.17)	0.059	(0.21)
EPL increase			0.185	(0.57)	-0.028	(-0.08)			-0.013	(-0.04)	-0.026	(-0.07)			0.042	(0.07)	-0.223	(-0.75)
low work intensity HH (15-24) (%)					-0.017	(-0.19)					-0.070	(-0.58)					-0.090	(-0.76)
home ownership (%)					0.094**	(2.66)					0.143**	(2.62)					-0.026	(-0.42)
living with parents (20-29) (%)					0.039	(0.86)					0.044	(0.71)					-0.028	(-0.31)
N	346		325		226		187		178		123		159		147		103	
sigma_u	2.620		2.514		3.691		2.557		3.757		5.052		6.440		4.627		4.422	
sigma_e	1.672		1.578		1.094		1.553		1.494		0.997		1.587		1.395		1.010	

	Total			**"High"**			**"Low"**		
	(RE)	(RE)	(FE)	(RE)	(FE)	(FE)	(FE)	(FE)	(FE)
rho	0.711	0.717	0.919	0.730	0.863	0.963	0.943	0.917	0.950
R^2 within	0.507	0.554	**0.701**	0.651	**0.694**	**0.790**	**0.524**	**0.605**	**0.786**
R^2 between	0.469	0.614	0.361	0.429	0.517	0.326	0.009	0.036	0.115
R^2 overall	**0.475**	**0.605**	0.396	**0.471**	0.533	0.380	0.023	0.071	0.192
F-test for joint sign. (panel)	28.752***	26.329***	23.668***	29.206***	21.924***	12.645***	11.774***	10.862***	3.685***
F-test for joint sign. (year)	0.984	1.365	1.708*	1.517	1.349	1.937*	1.321	2.006**	1.535
Hausman test	12.75^	20.92^	374.59***	14.07^	296.25***	-1620.61†	188.07***	54.83***	55.09***

Notes: FE- fixed effects; RE – random effects. *t* statistics in parentheses. Heteroscedasticity-robust standard errors. * p<0.10, ** p<0.05, *** p<0.01. A constant is also included but not reported. ^ - Breusch and Pagan Lagrangian multiplier test for random effects suggests the use of random effects estimator instead of OLS estimator. † - chi2<0 ==> model fitted on these data fails to meet the asymptotic assumptions of the Hausman test.

Source: Author's calculations.

Further examination of the models fit

Given that Hausman test suggests that all of the model specifications in case of youth unemployment rate should be estimated by the fixed effect estimator, in order to analyse the effect of specific variables on youth unemployment rate in individual countries we have also calculated country-specific effects within our total sample and the two subsamples for the youth unemployment rate. The results are displayed in Table A.1 in Appendix. As already indicated in Table 3, country-specific constants are jointly statistically significant in all model specifications.

In general, the fixed effects show the country-specific level of youth unemployment (over the total period) net of the overall effect of different set of variables on youth unemployment. For example, in Croatia, using the second model specification, average youth unemployment over the period, net of the overall effect, is estimated at 26.7 percent. This compares with an average youth unemployment rate for this country over the full period of 34.4 percent. By comparison, the corresponding figures for United Kingdom are 8.4 and 16.0 percent. These comparisons clearly suggest that the "overall effect" for youth unemployment is not constant across countries. Again, there are differences between samples and models specifications. This only confirms heterogeneity among EU member countries and the need to evaluate effects on youth unemployment rate separately for different groups(s) of countries or even individual countries.

The robustness of the models for youth unemployment is also examined by comparing the observed youth unemployment rates with those obtained from the estimated models. Comparative figures by countries and years are presented in Figures A.1 and A.2 in the Appendix. Due to some missing data, the predicted values could not have been estimated for all the countries in all the observed years. In general, predicted results suggest that the basic model as well as supplementary model with policy/institutional variables explain youth unemployment rate rather well (except in the case of Cyprus). Supplementary model with additional structural variables, i.e., the share of youths who live in households with low work intensity, the percentage of home ownership in a country and the share of the population aged 20-29 that lives with their parents, on the other hand, seems to misexplain youth unemployment rate in EU countries, despite the statistical significance of these variables in the model. Again, there are big differences between countries; while in some of them the model seems to explain youth unemployment rate rather well in other it fails to do so.

Potential limitations of the study

Several additional caveats need to be mentioned here. First, one could argue that the division of the entire sample into *high youth unemployment rate countries and low youth unemployment rate countries* might seem somewhat arbitrary, potentially indicating that some different subsamples could provide different picture. However, these (groups of) countries proved to be (statistically) different in many aspects other than unemployment rates, thus justifying this potentially arbitrary division. Further, trying to control for many different aspects in our models, leads to a potential danger of multicollinearity between different covariates and even to a simultaneity bias. Nevertheless, this is for the main part solved by using the fixed-effects estimator. Additionally, we use "formal" EU definition of youths in the article as the population between 15 and 24. However, due to certain specific features, such as the extension of higher education after

24 years in some countries, the upper age limit could be extended to 29 years of age. Alternatively, because the system of secondary education is non-dual, i.e., young people are rarely simultaneously present in both education and work in some countries, or because the rates of early school leaving ("drop-out") differ substantially between different EU countries, the lower limit in the definition of young people could be moved from 15 to 18 or 20. Even the unemployment within formal definition of youths could be divided between those aged 15-19 and those aged 20-24. Of course, these alternative "measures" of youth unemployment would fit some countries better than others. Finally, better availability of the data would provide a better picture, even within the existing models.[24]

Summary of results and conclusion

Over the past few years, youth unemployment has crystallized as one of the main problems in the European Union as a whole, with special emphasis on certain member states. This is visible not only from the statistical data, but also from most of the sectoral strategic documents at both national and European level. A large set of programs and measures have been introduced to combat high youth unemployment, both on EU and member-state level. However, their outcomes are questionable, as they depend on the characteristics of each country. Yet, this heterogeneity among EU member countries is often not taken into account.

This article uses a unique dataset for EU-28 countries in order to explore the main determinants of youth unemployment rates by panel data model estimation. The period used in the analysis is extended to 13 years, from 2002 to 2014, for which most of the data used in the empirical analysis are available. In this way, the main determinants of youth unemployment in European countries are explored in a longer perspective, not only during the recent recession. Further, the article takes into account heterogeneity between countries in youth unemployment rates, but also in different economic and non-economic indicators, estimating our models on two different subsamples: *high youth unemployment rate countries* and *low youth unemployment rate countries*. Our main dependent variable is unemployment rate for those aged 15-24, while for additional robustness check we tested our models on the adult (25-64) unemployment rate, the ratio of youth and adult unemployment rate, and youth (15-24) NEET rate.

Apart from the generally accepted (macro) indicators that proved to be important in explaining high (youth) unemployment rates, such as real GDP growth rate or tax rate, we also test the dependence of youth unemployment rate in EU countries on additional indicators, the ones that are probably not the first to mention as culprits for high youth unemployment, but could be responsible as much as the macro variables, if not even more. For this purpose, we include, among other indicators, the perception of corruption index, index for economic regulation, low work intensity within the household of the youth population, the share of home ownership in a country, and living in a parental home for a longer period.

[24] One could also argue that we did not take into account the dynamic nature of youth unemployment rate, i.e., the effect that past unemployment rate(s) has on its present value. This would imply that the "unemployment hysteresis" is present on European (youth) labour markets. However, given that the number of panels/countries (as well as years) is rather small in our model, standard dynamic panel estimators, such as Arellano-Bond dynamic panel-data estimator, are not suitable in this case (see StataCorp. 2013). Also, the dynamic aspect is already covered by including time-fixed effects in our fixed- and random-effects estimations.

The presented main features of our model also illustrate the main contributions of this article. Namely, longer-term determinants of youth unemployment among EU countries, including the recent crisis, add to the literature by evaluating the main characteristics of the persistence of the youth unemployment problem in many European countries. Further, by estimating the models separately for countries that have experienced long periods of high youth unemployment and countries that have had significantly lower youth unemployment rates during the observed period, the article acknowledges heterogeneity between countries, and especially their labour markets. Finally, by adding the specific, non-economic, characteristics as explanatory variables into the model, we further extend the possible explanations of high youth unemployment rates in many EU countries. Some of these variables could actually reflect cultural differences between different EU member countries.

The main results of the empirical estimation suggest that real GDP growth rate and the share of construction sector in GVA are the most important determinants of lowering youth unemployment rates, while the share of public debt in GDP is the most resistant variable that showed to increase youth unemployment in European countries. In general, where significant, all variables have stronger effect on youth than on the adult unemployment rate. However, the direction of influence is mostly the same in both cases. Interestingly, when assessing the ratio of youth and adult unemployment rate, both the share of industry and construction sector in GVA tend to increase it. Hence, the share of the construction sector in the economy decreases both the youth and adult unemployment rate, but it increases the ratio between the two suggesting that youths are probably disproportionately employed by this sector. Share of temporary employment within the economy seems to decrease youth unemployment, whereas share of received personal remittances increases youth unemployment, at least in *high youth unemployment rate countries.* Corruption perception index (CPI) appears to have a rather negative effect on the youth unemployment as well. Variables indicating the share of young people (15-24) living in households with very low work intensity, share of home ownership within a population, and the share of young people (20-29) still living with their parents prove to be rather important in explaining high unemployment rates in *high youth unemployment rate countries* and in the total sample, while they were insignificant (and negative) in the *low youth unemployment rate countries* sample. However, it seems that adding these last three variables into the model the predictability of the estimation is drifting further away from the original observations of youth unemployment rates.

Although presented results are based on a rather simple model and publicly available data, there are still some important messages that can be extracted from them, especially when determining and evaluating different measures taken in order to mitigate (high) youth unemployment rates in Europe. Yes, one could always say that the solution is simple and that all we need to reduce unemployment is to boost economic growth (van Ours, 2015). Although true, this recipe is neither entirely complete nor far-reaching. Namely, even in the periods of economic growth some EU members have had rather high youth unemployment. Our results suggest that there are huge differences between countries in youth unemployment rates, but also in different economic and non-economic indicators. *High* and *low youth unemployment rate* countries differ substantially when trying to explain youth unemployment by the same set of variables, which confirms our assumption that EU countries should not be observed as one entity, and the need to divide the sample in (at least) two parts. Although the European Union has put a lot of effort in dealing with the youth unemployment in recent years, those measures could prove not to work

well in all countries. We have already pointed to a different economic structure and different age structure of the youths present on labour markets in different EU countries, but there are many more heterogeneities not visible at first sight. Sometimes, this is not even in the domain of the economic policy, but different actors should be included in dealing with the specific issues of high youth unemployment and youth NEET rates. Of course, this paper is just the "tip of the iceberg" on this issue, while more research, both in the domain of macro, but especially microeconometrics using individual-level data, is needed.

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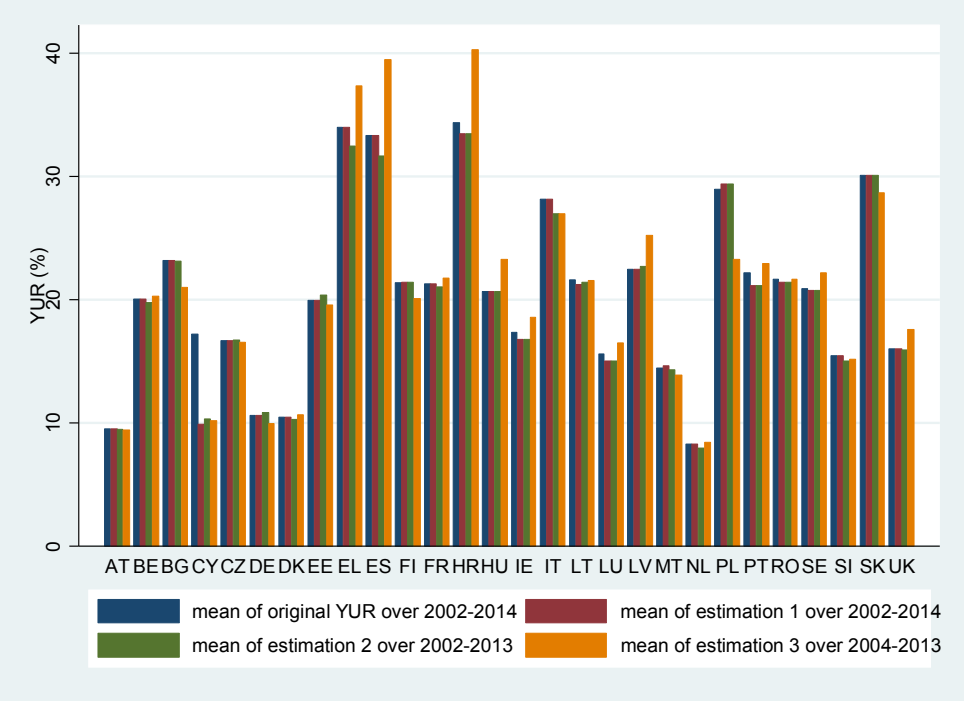
Appendix

Table A.1 *Country-specific effects from the panel estimation of youth unemployment rate*

	Total			"High"			"Low"		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BE	(.)	(.)	(.)				(.)	(.)	(.)
BG	23.837***	16.391***	2.774	(.)	(.)	(.)			
CZ	15.561***	10.380*	-1.004				0.888	-8.162	-19.257**
DK	-1.257	2.127	11.481***				-10.398***	-7.779***	-8.619**
DE	-4.300	-1.904	-3.626				-10.951***	-10.229***	-12.387*
EE	27.998***	22.107***	21.544***				21.053***	14.233**	16.724
IE	12.446**	9.308	6.006				-11.235*	-16.304**	-16.199
EL	18.655***	15.531***	9.372	-7.12	-3.265	7.048			
ES	50.163***	48.445***	42.471***	35.168***	38.890***	41.998***			
FR	13.147***	13.920***	21.912***	-3.104	7.51	26.724**			
HR	30.274***	26.668***	6.243	7.047*	12.507***	8.37			
IT	11.467**	10.279**	-1.589	-17.076***	-6.39	5.561			
CY	24.418***	20.318***	30.782***				-3.952	-13.013	-3.484
LV	20.182***	16.663***	8.137*	1.044	5.634	4.914			
LT	21.587***	14.576***	4.146	0.693	-2.236	-7.222			
LU	22.465***	20.049***	33.648***				16.717***	12.602*	21.937
HU	5.250*	2.820	-9.885**	-21.320***	-14.710***	-12.216			
MT	13.101**	8.446	6.331				5.294	-2.264	-4.392
NL	7.021**	8.890***	17.086***				-14.183***	-14.055***	-11.659**
AT	-2.056	0.479	-0.631				-9.077***	-9.258***	-17.831***
PL	35.936***	33.428***	21.644***	12.524**	15.188**	23.978**			
PT	18.121***	19.349***	9.891	-9.901	5.173	19.88			
RO	15.287***	10.327*	-10.259	-15.459**	-11.674*	-8.873			
SI	16.382***	15.101***	3.583				-3.398	-8.564*	-9.347*
SK	28.589***	23.044***	6.599	-8.003	-6.332	4.81			
FI	23.484***	24.436***	29.980***	11.472**	23.404***	36.248***			
SE	22.140***	23.653***	32.971***	5.876	20.167***	42.456***			
UK	7.830**	8.366**	10.280**				-0.565	-0.528	1.877

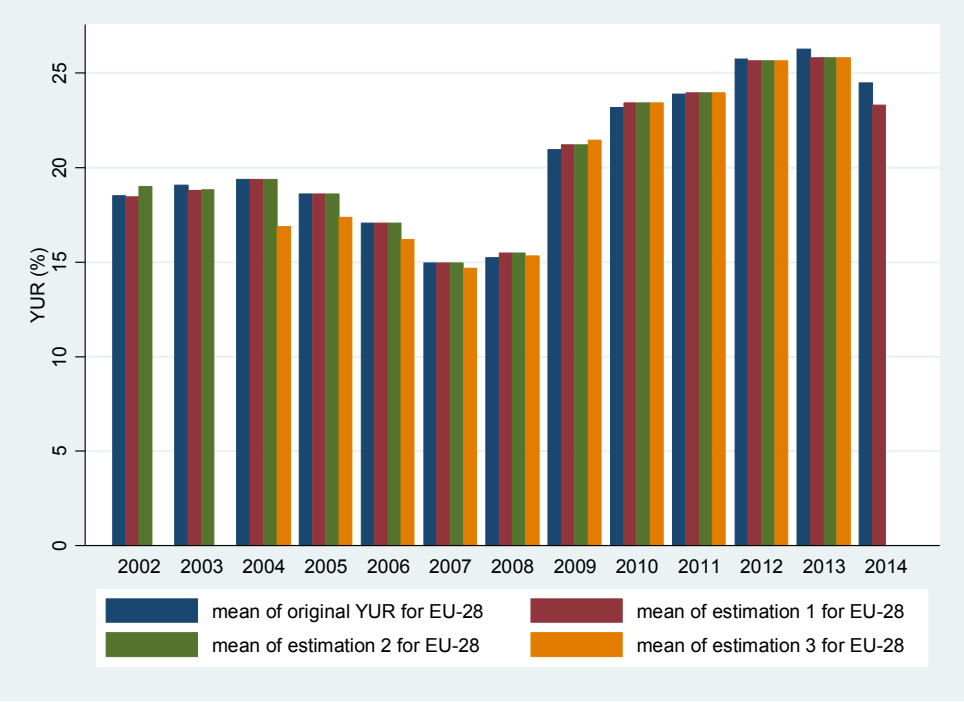
Notes: Dependent variable: youth (15-24) unemployment rate. * p<0.10, ** p<0.05, *** p<0.01.
Source: Author's calculations.

Figure A.1 *Mean observed vs. mean predicted values from the panel estimation of youth unemployment rate by countries (EU-28 sample)*



Notes: YUR – youth (15-24) unemployment rate.
Source: Author's calculations.

Figure A.2 *Mean observed vs. mean predicted values from the panel estimation of youth unemployment rate by years (EU-28 sample)*



Notes: YUR – youth (15-24) unemployment rate.
Source: Author's calculations.

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