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Youth Unemployment in Advanced Europe: Okun's Law and Beyond

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European Department

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Abstract

The crisis has intensified what was previously a chronic unemployment problem in Europe; youth unemployment is now at unprecedented highs in some European countries. This paper assesses the main drivers of youth unemployment in Europe. It finds that much of the increase in youth unemployment rates during the crisis can be explained by output dynamics and the greater sensitivity of youth unemployment to economic activity than adult unemployment. Labor market institutions also play a significant role in explaining the persistently high levels of youth unemployment, especially the tax wedge, minimum wages relative to the median wage, spending on active labor market policies, the opportunity cost of working (measured by the unemployment benefits), vocational training, and labor market duality. This suggests that policies to address youth unemployment should be comprehensive and country-specific, focused on reviving growth and advancing labor market reforms.

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I. INTRODUCTION¹

Youth unemployment has surged in Europe during the global crisis, and is at historic highs in many countries. Several papers have highlighted the deleterious consequences of high youth unemployment. These include the impact of “scarring” that leads to a lower probability of future employment and/or lower wages, which has been found to be persistent (Dao and Loungani, 2010; Ellwood, 1982; Gregg and Tominey, 2005; Kahn, 2010; Oreopoulos et al., 2012). High levels of youth unemployment have been shown to erode social cohesion and institutions (Giuliano and Spilimbergo, 2009; Altindag and Mocan, 2010; ILO, 2013), and foster crime (Fougère et al., 2009; Carmichael and Ward, 2001). In addition, young unemployed workers may have a higher propensity to relocate abroad because of lower “sunk costs” and greater potential for education and, subsequently, work abroad.² The outward migration of the youth combined with the general ageing of the population may lower the potential output of the euro area since a significant share of the outward migration is to countries outside the euro area (OECD, 2013a). High youth unemployment and an outward migration of younger members of the workforce could also undermine the sustainability of spending on social safety nets in euro area countries, which is of particular concern given their demographic challenges.

In response, specific policies have been formulated at both the European Union (European Commission, 2012 and 2013a) and national levels to deal with youth unemployment. The most notable examples are the EU’s Youth Guarantee Scheme, aimed at ensuring that all young people get a job offer within four months of leaving formal education or becoming unemployed, and the Youth Employment Initiative, aimed at supporting active labor market policies for young people not in education, employment or training in regions with high youth unemployment. Policies at the national level include, for instance, Italy’s July 2013 measures to support youth unemployment, including tax breaks for employers hiring under-30s on permanent contracts, and the increase in training, apprenticeship and internship schemes. Such policies aim to smooth the job-searching process and promote youth employment.

But what drives youth unemployment? Despite the focus on the harmful effects of pervasive youth unemployment and policies to address the problem, studies devoted to understanding the main drivers of youth unemployment are relatively limited. The large literature on labor

¹ We are grateful to Petya Koeva Brooks for her guidance on the project. We would also like to thank Shekhar Aiyar, Céline Allard, Larry Ball, Helge Berger, Olivier Blanchard, Rodolphe Blavy, John Bluedorn, Jörg Decressin, Prakash Loungani, Paulo Medas, Mahmood Pradhan, and other IMF colleagues, and seminar participants at the European Commission and the European Central Bank for their insightful comments. We are grateful to Xiaobo Shao and Katherine Cincotta for their excellent assistance with research and document preparation respectively.

² For example, there is evidence that Latvian emigrants during the crisis were slightly younger and slightly more educated than the average population (Hazans, 2011, Blanchard et al., 2013). Arpaia et al. (2014) show that a quarter of immigrants are in the age group of 15–24 years old, and 40 percent are in the age group of 15-29 years old.

markets usually examines overall unemployment, which has also been an important concern during the global crisis.

The few papers that do investigate youth unemployment and employment in advanced economies all point to the important role of economic activity and labor market institutions. Some find significant effects from *multiple* factors—including labor market reforms, economic freedom, education, part-time employment, and active labor market policies (Choudhry et al., 2012a). Others highlight the role of *individual* labor market institutions such as the union involvement in wage setting (Jimeno and Rodriguez-Palenzuela, 2002; Bertola et al., 2007), labor market flexibility (Bernal-Verdugo et al., 2012a), or employment protection legislation (Bassanini and Duval, 2006) for youth labor market outcomes.

Our paper examines the main cyclical and structural explanatory factors behind the youth unemployment dynamics during the global crisis. It covers 22 advanced European countries—18 in the euro area, as well as Denmark, Sweden, Norway and the United Kingdom, but the discussion places a special emphasis on the euro area. The sample period is from 1980 to 2012, with the actual size subject to data availability, in particular for labor market features.

The paper makes several contributions to the empirical literature. First, our analysis compares and contrasts the effects of various factors on both youth and adult unemployment, and the changes and levels of the unemployment rate. Second, our methodology allows us to take fuller account of output fluctuations on youth unemployment. Like many other studies on similar issues, we also utilize panel data to control for unobserved time-specific or country-specific characteristics. However, unlike these studies which assume that output fluctuations have a common effect across countries, we estimate the country-specific sensitivity of unemployment to output fluctuations and also control for such country-specific output-sensitivity when studying the role of labor market institutions. There is evidence that the sensitivity of unemployment to output varies significantly across countries (e.g., Ball et al., 2013).

Moreover, this paper investigates whether labor market factors amplify or dampen the sensitivity of unemployment to output fluctuations in each country. In the context of the current crisis, a few papers have studied how financial crises affect youth and how labor market institutions affect the reaction of youth unemployment to crisis (e.g., Choudhry et al., 2012b). However, they mainly focus on recessions (rather than output fluctuations in general) and only incorporate select labor market factors into the analysis (e.g., labor market flexibility in Bernal-Verdugo et al., 2012b, and employment protection legislation, O'Higgins, 2012). Our paper covers a broad range of labor market institutions that affect both labor demand and supply. Also, it looks at how each of a broad set of labor market factors affect the sensitivity of youth unemployment rates to the output gap, including during

downturns. We do so by introducing an interaction term of output gaps and labor market institutions.

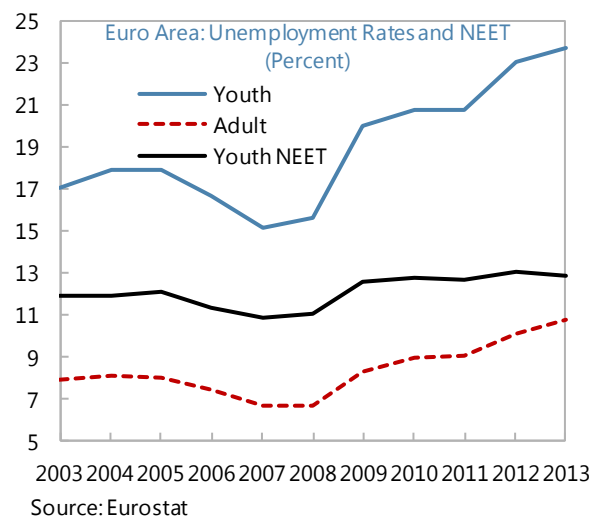
The results suggest that youth unemployment rates are more sensitive to output fluctuations than adult unemployment, and the *significant increase* in youth unemployment during the crisis, especially in vulnerable euro area economies, was largely due to the decline in economic activity. In addition, the persistently high *levels* of youth unemployment could be also explained by a host of labor market institutions, including: the opportunity cost of working (measured by the unemployment benefits), labor costs (measured by the tax wedge and minimum wage relative to the median wage), spending on active labor market policies (ALMPs), vocational training, and labor market duality. Finally, labor market features do not generally affect the sensitivity of youth unemployment to output gaps.

The remainder of the paper is structured as follows: Section II documents stylized facts about labor market dynamics in advanced European countries. Section III describes empirical methodology and data. Section IV summarizes the empirical results, and, finally, Section V concludes.

II. STYLIZED FACTS

The crisis has left a sizable dent in euro area output and investment, which dropped by 2 and 19 percent respectively since their pre-crisis peak. The hardest hit sectors were construction, retail and wholesale sectors, and manufacturing, with sectoral output lower than their pre-crisis peaks by 20 percent, 5 percent, and 4 percent, respectively.

Labor market outcomes have been dismal: about 4 million jobs were lost across the advanced Europe during this time period, with unemployment rates—youth unemployment in particular—rising to unprecedented levels.³ The crisis has reversed a decade-long trend of modest declines in youth unemployment—the youth unemployment rate in the euro area remains elevated at 24 percent in mid-2014, well above the 15 percent rate in 2007. The adult unemployment rate has also risen significantly, but less so than youth unemployment (10¼ percent in mid-2014, from 6½ percent in 2007). The higher youth unemployment rate only partly reflects the fact that the youth labor force is typically smaller than the adult labor

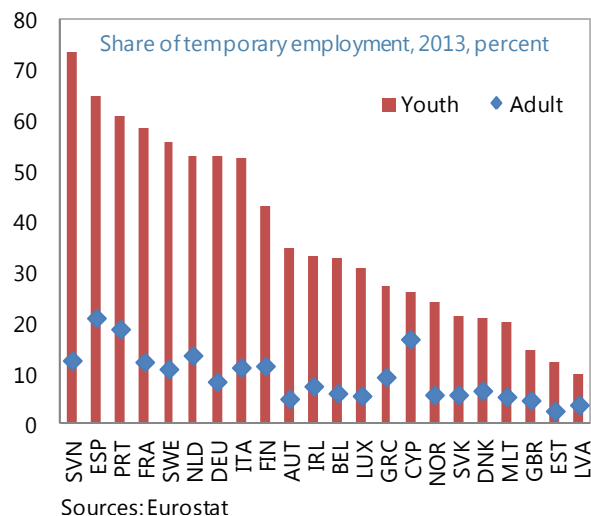


³ Henceforth, youth refers to individuals aged 15–24 years, and adults refer to individuals aged 25–64 years. Unemployment refers to the unemployment rate.

force; the gap between youth and adult unemployment rates has increased significantly after the crisis.⁴ The NEET rate, defined as the share of the youth population that is not employed or involved in further education or training, is less influenced by measurement biases inherent in determining the size of the youth labor force. Even the NEET rates show that the mild improvements that had started before the crisis have now been reversed.

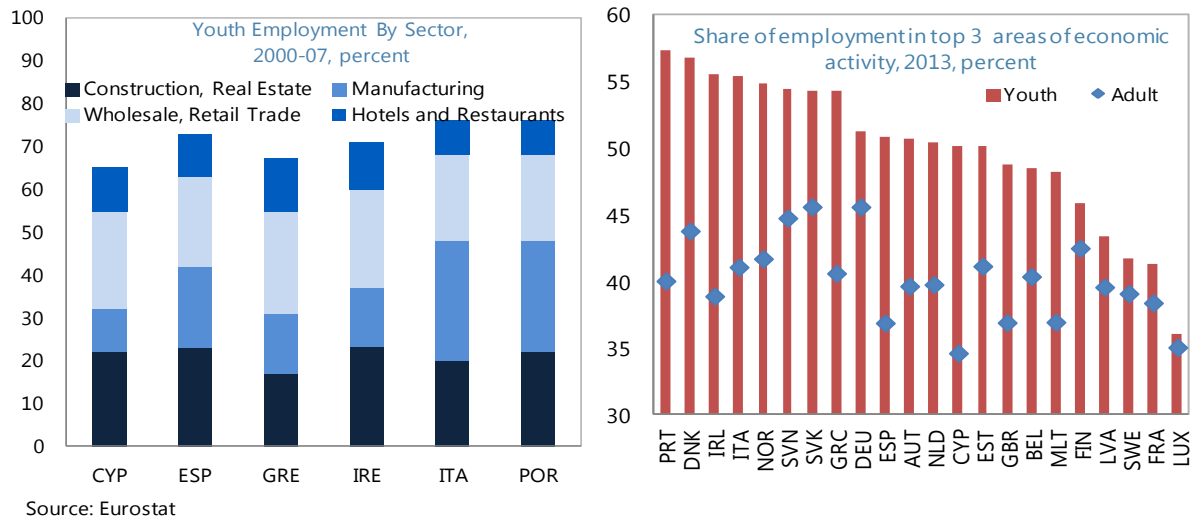
Across the euro area, there are large cross-country differences in the level and change in youth unemployment, and these differences have increased during the crisis. The current unemployment situation reflects a complex mix of developments during the crisis, combined with a variety of pre-crisis unemployment rates. Taking these differences into account, euro area countries can be placed into four buckets: (i) those that witnessed large increases in the youth unemployment during the crisis from relatively low pre-crisis levels (Ireland, Cyprus); (ii) those with above-average unemployment rates before the crisis, but small increases since the crisis (Belgium, France, Finland and Sweden); (iii) those with the worst of both of the above categories—large increases in youth unemployment after the crisis, but relatively high rates to begin with (Greece, Spain, and Italy); and, (iv) those with the best of both worlds (Austria, Netherlands, Germany), with small increases in unemployment (or even a decline in the case of Germany) on top of low pre-crisis unemployment rates to begin with.

Youth employment conditions are fragile, tenuous and concentrated. The young are far more likely to be hired on temporary contracts than adults in all countries, but particularly in Spain, Italy and Portugal, countries which experienced some of the largest increases in youth unemployment during the crisis. Youth employment is also concentrated in sectors which tend to be more sensitive to the business cycle: manufacturing, wholesale and retail trade, and hotels and restaurants. Before the crisis, these sectors comprised 65–75 percent of youth employment in countries where youth unemployment increased the most after the global crisis. In the aftermath of the crisis, the top three sectors below together still employed on average 50 percent of the



⁴ The youth labor force tends to be smaller than that for other age cohorts because young individuals may choose to pursue full-time education, although participation in education does not necessarily exclude participation in the labor force (e.g., part-time work or apprenticeships). The youth labor market is also characterized by frequent search and matching as individuals look for better jobs, using intermediate stages for accumulating experience (and perhaps, occasionally, dropping out of the labor force).

youth and 40 percent of adults. As of 2013, wholesale and retail trade was the dominant sector for youth employment, followed by manufacturing and accommodation and food services.⁵



III. DATA AND METHODOLOGY

A. Variable Selection and Data Coverage

Measure. In line with the literature, this paper uses the unemployment rate as a main measure of youth and adult unemployment. This enables us to exploit existing theoretical frameworks for our analysis, and allows easier comparison with the literature. Some have argued that the unemployment rate is not informative and is a biased measure of the incidence of unemployment given the smaller and more volatile size of the youth labor force. But other measures also come with their own challenges.

Alternative measures. Other unemployment indicators—the NEET rate or the unemployment ratio⁶—can be problematic to use. First, it is challenging to construct the appropriate analytical framework that could allow these measures to be used for empirical analysis, which is, perhaps, also why they are seldom used in the literature. Second, these indicators pose statistical challenges. The NEET rate does not allow for a comparison with adult unemployment as it is only defined for the 15–34 years old age group. The definition of NEET varies across countries,⁷ making cross-country comparisons difficult. As for the

⁵ Top areas of economic activity for adults vary more by country. The dominant ones are human health and social work activities, wholesale and retail trade as well as manufacturing.

⁶ The unemployment ratio is defined as the unemployed as a share of total population.

⁷ The NEET referred to in this paper is the definition adopted in most European countries (Eurofound, 2012). In the United Kingdom (Coles et al., 2002; McGregor et al., 2006) and in New Zealand (Hill, 2003), the NEET mainly capture teenagers. The Japanese definition of NEET refers to people aged 15–34 years old who are not in the labor force, not attending school and not housekeeping (OECD, 2008a), while in Korea NEET refers to

(continued...)

unemployment ratio, it is perhaps as biased as the unemployment rate—both indicators ignore considerations such as: the unemployed not joining the labor force and remaining in education because they could not find a job, or returning to university to avoid a potentially scarring unemployment spell, even though they would have preferred to work; those without a job who are not registered as unemployed; or, those that migrate abroad to study and work. Moreover, the unemployment rates and ratios are closely correlated (with a correlation coefficient of 0.89), suggesting that using one over the other is unlikely to fundamentally change any conclusions regarding the dynamics of youth unemployment.

Measurement of labor market factors. For robustness, a number of different measures are used for each of the following categories of labor market features— labor costs; the opportunity cost of working; collective bargaining; labor market duality; education and training; and spending on ALMPs. In each category, the analysis relied on several indicators and different sources (see Table 1 for definitions). For instance, labor costs were measured by the tax wedge and the ratio of the minimum wage to the median wage under the assumption that the former was most relevant for the youth. Several countries in the euro area do not have minimum wages and this ratio was set to zero in the data base. Similarly, the opportunity costs of employment are measured by gross benefit replacements rates, net replacement rates (benefit replacement rates net of taxes) and “the inactivity trap” which arises when tax and benefit systems interact to reduce the financial incentive of individuals who qualify for social protection benefits to work.

Data challenges. There are several constraints. Some arise from the challenges inherent in capturing the structural characteristics of labor markets in a manner that captures country-specific institutional context. Others arise from the need to measure labor market factors consistently across a broad range of countries and over a long period of time to maximize the sample size.

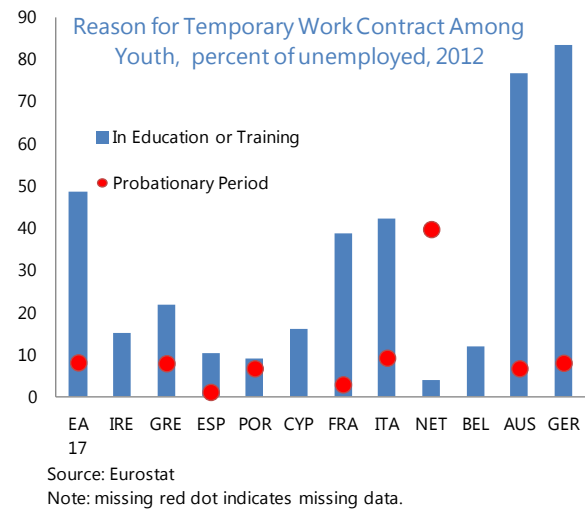
- *Sample size.* Data on the selected labor market institutions is usually not available for the full sample period, and is especially limited for new entrants to the euro area. The smaller sample size implies that country-by-country empirical analysis combining the institutional variables and measures of the business cycle together would not yield robust results. For instance, the data series for some variables (e.g., ALMPs) starts from late 1990s for most countries, and even later for smaller countries; some variables (e.g., OECD’s index for employment protection legislation) are missing in some countries, and other series (e.g., tax wedge) only start from early 2000’s for all countries. This cuts the total sample size significantly, and in some cases, we have to use fewer variables than preferred.

people aged 15-34 years who have left school, are not preparing to enter a company, do not have a job, do not have family responsibilities (or children) and are not married (OECD, 2008b).

- *Duration of the analysis.* Given the long lags in data availability, it is difficult to extend the analysis beyond 2012 at this juncture since only a subset of the labor market variables is available. Thus, labor market reforms since the crisis are not fully captured in the dataset, e.g., Spain's major labor market reforms of 2012 (Ley 3/2012 de medidas urgentes para la reforma del Mercado laboral) which included reforms to collective bargaining, opt-outs and firm level internal flexibility regarding working conditions (wages, hours), and dismissals (conditions, costs).

- *Measurement and relevance.* The analysis had to use data series that were available for a large set of countries over a long period of time. But some of these variables are not always relevant for the young

unemployed (e.g., the unemployment benefit system), nor do they capture the country-specific institutional context that may be driving unemployment. Some variables only partially capture the elements that might have an impact on unemployment. For example, the OECD's indicator on union density measures the incidence of unionization among the employed, but does not measure the degree of centralization or the coverage of unions. Another example is measuring the skill levels of unemployed workers. The level of formal



education may not provide a complete picture of a worker's skills; vocational training and apprenticeships are also important but are difficult to measure. The analysis was based thus on both measures of skills, and survey data on the reasons for temporary work contracts was used as a proxy for the incidence of vocational training. Last but not least, product market flexibility was measured using the Global Competitiveness Index, but this index includes components such as the intensity of local competition, extent of market dominance and anti-monopoly policy, whose effect on unemployment rates may be ambiguous.⁸ On the other hand, alternative measures such as the progress in reducing the cost of starting a business according to the World Bank Doing Business indicators is less comprehensive.

- *Slow moving.* Finally, by their very nature to some extent, structural variables change very slowly from year to year, which makes it difficult to study the impact of reforms on

⁸ The OECD's Product Market Reform indicator is only available every five years. We therefore focus on the Goods Market Efficiency: Competition sub-indicator compiled from the Global Competitiveness Report and the cost of starting a business from the World Bank Doing Business Indicators.

labor market dynamics. Also, labor and product market features have remained relatively unchanged since 2000 for many of the countries in the sample (Figure 1) because of lack of major reforms in several countries, regardless of which indicator is used. In general, these indicators seem to have remained broadly the same or even deteriorated in countries that have witnessed the highest levels and the biggest increases in youth unemployment. Germany and the Scandinavian countries are among the few that have registered improvements.

B. Methodology

There were several methodological constraints. These limitations arose as a result of the data challenges discussed in the previous section and the uncertainties involved in estimating equilibrium values of potential output and unemployment. As a result, the specifications considered below did not take into account non-linear and lagged effects of output and labor market indicators. In addition, significant simplifying assumptions had to be made about the country-specific effects of labor market features.

Okun's Law estimation

The Okun's Law, proposed by Arthur Okun in 1962, is the empirical regularity that changes in unemployment rates and output growth are negatively related.⁹ Many studies confirm this relationship for overall unemployment but research on youth unemployment is less common. Some authors highlight the higher sensitivity of youth unemployment to the business cycle (OECD, 2006; Scarpetta, 1996; Scarpetta et al., 2010; and European Commission, 2013b).

Standard specification. The Okun's coefficient for individual countries is estimated on the basis of the following specification, where $\beta_{2,i}$ is the estimated value of the Okun's coefficient for country i (Table 2):

$$\Delta u_{i,t} = \beta_0 + \sum_{i=2}^{22} \beta_{1,i} c_i + \sum_{i=1}^{22} \beta_{2,i} c_i \Delta y_{i,t} + \varepsilon_{it}, \quad (1)$$

- where $\Delta u_{i,t}$ is the change in youth or adult unemployment rates in country i , year t
- c_i is the dummy variable for country i (other than for country 1 to avoid perfect collinearity)
- $\Delta y_{i,t}$ is output growth, and,

⁹ See Ball et al. (2013) for an extensive discussion on this topic and theoretical derivation of the reduced form relationships in (1) and (1a).

- ε_{it} is the error term with standard assumptions.

Alternative specification. We also consider an alternative specification using the output gap ($y_{i,t} - y_{i,t}^*$) and deviation from natural rates of unemployment $u_{i,t} - u_{i,t}^*$, respectively, as independent and dependent variables. $\beta_{2,i}$ is the Okun's coefficient in this model (with estimates provided in Table 2):

$$u_{i,t} - u_{i,t}^* = \beta_0 + \sum_{i=2}^{22} \beta_{1,i} c_i + \sum_{i=1}^{22} \beta_{2,i} c_i (y_{i,t} - y_{i,t}^*) + \varepsilon_{it}, \quad (1a)$$

Ball et al. (2013) argue in favor of the specification (1a) on the grounds that specification (1) is only theoretically valid if one is willing to assume a constant equilibrium unemployment rate as well as constant potential growth. However, estimating the output gap and deviation from structural unemployment in specification (1a) is difficult. We use output gap estimates from the IMF's *World Economic Outlook* database and apply the HP filter (with a smoothing parameter of 100) to get the natural rate of unemployment. The HP filter suffers from the well-known problems of unreliability at the end of the sample, and using output gap measurement from WEO allows us to sidestep this problem somewhat for potential output, but not for the natural rates of unemployment. Therefore, the specification in differences in equation (1) is our referred method for estimating the Okun's coefficient.

Disaggregation. The idea of disaggregating the Okun's Law specification into the impact of various expenditure components was proposed in Anderton et al. (2014), which, however, did not differentiate between youth and adult unemployment. We apply this methodology as well to see which component of growth—consumption, investment and exports—has the largest effect on unemployment. For practical purposes, this involves replacing $\Delta y_{i,t}$ in equation (1) by the growth of various expenditure components (namely, growth in consumption, investment and exports). The results are listed in Table 3.

The role of labor market institutions

Due to the previously discussed data challenges, it is not feasible to estimate country-specific effects of several labor market factors simultaneously, while also allowing for individual country effects of the business cycle (measured by the output gap). As a result, this paper considers two model specifications.

Multivariate approach. This specification considers the effect of several labor market features (and output gap) simultaneously, but restricts their impact to be the same across countries, while allowing the impact of the business cycle to vary across countries. More formally, the specification for the multivariate approach is given by the following model with the estimates provided in Table 4:

$$u_{i,t} = \beta_0 + \beta_{1,i}c_i + \sum_j \gamma_j x_{i,j,t} + \sum_{i=1}^{22} \beta_{2,i}c_i(y_{i,t} - y_{i,t}^*) + \varepsilon_{i,t}, \quad (2)$$

- where $u_{i,t}$ is the level of the youth or adult unemployment rate,
- c_i is the dummy variable equal to 1, if dependent variable is from country i ,
- $(y_{i,t} - y_{i,t}^*)$ is the output gap, and
- $x_{i,j,t}$ represents labor market institution j , in country i , year t .

Univariate approach. An important drawback of the multivariate specification (equation (2) above) is the reduction in sample size as additional labor market variables are added to the list of x . To circumvent this limitation, equation (2) was also estimated for each labor market feature individually. The results of this approach are listed Table 5.

Univariate approach with interaction term. The trade-off between maximizing the sample size and incorporating variable effects of labor market factors in each country also motivates our second univariate approach.

This approach also considers the impact of one labor market feature at a time but allows its impact to vary across countries via its interaction with the business cycle. We consider the following specification, with the same notations as in (2):

$$u_{i,t} = \beta_0 + \beta_{1,i}c_i + \beta_2 x_{i,t} + \sum_{i=1}^{22} \beta_{3,i}c_i(y_{i,t} - y_{i,t}^*) + \sum_{i=1}^{22} \beta_{4,i}c_i x_{i,t}(y_{i,t} - y_{i,t}^*) + \varepsilon_{i,t}, \quad (3)$$

This specification includes one additional term—the interaction of the labor market variable institutional variable, output gap, and the country dummy. It is based on the assumption that (i) labor market features may affect the way unemployment rates responds to the business cycle, and this impact may vary across countries; and the simplifying assumption that (ii) the effect of the labor market factor remains the same across countries, except indirectly via its impact on the business cycle.

From equation (3), the marginal impact of the change in labor market feature $x_{i,t}$ on the *level* of unemployment is given by the partial derivative:

$$\frac{\partial u_{i,t}}{\partial x_{i,t}} = \beta_2 + \beta_{4,i}c_i(y_{i,t} - y_{i,t}^*),$$

Thus, the impact of a change in any labor market feature differs across countries. Crucially, the marginal effects of a unit change in variable labor market factor will then depend on the value of the output gap $y_{i,t} - y_{i,t}^*$ at which they are evaluated. This point is calculated at *the*

country-specific average output gap during the sample period. The standard errors for the marginal effects are computed using the delta method. The results of this approach are summarized in Figure 2.

Robustness check. A variety of additional specifications were considered, e.g., using the total unemployment rate and employment rates for different age groups as dependent variables. In addition, we have considered models with changes in labor market institutions as independent variables and output growth instead of the output gap as the independent variable, to mimic the standard Okun's law formulation in (1) more closely.

Levels versus changes. Our preference ultimately lies with models that feature levels (not changes) of unemployment rate as dependent variables. A number of theoretical models of unemployment are consistent with using unemployment rate in levels as dependent variable in reduced-form equations. For example, Nickell and Layard (1999) develop a wage bargaining model with numerous identical firms, showing that equilibrium *level* of unemployment rate will be decreasing in any exogenous factor that increases job separation rate (represented in our case by the output gap), increases the search effectiveness of the unemployed (represented by ALMPs), lowers the benefit replacement ratio, lowers the strength of the workers in the wage bargain (union density) or raises the elasticity of product demand facing the firm. The latter argument even suggests some scope for including variables associated with product market regulation into unemployment equations. Other examples of similar models include Scarpetta (1996) and Bassanini and Duval (2006), who estimate a specification very similar to ours.¹⁰

IV. EMPIRICAL RESULTS

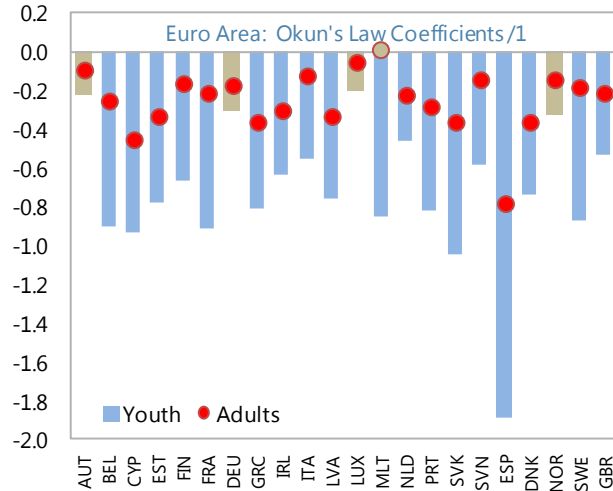
This section discusses the main results from the various specifications described in Section III. Some of these results need to be interpreted with caution given the methodological and data constraints already discussed. Moreover, it would be important to remember that these results do not measure the impact of the reforms undertaken in countries after the crisis as they fall outside the sample period. Some results are counterintuitive and difficult to explain without additional granular information about other relevant and country-specific factors.

¹⁰ Bassanini and Duval (2006) estimate a reduced-form equation consistent with a variety of theoretical models of labor market $u_{i,t} = \sum_j \beta_j X_j + \chi G_{i,t} + \alpha_i + \lambda_t + \varepsilon_{i,t}$ equilibrium (job search, wage setting), where unemployment is regressed on a series of structural variables (in vector X), an output gap measure (G), as well as country and time fixed effects. We depart from this specification by including interaction terms and excluding time fixed effects (equation 2).

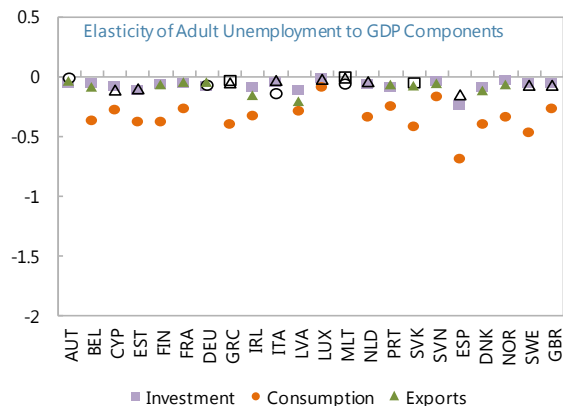
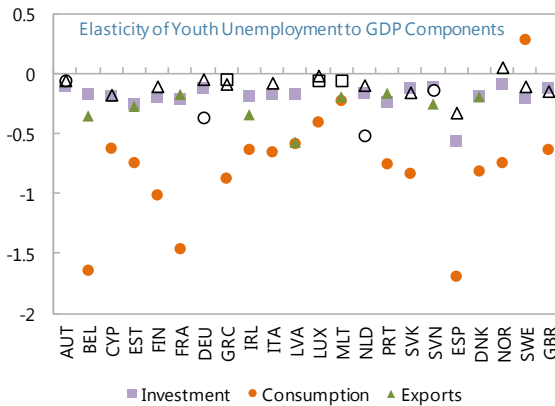
A. Estimating the Okun's Coefficient

Standard Okun's coefficient. We find unambiguous evidence validating the Okun's law across a wide range of countries. This is true regardless of how output fluctuations are measured—by real GDP growth or the output gap. In equations (1) and (1a), cyclical factors explain around 50 percent of the variation in the changes in youth unemployment rates and around 60 percent for adult unemployment rates across all advanced European countries, as measured by the R-squared (Table 2). Youth unemployment is more sensitive than adult unemployment in every country, reflecting their relatively fragile unemployment conditions.

Disaggregated Okun's coefficient. In order to find out which component of growth relates most to youth and adult unemployment, the Okun's law regression (1) was generalized and estimated by using growth rates of consumption, investment and exports as independent variables. The results indicate that, for most countries in the sample, youth and adult unemployment rates are most sensitive to consumption growth but much less sensitive to export growth in many countries



1/ Shaded bars and circles reflect estimations that are not significant.



Sources: Eurostate WEO; authors' estimates. Unfilled shapes indicate statistically insignificant coefficients.

(Table 3). This is broadly consistent with the findings by Anderton et al. (2014), which argues that “this reflects the highly labor-intensive nature of the services that represent the bulk of consumers’ expenditure, while the higher productivity manufacturing-related content of exports tends to be less labor intensive.”

Greater sensitivity of youth. All estimates of the Okun's coefficient suggest that youth unemployment is much more sensitive to the business cycle than adult unemployment. In every country, the estimated Okun's coefficient is, on average, two to three times as large for the youth than for adults. It is partly because a smaller labor force means youth unemployment rates necessarily react more sharply than adult unemployment rates to a change in the GDP growth or output gap. However, it could also be explained by the greater concentration of youth employment in cyclically sensitive industries and perhaps in small- and medium-sized enterprises (SMEs) (Box 1).

Box 1. SMEs: Financing Constraints and Youth Unemployment

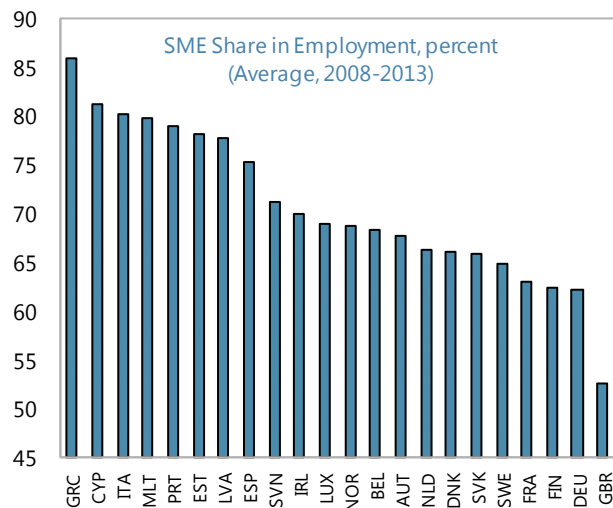
Small- and medium-sized enterprises (SMEs)¹¹ employ the majority of the labor force in Europe, with the employment share especially high in some stressed economies which experienced high increases in youth and adult unemployment rates—more than 75 percent for Spain, Italy and Portugal, for example. SMEs are usually more financially constrained than larger firms, particularly in the current environment of financial fragmentation and private sector deleveraging.

The Okun's law framework is augmented with financial constraints—measured as either the share of firms in industry and services sectors which report financial constraints as a factor limiting production in surveys conducted by the EC or the average share of SMEs in an economy. The surveys do not list SMEs as a separate category, but evidence from other data sources, e.g. bank lending surveys, suggests that they are more affected by financial constraints than larger firms.¹

Greater financial constraints are associated with higher youth unemployment.

- Controlling for country-specific fixed effects and output gap, an additional percentage point of firms reporting financial constraints is associated with higher youth unemployment rates by 0.3 and 0.4 percentage points (for industrial and services sector respectively). The effect on adult unemployment rates is smaller (0.2 percentage points).
- A 10-percentage-point increase in the average employment share in SMEs (or the SME share of value added) lowers the Okun's coefficient by 0.1, making unemployment more pro-cyclical.

¹ There are data limitations. The average share of SME up to 2008 is used for each country because the data is available only from 2008 and stays broadly constant. The percentage of firms reporting financial constraints is small (often zero) and relatively unchanged, e.g., before the financial crisis only 2 percent of industrial firms reported financial constraints, on average, compared to 2012–2013 when the average was 9.3 percent.



Sources: European Commission; authors' calculations

Cross-country variation. The Okun's coefficient, i.e., the sensitivity of unemployment rates to output fluctuations, varies across countries. Estimates range from not significantly

¹¹ SMEs are defined as firms with less than 250 employees, turnover of less than 50 million euro or a balance sheet less than 43 million euro.

different from zero (e.g., Austria, Germany¹²) to -1.9 in Spain, i.e., a one-percentage-point reduction in growth increases youth unemployment rates by almost 2 percentage points. The ranking in the size of the Okun's coefficient of the countries is consistent with the estimates reported in Ball et al. (2013), who document the largest coefficient for Spain and the smallest one for Austria.¹³

Intercept. The intercept in the Okun's law equations (1) and (1a) also has an interesting interpretation, which is sometimes overlooked. The intercept (including the fixed effect component) would equal the change in unemployment rate when economic growth is zero. Ball et al. (2013) point out that under the assumption of constant potential growth, the intercept equals the product of minus the implied potential growth rate and the estimated Okun's law coefficient. In other words,

$$\beta_0 + \beta_{1,i} = -\beta_{2,i}\Delta y^* \text{ in equation (1)}$$

Because the Okun's law coefficient is empirically expected to be negative, this suggests that the intercept in equation (1) should always be positive. The estimates in Table 2 confirm that this is indeed the case. Intuitively, a positive intercept implies that if actual growth is zero, while potential growth is positive, the unemployment rate is expected to increase because of a wider output gap. High values of the intercept terms suggest greater difficulties in sustainably reducing unemployment, or, put differently, a stronger growth is required to prevent unemployment rates from rising. Spain has the highest Okun's law intercept for youth unemployment exceeding 5 percentage points, with intercepts for Cyprus, Estonia, Greece, Ireland, Latvia, Portugal, Slovakia, and Sweden exceeding 2 percentage points. Only for Austria, Germany, Netherlands, and Norway are intercepts not significantly different from zero. On the other hand, the intercepts in equation (1a) (also including fixed effects) are almost all insignificant with the exception of Latvia. This is also consistent with economic theory—when output gap is zero, the deviation of unemployment rate from its natural level should be zero as well.

Business cycle effects across specifications. How does the impact of the business cycle or the output gap differ across specifications, i.e. between equation 1(a) which excludes the effect of labor market factors, and (2) and (3) that includes labor market factors? The estimations are not comparable because of very different sample sizes. The estimates of the Okun's coefficient according to equation 1(a) are based on 565 observations (Table 2). The output gap coefficients in equation 2, on the other hand, are based on samples sizes that range from 99–160 observations (Table 4); these results are less robust and have therefore not been reported in this paper to avoid confusion. It is therefore not meaningful to compare the results

¹² Even in those cases, some studies have found that the Okun's law holds for measures of hours worked. For instance, instead of layoffs, German companies resorted to a decrease in average hours worked per worker (Reisenbichler and Morgan, 2012).

¹³ Not surprisingly, the magnitudes differ somewhat from Ball et al. (2013) because our analysis focuses on specific age groups of the unemployed.

across specifications to derive the additional explanatory power from the inclusion of labor market factors in the estimations, all the more so because of the simplifying assumption that labor market factors have the same effect across all countries.

B. Estimating the Role of Labor Market Features

Output changes, on average, explain about 50 percent of the increase in youth unemployment rates during the crisis, as shown in Table 2. Drawing on the labor market literature, this section examines the role of other possible explanatory factors, in particular the structural features of the labor market.

Empirical results. Changes in labor market variables were found to not be significant explanatory factors for the increase in youth unemployment rates. The lack of a robust relationship between labor market factors and changes in the unemployment rate could simply reflect the empirical, specification and data challenges that have already been discussed as well as the inability of the chosen labor market variables to capture country-specific institutional details that may also be relevant in individual countries.

However, the results of the multivariate approach (equation (2)) suggest that a number of labor market features are significantly associated with the levels of youth unemployment rate (Table 4). In particular, lower labor costs (measured by the tax wedge and minimum wages relative to the median wage) and higher spending on ALMPs, especially for training, are associated with lower unemployment. Higher opportunity costs of working (measured by gross and net benefit replacement rates) and stronger labor market duality (indicated by higher shares of temporary workers and lower employment protection of temporary workers) tend to raise unemployment, whereas collective bargaining (proxied by union density) has mixed effects which are not robust.

Robustness. The above results are, by and large, confirmed by the univariate approaches as well. However, there is a wide divergence in the range of estimates in part due to different sample sizes used for the different estimations because of data constraints. Considering one variable at a time allows the utilization of the whole sample for which data is available for the regressor variable whereas in a multivariate specification the length of the sample is determined by the sample size of the variable for which the data is least available. Thus, the sample size can generally be much larger for the univariate estimations than for the multivariate estimations. However, an important caveat to the results of the univariate regressions is that they may be prone to omitted variable bias when there are significant correlations among different labor market features which affect unemployment. Subsequent references to the estimation of the impact of labor market features generally refer to the multivariate specifications reported in Table 4, unless otherwise specified.

Greater hiring costs are associated with higher unemployment rates in the literature. Taxes on employers and employees, together with high statutory minimum wage rates increase

labor costs and reduce labor demand. Our results indicate that a one-percentage-point increase in the tax wedge is associated with an increase in youth unemployment rates by 0.3-1.3 percentage points. The size of the correlation with adult unemployment is smaller (around 0.4–0.5 percentage points). A one-percentage-point increase in minimum wages (relative to median wages) is associated with an increase in youth unemployment by 0.4-1.2 percentage points, while the magnitude is smaller for adults. This is consistent with the finding of OECD (2012) that since 2007 the young have on average been at a big disadvantage in countries where the minimum wage is relatively high as a share of median pay.¹⁴

Generous unemployment benefits can raise unemployment by reducing the willingness to search for jobs and/or increasing the reservation wage to accept job offers.¹⁵ Our results indicate that youth and adult unemployment rates tend to be higher when the opportunity costs of working are high. A one-percentage-point increase in the gross replacement rates¹⁶ is associated with higher youth unemployment by 0.4–0.5 percentage points and higher adult unemployment rates by 0.1–0.2 percentage points.

An *inactivity trap* can arise through the interaction of tax and benefit systems. High social protection benefits can reduce financial incentives to work because the combined effects of increased tax payments and withdrawn income-tested benefits offset the potential gain in disposable incomes from increased earnings. Higher inactivity trap is not significantly related to unemployment when other labor market features are controlled for (Table 4), but is associated with higher unemployment when investigated alone (Table 5).

Theoretically, *labor market duality*—a high share of temporary employment contracts together with lower employment protection for the temporary workers—has an ambiguous impact on unemployment. This is because stronger employment protection lowers not only job separation rates by increasing the cost of firing, but also the job finding rate by increasing the reluctance to hire workers in the first place. Our estimates suggest that a stronger labor market duality can have a detrimental effect on the employment of young people. Higher employment protection for temporary contracts is related with lower unemployment rates for youth and adults, with stronger effects for the youth given their higher share of employment on temporary contracts.¹⁷ A one-unit increase in the rating for employment protection

¹⁴ See also Bernal-Verdugo (2012a).

¹⁵ Young workers may not be entitled to full unemployment benefits given their short employment histories. However, OECD (2006) finds a negative impact of generous unemployment benefits on youth employment that is comparable in magnitude to other age cohorts.

¹⁶ We rely on the OECD gross replacement rate measure due to its availability for a longer period of time (1983-2011, on a biannual basis).

¹⁷ These results are in line with some recent studies—labor market duality has been associated with lower youth employment rate in a sample of 17 OECD countries over 1960–1996 (Bertola et al., 2007), and flexible labor market is found to help improve youth labor market outcomes (OECD, 2006, and Choudhury et al., 2012a).

legislation (EPL)¹⁸ is associated with a decline in youth unemployment rates by 2.5-5 percentage points and adult unemployment by 1.5–2 percentage points. A one-percentage-point increase in the share of youth on temporary contracts is associated with an increase in youth unemployment by 0.3–0.4 percentage points, but the relation with adult unemployment rates is not statistically significant.

Overall, the role of *higher union density* is found to be unclear and not robust. A one-percentage-point increase in union density could be associated with lower youth unemployment rates by 0.2–0.6 percentage points under some specifications.¹⁹ However, this finding is not robust to alternative specifications, including using different control variables or allowing country-specific interactions. The results from specifications with employment as dependent variable²⁰ suggest that higher union density may be associated with an altered employment composition, perhaps because employers prefer to hire the non-unionized youth instead of the unionized adults in order to preserve the flexibility to adjust the work force as needed, leading to higher employment for the youth and lower employment for adults.

Educational attainment tends to improve employability (OECD, 2013b). Vocational training and expanded access to training could help make temporary jobs a stepping stone toward open-ended contracts (OECD, 2004). Our results indicate that access to vocational training—measured by the share of temporary workers under probation or vocational training—is associated with lower youth unemployment by around 0.3 percentage points, but is not statistically significant for adult unemployment. A higher share of individuals with low levels of education has generally no significant effects on youth unemployment or employment rates, but has a strong negative effect on adult unemployment and employment rates. Low education may be less of an obstacle for youth employment, perhaps because young workers can be more easily trained than adults.

Most empirical studies using macro-level data have found that *ALMP spending*, especially on training, reduces total unemployment (OECD, 2006). We find that higher spending on ALMPs, especially on training, is associated with reductions in both youth and adult unemployment rates. An additional thousand euros per unemployed increase in ALMPs spending is associated with lower youth and adult unemployment rates by around 0.3 and 0.1 percentage points respectively.²¹

¹⁸ The rating is on a scale from 1 (least protection) to 6.

¹⁹ This result is based on the OECD's indicator on union density which measures the incidence of unionization among the employed, but does not measure the degree of centralization.

²⁰ Not reported in this paper, but available upon request.

²¹ However, micro-level studies find that the effectiveness of ALMPs varies, and that programs similar at appearance can yield very different outcomes (e.g., Card, et al., 2010; Kluve, 2010). ALMPs need to be designed and monitored properly as analysis of such programs shows that the impact and cost-effectiveness of ALMPs vary significantly based on their design. Studies also show that ALMPs that target young people are not

(continued...)

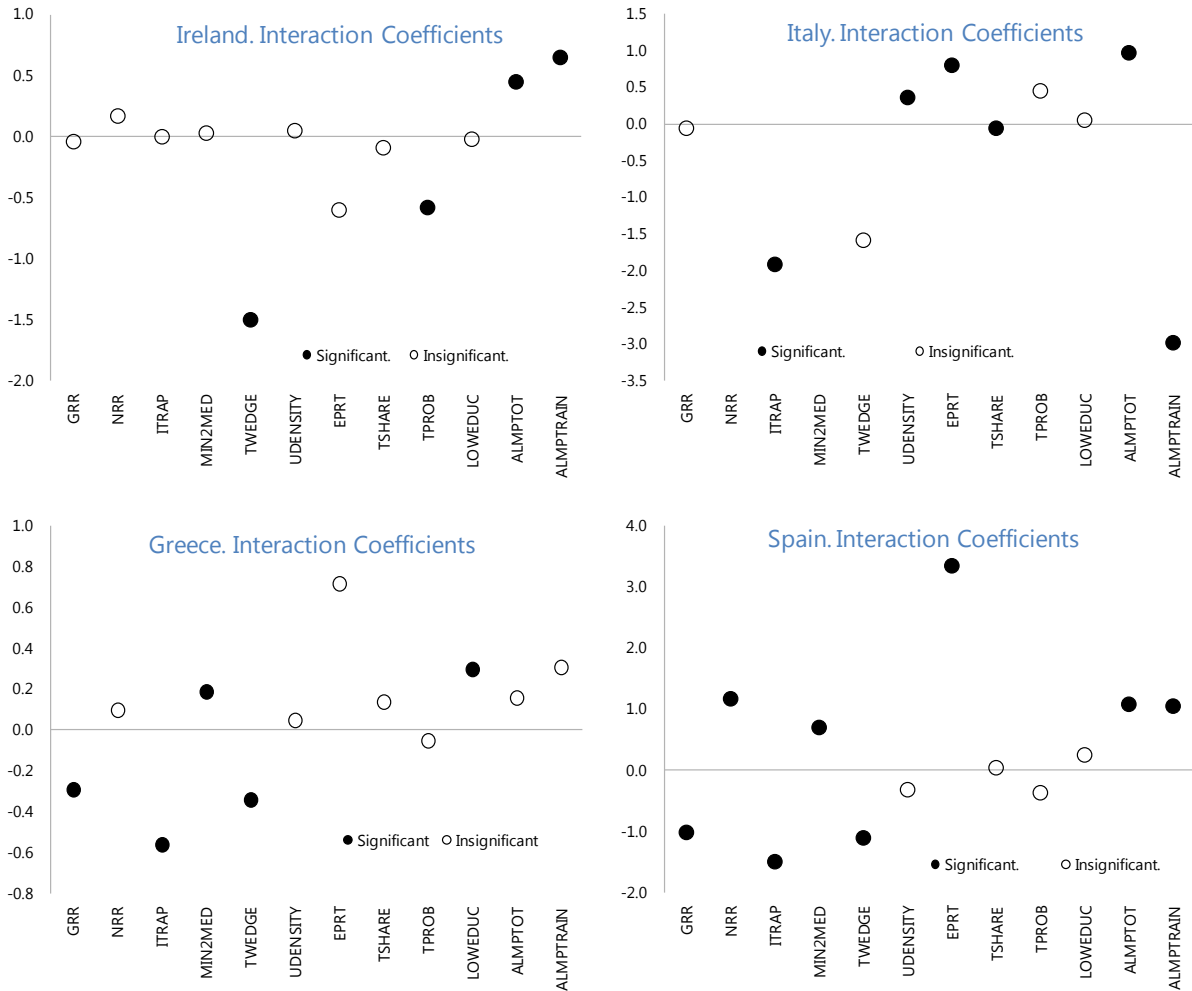
Impact on sensitivity to business cycle. Allowing for interactions between labor market features and output fluctuations, as specified in equation (3), reveals significant cross-country differences in the role of labor market features. The coefficient before the interaction term of the output gap and the labor market variable would indicate the direction and magnitude of such effect. Given that the Okun's coefficient is negative, a negative (positive) coefficient would imply that a particular labor market variable amplifies (dampens) the impact of the business cycle on unemployment (Table 6). Our analysis, for the most part, finds only limited evidence that labor market features change how youth unemployment responds to output fluctuations. For instance, a higher tax wedge is found to amplify the impact of the business cycle for Finland, Greece, Ireland, Slovakia and Spain, and dampen the impact for Denmark, Sweden and the United Kingdom (column 5, Table 6). Similarly, total ALMP spending is found to dampen the business cycle effect in Ireland, Slovakia, and Spain, but amplify the impact in Finland, France, and Malta. Some of these results may seem counterintuitive and cannot be properly explained without a detailed assessment of country-specific factors that may be influencing the results but are not adequately captured in the model specification.

C. The Role of Product Market Reforms

Some authors have suggested that insufficient progress in other structural reforms—e.g., product market liberalization—is also an obstacle to facilitating greater youth employment (see e.g. Nicoletti and Scarpetta, 2001). Picking the appropriate indicator for cross-country comparison in this dimension was not easy (see Section III), and the chosen measure of product market reform has important limitations. Thus, it is not surprising that we did not find conclusive evidence of the link between these indicators and youth unemployment. For the indicator “goods market efficiency” the estimated coefficient generally have the correct signs, but the results are only significant in a few countries. The strongest effects are on adult employment where higher goods market efficiency is associated with higher employment. The results from using the “cost of doing business indicator” are counterintuitive, perhaps because many countries have done reforms aimed at reducing the cost of starting a business in the aftermath of the crisis, suggesting substantial endogeneity.

However, these results should not be construed as evidence against the importance of product market reforms to facilitate entrepreneurship, but rather of data limitations. A suitable indicator for measuring the ease of entrepreneurial activity on a cross-country basis is needed, especially with regard to the ease of starting a new business.

very effective regardless of the type of the program. See “Youth Unemployment in Advanced Economies in Europe: Searching for solutions,” IMF SDN14/11, Box 1.



Note: The data refers to the coefficients for the interaction between labor market features and the output gap. Source: Authors' estimates.

V. CONCLUSIONS

This paper documents labor market dynamics in advanced European countries, contrasting developments in youth and adult labor markets. The analysis investigates the roles of growth and labor market features in influencing both youth and adult unemployment rates. There is considerable heterogeneity across countries in the levels and dynamics of youth unemployment, labor market features and the responsiveness of the labor market to the business cycle. Nevertheless, a few significant conclusions emerge.

Youth unemployment is more sensitive to economic growth than adult unemployment, and the drop in economic activity during the global financial crisis explains the increase in unemployment since 2007 to a large extent, especially in countries that experienced the highest unemployment. The persistently high levels of unemployment across countries are explained by both the output gap and a number of labor market features, such as the tax

wedge, minimum wages relative to the median, spending on ALMP, and the generosity of unemployment benefit systems, the availability of vocational training and the incidence of labor market duality. As the economic recovery takes hold and unemployment rates return closer to their historical averages, labor market institutions may play an increasingly large role in influencing labor market dynamics.

The analytical approaches adopted in this paper have been limited by the availability of comparable data across countries for a variety of structural reform indicators as well as uncertainties regarding estimations of the output gap and the equilibrium rate of unemployment. The results therefore may not reflect sufficient country-specific information, nor do they include the non-linear and lagged effects of the explanatory variables; all this could have a material effect on the unemployment outcome in a given country. Overcoming these methodological and data limitations could be a productive avenue for future research. Nevertheless, the cross-country evidence presented here can highlight systematic patterns of cross-country divergence and serve as motivation for country-specific analysis. Achieving a sustainable reduction in unemployment rates in a number of advanced European countries will be an enormous challenge, suggesting that more analysis will continue to be required in the future for these countries.

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Table 1. Data Definitions

Variable	Definition	Source
Output gap	(Real GDP - Real potential GDP) as a percent of real potential GDP	WEO (estimates as of Feb. 2014)
GDP growth	Year-on-year growth of GDP, constant price	WEO
Unemployment rate	Unemployed population as a percent of labor force in corresponding age cohort.	Eurostat
Net replacement rate	Net benefits replacement rate is defined as the ratio of net income while out of work (mainly unemployment benefits if unemployed, or means-tested benefits, if on social assistance) divided by net income while in work. A lower net replacement rate is associated with greater incentive to search for and take up a job when unemployed.	European Commission Tax and Benefits Indicators Database
Gross replacement rate	Average of the gross unemployment benefit replacement rates for two earnings levels, three family situations and three durations of unemployment.	OECD
Inactivity trap	The inactivity trap - or the implicit tax on returning to work for inactive persons - measures the part of additional gross wage that is taxed away when an inactive person (not entitled to receive unemployment benefits but eligible for income-tested social assistance) takes up a job. In other words, this indicator measures the financial incentives to move from inactivity and social assistance to employment.	European Commission Tax and Benefits Indicators Database
Minimum wage/Median wage	Minimum wage relative to median wage for full-time workers. This ratio is set to be zero for countries without a national minimum wage.	OECD
Protection of temporary workers	Strictness of employment protection for temporary contracts.	OECD
Share of temporary workers	Temporary employees as percentage of the total number of employees.	Eurostat
Tax wedge (EC)	The tax wedge is defined as the proportional difference between the costs of a worker to their employer (wage and social security contributions, i.e. the total labour cost) and the amount of net earnings that the worker receives (wages minus personal income tax and social security contributions, plus any available family benefits). Tax wedge measures both incentives to work (labour supply side) and to hire persons (labour demand side).	European Commission Tax and Benefits Indicators Database
Union density	Trade union density corresponds to the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners (OECD Labour Force Statistics). Density is calculated using survey data, wherever possible, and administrative data adjusted for non-active and self-employed members otherwise.	OECD
Adjusted bargaining power	Employees covered by wage bargaining agreements as a percentage of all wage and salary earners in employment with the right to bargaining, adjusted for the possibility that some sectors or occupations are excluded from the right to bargain (removing such groups from the employment count before dividing the number of covered employees over the total number of dependent workers in employment).	The QOG (Quality of Government) Institute, University of Gothenburg
Share of temporary workers on probation	Proportion of total temporary workers on probation (other reasons for being on temporary contracts include "could not find a permanent job", "did not find a permanent job", "in education or training").	Eurostat
Share of low-educated workers	Persons with lower secondary education attainment.	Eurostat
ALMP total spending per unemployed	Active labor market policies are programs that intervene in the market to address unemployment, via increasing employment opportunities for job seekers and improving balance between jobs available and qualified job seekers. Total spending per unemployed includes spending on labor market services, training, hiring incentives for firms, supported employment and direct jobs (for the public/nonprofit sector), and start-up incentives for self-employment.	Eurostat
ALMP spending per unemployed on training	Active labor market policy: spending on training per unemployed. This is a sub-component of the total ALMP spending defined above. Spending on training is among the largest components of ALMP spending in most countries.	Eurostat

Table 2. Okun's Law Estimates

	Specification in Differences				Specification with Output Gap			
	Youth	Adult	Youth	Adult	Youth	Adult	Youth	Adult
	Intercepts ($\beta_0 + \beta_1, i$)		Okun's Coefficients (β_2, i)		Intercepts ($\beta_0 + \beta_1, i$)		Okun's Coefficients (β_2, i)	
Austria	0.54 (0.67)	0.16 (0.16)	-0.21 (0.26)	-0.09* (0.05)	-0.06 (0.15)	-0.00 (0.07)	-0.23*** (0.07)	-0.09** (0.04)
Belgium	1.65** (0.66)	0.41*** (0.14)	-0.90*** (0.27)	-0.25*** (0.07)	0.04 (0.37)	0.01 (0.13)	-0.93*** (0.21)	-0.27*** (0.09)
Cyprus	3.51*** (0.85)	1.49*** (0.42)	-0.93*** (0.27)	-0.45*** (0.12)	-0.42 (0.67)	-0.16 (0.25)	-1.12*** (0.37)	-0.42** (0.20)
Estonia	3.64*** (0.69)	1.47*** (0.56)	-0.78*** (0.09)	-0.33*** (0.07)	0.76 (0.78)	0.34 (0.36)	-0.92*** (0.12)	-0.42*** (0.06)
Finland	1.76*** (0.48)	-0.05 (0.12)	-0.67*** (0.12)	-0.16*** (0.03)	0.12 (0.62)	0.07 (0.13)	-0.96*** (0.18)	-0.17*** (0.03)
France	1.81*** (0.63)	0.49*** (0.16)	-0.91*** (0.27)	-0.21*** (0.06)	-0.12 (0.39)	-0.03 (0.12)	-0.92*** (0.18)	-0.22*** (0.06)
Germany	0.49 (0.55)	0.32 (0.22)	-0.30 (0.20)	-0.17** (0.08)	-0.20 (0.33)	-0.17 (0.20)	-0.15 (0.10)	-0.13** (0.05)
Greece	2.28*** (0.44)	1.10*** (0.29)	-0.81*** (0.12)	-0.36*** (0.09)	0.17 (0.40)	0.08 (0.19)	-0.79*** (0.14)	-0.35*** (0.07)
Ireland	3.11*** (0.59)	1.35*** (0.34)	-0.64*** (0.10)	-0.30*** (0.06)	-0.09 (0.27)	-0.04 (0.16)	-0.94*** (0.08)	-0.40*** (0.04)
Italy	0.97** (0.49)	0.33** (0.15)	-0.55*** (0.20)	-0.12* (0.06)	0.23 (0.47)	0.06 (0.13)	-0.56* (0.31)	-0.13 (0.09)
Latvia	3.18*** (0.65)	1.49*** (0.31)	-0.76*** (0.08)	-0.33*** (0.04)	-2.96*** (0.75)	-1.52*** (0.24)	-1.06*** (0.07)	-0.48*** (0.05)
Luxembourg	1.22* (0.65)	0.27* (0.14)	-0.19 (0.12)	-0.05** (0.02)	0.25 (0.45)	0.05 (0.10)	-0.11 (0.07)	-0.03 (0.02)
Malta	1.62** (0.82)	0.01 (0.25)	-0.85*** (0.32)	0.01 (0.09)	-0.35 (0.31)	-0.00 (0.09)	-0.88*** (0.15)	-0.00 (0.05)
Netherlands	0.68 (0.66)	0.33** (0.16)	-0.46** (0.22)	-0.22*** (0.04)	-0.06 (0.23)	-0.03 (0.12)	-0.41*** (0.11)	-0.19*** (0.07)
Portugal	2.50*** (0.51)	1.00*** (0.15)	-0.82*** (0.14)	-0.28*** (0.04)	-0.38 (0.30)	-0.06 (0.11)	-0.85*** (0.13)	-0.32*** (0.05)
Slovakia	4.95*** (0.83)	1.57*** (0.54)	-1.05*** (0.15)	-0.36*** (0.09)	-0.81 (1.00)	-0.27 (0.48)	-1.77*** (0.66)	-0.52** (0.25)
Slovenia	1.39** (0.66)	0.55*** (0.18)	-0.58*** (0.15)	-0.14*** (0.02)	-0.35 (0.43)	0.03 (0.14)	-0.40*** (0.11)	-0.19*** (0.05)
Spain	5.21*** (0.63)	2.36*** (0.22)	-1.89*** (0.18)	-0.78*** (0.08)	0.09 (0.36)	0.04 (0.22)	-2.17*** (0.19)	-0.92*** (0.12)
Denmark	1.08** (0.51)	0.55*** (0.17)	-0.74*** (0.19)	-0.36*** (0.06)	-0.20 (0.20)	-0.11 (0.10)	-0.78*** (0.09)	-0.44*** (0.06)
Norway	0.83 (0.71)	0.21* (0.11)	-0.32 (0.23)	-0.14*** (0.04)	-0.01 (0.21)	0.08 (0.08)	-0.86*** (0.11)	-0.32*** (0.05)
Sweden	2.50*** (0.57)	0.36 (0.23)	-0.87*** (0.18)	-0.18** (0.07)	0.49 (0.65)	0.02 (0.23)	-0.88*** (0.24)	-0.08 (0.07)
United Kingdom	1.40** (0.62)	0.46*** (0.12)	-0.53*** (0.18)	-0.21*** (0.04)	0.11 (0.20)	0.04 (0.10)	-0.70*** (0.13)	-0.30*** (0.05)
Total observations	554	493			565	509		
Adjusted R-squared	0.51	0.58			0.53	0.57		

Sources: Authors' estimates

Table 3. Okun's Law: Decomposition of Expenditure Components

	Youth	Adult	Youth	Adult	Youth	Adult
	Consumption ($\beta_{2,i}$)		Investment ($\beta_{2,i}$)		Exports ($\beta_{2,i}$)	
Austria	-0.05 (0.47)	0.03 (0.23)	-0.10*** (0.03)	-0.05*** (0.02)	-0.05 (0.03)	-0.03*** (0.01)
Belgium	-1.64*** (0.54)	-0.36** (0.16)	-0.17*** (0.06)	-0.05*** (0.02)	-0.35*** (0.12)	-0.08** (0.03)
Cyprus	-0.62*** (0.19)	-0.27*** (0.10)	-0.18*** (0.04)	-0.07** (0.03)	-0.17 (0.14)	-0.10 (0.06)
Estonia	-0.74*** (0.11)	-0.37*** (0.08)	-0.25*** (0.04)	-0.11*** (0.02)	-0.27* (0.16)	-0.09 (0.09)
Finland	-1.01*** (0.20)	-0.37*** (0.12)	-0.19** (0.07)	-0.06*** (0.02)	-0.10 (0.09)	-0.06*** (0.02)
France	-1.46*** (0.53)	-0.26* (0.15)	-0.21*** (0.04)	-0.05*** (0.01)	-0.17* (0.10)	-0.04* (0.03)
Germany	-0.36 (0.37)	-0.06 (0.13)	-0.12*** (0.03)	-0.07*** (0.02)	-0.04 (0.03)	-0.04** (0.02)
Greece	-0.87*** (0.13)	-0.39*** (0.07)	-0.04 (0.02)	-0.02 (0.01)	-0.08 (0.05)	-0.04 (0.03)
Ireland	-0.63*** (0.13)	-0.32*** (0.08)	-0.18*** (0.04)	-0.08*** (0.02)	-0.34*** (0.08)	-0.15*** (0.04)
Italy	-0.65** (0.25)	-0.13 (0.08)	-0.17** (0.07)	-0.04** (0.02)	-0.07 (0.07)	-0.02 (0.02)
Latvia	-0.58*** (0.08)	-0.28*** (0.05)	-0.17* (0.10)	-0.11*** (0.03)	-0.57** (0.26)	-0.20* (0.12)
Luxembourg	-0.40* (0.22)	-0.08*** (0.03)	-0.05 (0.04)	-0.01** (0.01)	-0.01 (0.05)	-0.01 (0.01)
Malta	-0.22 (0.34)	-0.05 (0.05)	-0.05 (0.04)	0.01 (0.01)	-0.19*** (0.07)	0.00 (0.02)
Netherlands	-0.51 (0.33)	-0.33*** (0.06)	-0.16*** (0.04)	-0.06*** (0.01)	-0.09 (0.06)	-0.03 (0.03)
Portugal	-0.75*** (0.14)	-0.24*** (0.03)	-0.23*** (0.05)	-0.08*** (0.01)	-0.16*** (0.06)	-0.06*** (0.02)
Slovakia	-0.83*** (0.18)	-0.41*** (0.13)	-0.12** (0.05)	-0.04 (0.03)	-0.15 (0.12)	-0.07** (0.04)
Slovenia	-0.13 (0.18)	-0.16* (0.08)	-0.11** (0.05)	-0.03*** (0.01)	-0.25** (0.10)	-0.05*** (0.01)
Spain	-1.69*** (0.19)	-0.68*** (0.13)	-0.56*** (0.05)	-0.23*** (0.03)	-0.32 (0.24)	-0.14 (0.11)
Denmark	-0.81*** (0.26)	-0.39*** (0.09)	-0.18*** (0.03)	-0.08*** (0.01)	-0.19** (0.10)	-0.11** (0.04)
Norway	-0.74** (0.32)	-0.33*** (0.10)	-0.08* (0.04)	-0.02* (0.01)	0.06 (0.12)	-0.06** (0.03)
Sweden	0.29*** (0.11)	-0.46* (0.26)	-0.20*** (0.04)	-0.05** (0.02)	-0.10 (0.15)	-0.06 (0.04)
United Kingdom	-0.63*** (0.24)	-0.26*** (0.05)	-0.12*** (0.02)	-0.05*** (0.01)	-0.14 (0.09)	-0.06 (0.04)
Total observations	549	488	549	488	554	493
Adjusted R-squared	0.402	0.525	0.368	0.456	0.134	0.141

Note: To conserve space intercepts for decomposition equations are not reported, but are available upon request.

Source: Authors' estimates

Table 4. Multivariate Model Estimates

	Unemployment Rate (Level)											
	Youth						Adult					
Gross replacement rate	0.48*** (0.12)	0.46*** (0.09)			0.39*** (0.09)		0.18*** (0.05)	0.19*** (0.04)			0.12*** (0.04)	
Inactivity Trap			0.31 (0.20)	-0.24 (0.20)		0.28 (0.23)			-0.05 (0.08)	-0.15 (0.10)		0.10 (0.08)
Minimum wage / Median wage			1.24*** (0.25)	0.40 (0.28)		1.34*** (0.28)			0.39*** (0.14)	-0.06 (0.16)		0.56*** (0.13)
Tax wedge	1.27*** (0.29)	0.71** (0.28)	0.33 (0.39)	0.77* (0.39)	1.04*** (0.24)	0.06 (0.36)	0.50*** (0.13)	0.40*** (0.13)	0.47*** (0.16)	0.50*** (0.19)	0.42*** (0.11)	0.30** (0.15)
Union density	-0.62*** (0.16)	-0.41*** (0.11)	-0.15 (0.14)	-0.21 (0.13)	-0.24* (0.13)	-0.20 (0.15)	-0.01 (0.05)	0.00 (0.05)	0.06 (0.05)	0.07 (0.05)	0.08 (0.05)	-0.05 (0.05)
Protection of temporary workers	-2.50* (1.31)		-3.49*** (1.22)		-5.20*** (1.17)		-1.47*** (0.48)		-1.49** (0.60)		-1.97*** (0.59)	
Share of temporary workers		0.36*** (0.07)		0.44*** (0.09)		0.17* (0.10)		0.15 (0.16)		0.23 (0.20)		-0.20 (0.14)
Weekly hours per worker (full-time)	1.22** (0.47)	1.18** (0.48)	0.97 (0.60)	0.70 (0.54)	1.13** (0.45)	0.81 (0.58)	0.69*** (0.20)	0.71*** (0.22)	0.96*** (0.22)	0.46* (0.25)	0.89*** (0.19)	0.73*** (0.20)
Share of temporary workers due to probation			-0.31** (0.14)		-0.41*** (0.09)	-0.25* (0.14)			0.02 (0.01)		-0.02** (0.01)	0.00 (0.01)
Share of low-educated workers	0.01 (0.10)	0.08 (0.08)		0.07 (0.08)			-0.13*** (0.04)	-0.12*** (0.04)		-0.12** (0.05)		
ALMP total spending per unemployed	-0.36*** (0.06)	-0.32*** (0.04)	-0.21*** (0.07)	-0.23*** (0.07)	-0.27*** (0.06)	-0.21*** (0.07)	-0.13*** (0.03)	-0.14*** (0.02)	-0.07*** (0.02)	-0.10*** (0.03)	-0.08*** (0.02)	-0.10*** (0.02)
Country-specific output gap coefficient	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	144	151	104	160	99	106	144	151	107	160	101	114
Adjusted R-squared	0.93	0.94	0.96	0.93	0.96	0.96	0.93	0.93	0.95	0.91	0.95	0.95

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Homoskedasticity is tested for each regression. If rejected, robust standard errors are estimated. Equation (2) was estimated for each column.

This table reports only the coefficient before structural variable x.

Source: Authors' estimate

Table 5. Univariate Model Estimates without Interaction Term

	Unemployment rate		Long-term Unemployment		Employment rate	
	Youth	Adult	Youth	Adult	Youth	Adult
<i>Opportunity cost of working</i>						
Gross replacement rate	0.05 (0.03)	0.06*** (0.01)	-0.01 (0.07)	-0.10 (0.07)	-0.20*** (0.05)	-0.00 (0.03)
Net replacement rate	0.12 (0.08)	0.09*** (0.02)	-0.03 (0.07)	-0.01 (0.09)	0.05 (0.04)	-0.12*** (0.03)
Inactivity trap	0.33*** (0.06)	0.14*** (0.03)	0.00 (0.09)	0.02 (0.12)	0.02 (0.05)	-0.10*** (0.02)
<i>Hiring cost</i>						
Minimum wage/Median wage	0.18* (0.11)	0.01 (0.06)	0.62*** (0.16)	0.56*** (0.17)	-0.42*** (0.09)	-0.51*** (0.08)
Tax wedge (EC)	0.72** (0.28)	0.39*** (0.11)	0.86** (0.36)	1.04*** (0.35)	-0.30** (0.15)	-0.41*** (0.08)
<i>Collective bargaining</i>						
Union density	-0.01 (0.04)	0.10*** (0.03)	0.34*** (0.10)	0.43*** (0.14)	0.29*** (0.06)	-0.49*** (0.04)
Adjusted bargaining power	0.16*** (0.05)	0.00 (0.03)	-0.66*** (0.24)	-1.11*** (0.19)	0.19*** (0.07)	0.00 (0.05)
<i>Duality</i>						
Protection of temporary workers	2.26 (1.78)	1.05 (0.77)	3.35 (2.58)	2.91 (2.18)	1.35 (1.05)	-0.51 (0.56)
Share of temporary workers	0.06** (0.03)	0.06 (0.05)	-0.10* (0.06)	0.38* (0.22)	-0.17*** (0.04)	0.58*** (0.08)
<i>Education/Training</i>						
Share of temporary workers due to probation	-0.14 (0.08)	0.02** (0.01)	-0.09 (0.09)	0.03 (0.05)	0.15 (0.10)	-0.08*** (0.01)
Share of low-educated workers	-0.12*** (0.04)	-0.00 (0.02)	0.25*** (0.05)	0.36*** (0.06)	0.18*** (0.04)	-0.30*** (0.01)
<i>Active labor market policy</i>						
ALMP total spending per unemployed	-0.33*** (0.06)	-0.10*** (0.02)	-0.32*** (0.09)	-0.14 (0.10)	0.14*** (0.04)	0.09*** (0.03)
ALMP training spending per unemployed	-0.60*** (0.12)	-0.18*** (0.04)	-0.65*** (0.21)	-0.25 (0.22)	0.10 (0.09)	0.22*** (0.07)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	No	No	No	No	No	No

Standard errors in parentheses.

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Homoskedasticity is tested for each regression. If rejected, robust standard errors are estimated. Each structural variable enters the following regression individually. The regression below was run with each of the 13 measures of labor market features included one at a time.

This table reports only the coefficient before structural variable x due to space constraint.

$$u_{i,t} = \beta_0 + \beta_{1,i} c_i + \beta_2 x_{i,j,t} + \sum_{i=1}^{22} \beta_{2,i} c_i (y_{i,t} - y_{i,t}^*) + \varepsilon_{it}, \text{ where } j=1, \dots, 13$$

Source: Authors' estimate

Table 6. Univariate Model Estimates with Interaction Term

	Youth Unemployment Rate (Level)						
	1	2	3	4	5	6	7
Gross replacement rate	0.04 (0.03)						
Net replacement rate		0.14 (0.09)					
Inactivity trap			0.36*** (0.07)				
Minimum/Median wage				0.20** (0.09)			
Tax wedge (EC)					0.58** (0.27)		
Union density						-0.01 (0.04)	
Adjusted bargaining power							0.13** (0.06)
Austria	-0.27** (0.12)	-0.00 (0.00)	0.06 (0.57)		0.14 (0.55)	0.03 (0.03)	
Belgium	-0.28 (0.21)	-0.12 (0.24)	-1.38* (0.79)	-0.29*** (0.10)	-2.25 (2.26)	0.51*** (0.13)	-4.31** (2.14)
Cyprus		12.01*** (0.32)	6.89*** (0.16)		-0.05 (0.51)		
Estonia		-0.17*** (0.04)	-0.28*** (0.06)	-0.03 (0.08)	-0.43 (0.32)	0.04** (0.02)	-0.15 (0.12)
Finland	-0.16 (0.20)	0.44** (0.19)	0.03 (0.55)		-1.19** (0.50)	-0.11 (0.09)	0.10* (0.06)
France	0.03 (0.13)	-0.17 (0.11)	-0.22*** (0.06)	0.14* (0.07)	0.03 (0.67)	-0.00 (0.14)	-0.15 (0.14)
Germany	0.02 (0.11)	-0.07 (0.14)	0.26 (0.46)		0.12 (0.37)	0.02 (0.03)	0.23 (0.21)
Greece	-0.29** (0.12)	0.10 (0.12)	-0.56** (0.25)	0.19* (0.11)	-0.34*** (0.11)	0.05 (0.05)	0.23** (0.11)
Ireland	-0.04 (0.06)	0.17 (0.39)	0.00 (0.42)	0.03 (0.09)	-1.50*** (0.34)	0.05 (0.06)	
Italy	-0.05 (0.03)	0.00 (0.00)	-1.91*** (0.46)		-1.58 (1.28)	0.37** (0.16)	0.83*** (0.24)
Latvia		0.03 (0.15)	-0.07 (0.09)	0.02 (0.04)	-0.17 (0.14)		-0.05*** (0.00)
Luxembourg	-0.00 (0.01)	-0.35 (0.41)	-0.13 (0.50)	0.20 (0.12)	0.12 (0.47)	-0.18*** (0.06)	-0.01** (0.00)
Malta		-0.13** (0.06)	-0.09* (0.05)		-0.19 (0.31)		0.49*** (0.04)
Netherlands	-0.00 (0.05)	-0.02 (0.14)	-0.03 (0.05)	-0.08 (0.12)	-0.24 (0.35)	-0.19 (0.22)	0.07 (0.45)
Portugal	-0.09 (0.06)	0.66*** (0.16)	-1.91 (1.93)	0.01 (0.08)	0.31 (1.95)	0.01 (0.02)	-0.02 (0.13)
Slovakia	-3.54** (1.55)	-0.14 (0.18)	0.04 (0.09)	0.10 (0.29)	-1.99** (0.84)	0.00 (0.12)	-0.18 (0.19)
Slovenia		-0.11 (0.21)	-0.18 (0.21)	-0.09* (0.05)	0.32 (0.21)	0.01 (0.06)	-0.00 (0.00)
Spain	-1.01* (0.57)	1.18*** (0.28)	-1.49*** (0.42)	0.71** (0.28)	-1.10*** (0.38)	-0.31 (0.21)	-0.44 (0.28)
Denmark	0.06* (0.03)	0.55* (0.29)	0.90*** (0.31)		1.06*** (0.32)	-0.05 (0.06)	0.02 (0.04)
Norway	-0.04 (0.03)	0.27 (0.27)	-0.18 (0.36)		-0.93 (1.19)	-0.00 (0.18)	0.13 (0.44)
Sweden	0.28** (0.12)	0.32*** (0.11)	0.49** (0.23)		0.69** (0.31)	-0.17* (0.09)	0.13 (0.13)
United Kingdom	-0.15 (0.20)	-0.38*** (0.13)	-0.03 (0.39)	0.32*** (0.07)	0.63* (0.32)	0.01 (0.04)	-0.06*** (0.02)
Constant	5.63*** (1.09)	1.55 (4.47)	-12.74*** (4.08)	6.63*** (0.40)	-19.49 (13.22)	7.00*** (1.70)	6.51 (5.75)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	No	No	No	No	No	No	No
Observations	471	239	239	507	258	498	313
Adjusted R-squared	0.77	0.83	0.84	0.78	0.86	0.77	0.76

Table 6. Univariate Model Estimates with Interaction Term (concluded)

	Youth Unemployment Rate (level)					
	8	9	10	11	12	13
Protection of temp workers	-0.51 (0.37)					
Share of temp workers		0.05 (0.03)				
Share of temp workers due to probation			-0.27** (0.11)			
Share of low-educated				-0.08* (0.04)		
ALMP total spending per unemployed					-0.29*** (0.07)	
ALMP training spending per unemployed						-0.54*** (0.15)
Austria	0.03 (0.21)	-0.08* (0.05)	-0.05 (0.06)	0.33*** (0.09)	0.07 (0.11)	0.10 (0.24)
Belgium	-0.49** (0.21)	0.09** (0.04)	-0.16 (0.10)	-0.02 (0.19)	0.14 (0.17)	0.41 (0.29)
Cyprus		0.46* (0.26)	0.00 (0.00)	0.58*** (0.12)	1.99*** (0.49)	-4.33 (2.64)
Estonia	-0.62*** (0.11)	-0.11* (0.05)	0.12** (0.05)	0.20** (0.09)	0.24 (0.21)	3.85 (4.66)
Finland	6.10*** (1.85)	-0.22 (0.15)	-0.52 (0.39)	-0.84** (0.36)	-0.46*** (0.17)	-1.00*** (0.32)
France	0.07 (0.72)	0.04* (0.02)	-0.15** (0.07)	-0.29** (0.12)	-0.29 (0.19)	-1.22** (0.60)
Germany	0.06 (0.19)	-0.02 (0.02)	-0.14 (0.21)	-0.17** (0.08)	-0.05 (0.14)	-0.14 (0.33)
Greece	0.72 (0.47)	0.14 (0.17)	-0.05 (0.24)	0.30*** (0.11)	0.16 (0.09)	0.31 (0.41)
Ireland	-0.60 (2.06)	-0.09 (0.08)	-0.58*** (0.03)	-0.02 (0.07)	0.45*** (0.13)	0.65*** (0.18)
Italy	0.81** (0.37)	-0.05* (0.03)	0.46 (0.67)	0.06 (0.08)	0.98*** (0.23)	-2.98*** (0.64)
Latvia	0.00 (0.00)	-0.03 (0.06)	-0.18*** (0.06)	0.23 (0.22)	1.46 (1.21)	-1.87 (1.48)
Luxembourg	0.03 (0.04)	0.03 (0.03)	-0.04 (0.12)	-0.01 (0.03)	-0.14 (0.10)	0.22 (0.27)
Malta		0.07 (0.14)	-0.14 (0.11)	-0.08** (0.03)	0.10 (1.29)	-4.13** (1.97)
Netherlands	1.26 (2.57)	0.06 (0.06)	-0.16*** (0.06)	-0.10 (0.16)	0.05 (0.08)	0.07 (0.13)
Portugal	2.92*** (0.72)	-0.14*** (0.05)	0.27** (0.12)	0.17*** (0.04)	4.29*** (0.32)	-0.01 (0.94)
Slovakia	-0.11 (1.35)	0.00 (0.10)		-0.15 (0.95)	0.15 (1.46)	-7.65 (5.57)
Slovenia	-0.38*** (0.11)	-0.00 (0.04)	-0.14 (0.09)	0.06 (0.12)	0.87*** (0.10)	1.81*** (0.52)
Spain	3.36*** (0.91)	0.05 (0.06)	-0.36 (1.34)	0.26 (0.18)	1.09*** (0.30)	1.06* (0.57)
Denmark	0.10 (0.18)	0.05 (0.03)	0.00 (0.00)	-0.02 (0.03)	-0.01 (0.04)	0.04 (0.09)
Norway	-0.36 (2.37)	-0.03 (0.32)		-0.04* (0.02)	0.10** (0.04)	0.10 (0.07)
Sweden	-0.98*** (0.28)	0.24** (0.11)	0.18 (0.31)	0.61 (0.87)	0.11 (0.10)	0.18 (0.17)
United Kingdom	-0.33 (3.37)	-0.13 (0.12)	0.07 (0.10)	0.03 (0.02)	-0.33** (0.14)	-0.37 (2.56)
Constant	7.35*** (0.65)	6.58*** (1.06)	9.71*** (0.87)	9.35*** (0.70)	15.97*** (2.04)	11.81*** (1.19)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	No	No	No	No	No	No
Observations	454	498	250	398	219	258
Adjusted R-squared	0.80	0.80	0.82	0.84	0.87	0.84

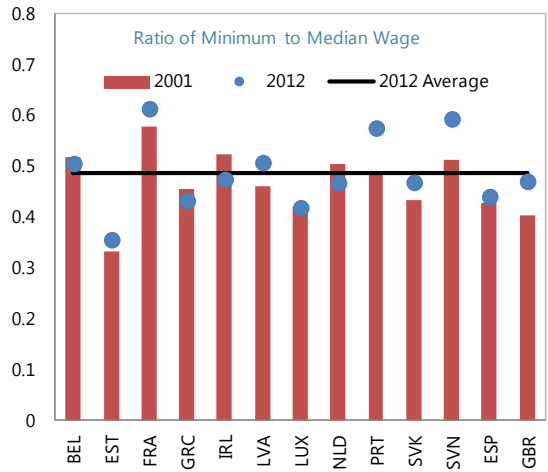
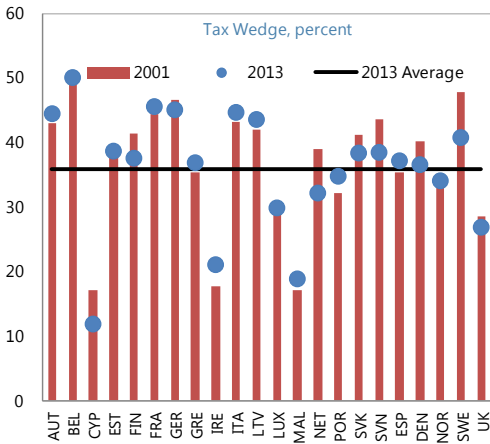
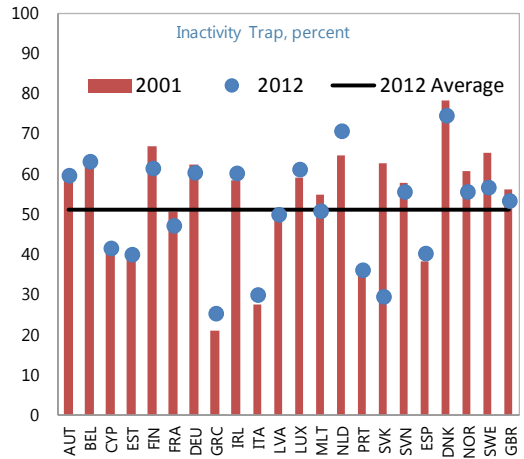
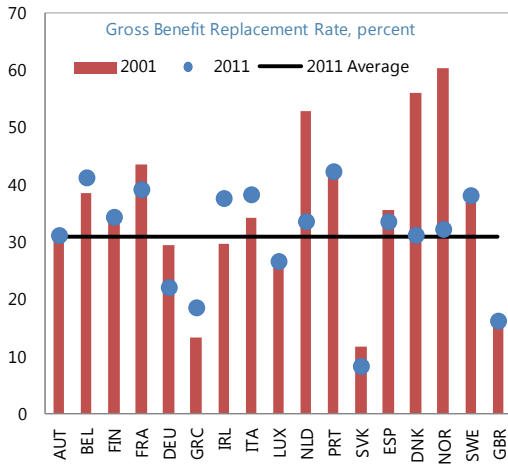
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Homoskedasticity is tested for each regression.

If rejected, robust standard errors are estimated. Equation (3) was estimated for each column.

Each structural variable enters regression individually. Table reports only the coefficient before structural variable x and the coefficient before the interaction of country dummy, x, and output gap.

Source: Authors' estimate

Figure 1. Labor and Product Market Institutions



Notes Latest data for Cyprus is 2007, Latvia and Malta, 2012.

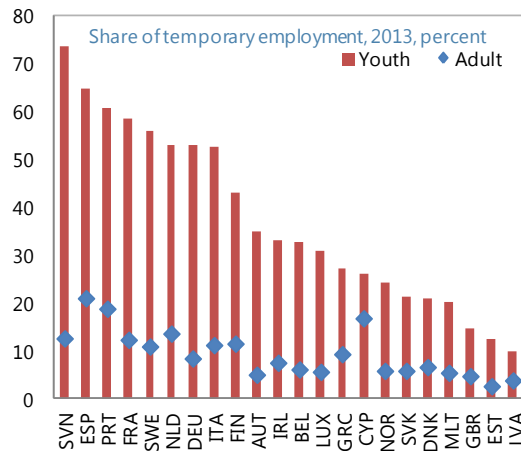
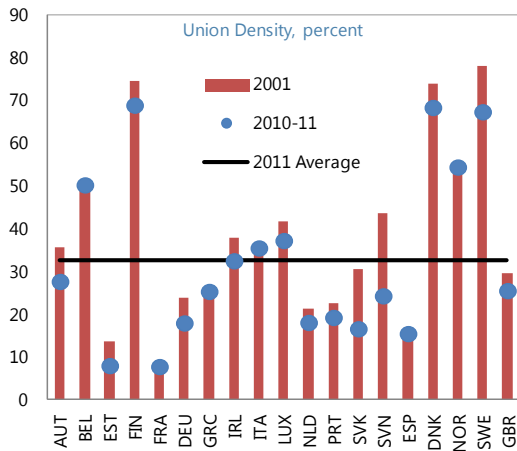


Figure 1. Labor and Product Market Institutions (concluded)



Source: Eurostat, European Commission, OECD, World Economic Forum, World Bank Doing Business Report, authors' calculations

Figure 2. Marginal Impacts of Labor Market Institutions on Unemployment Rates, percentage point

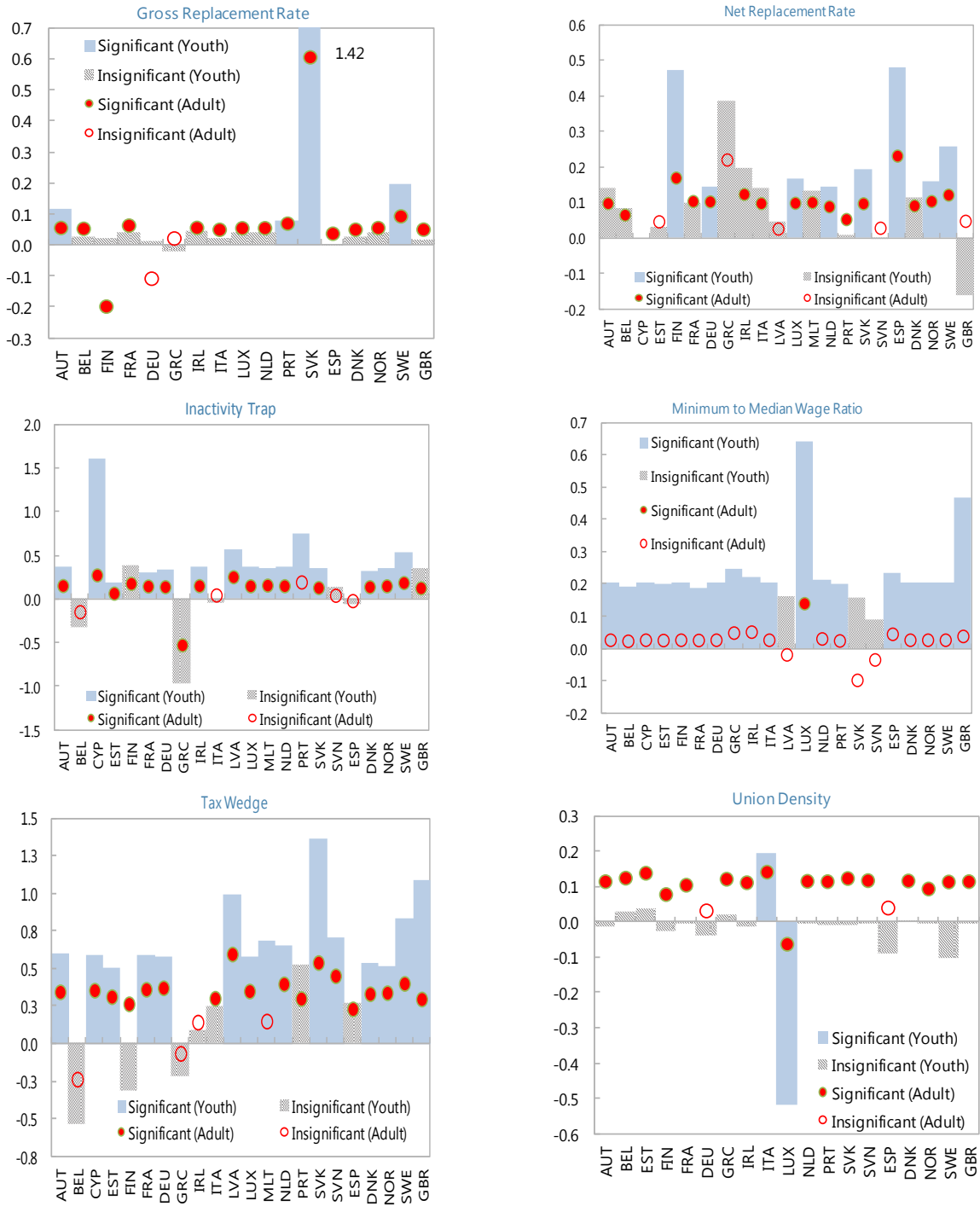
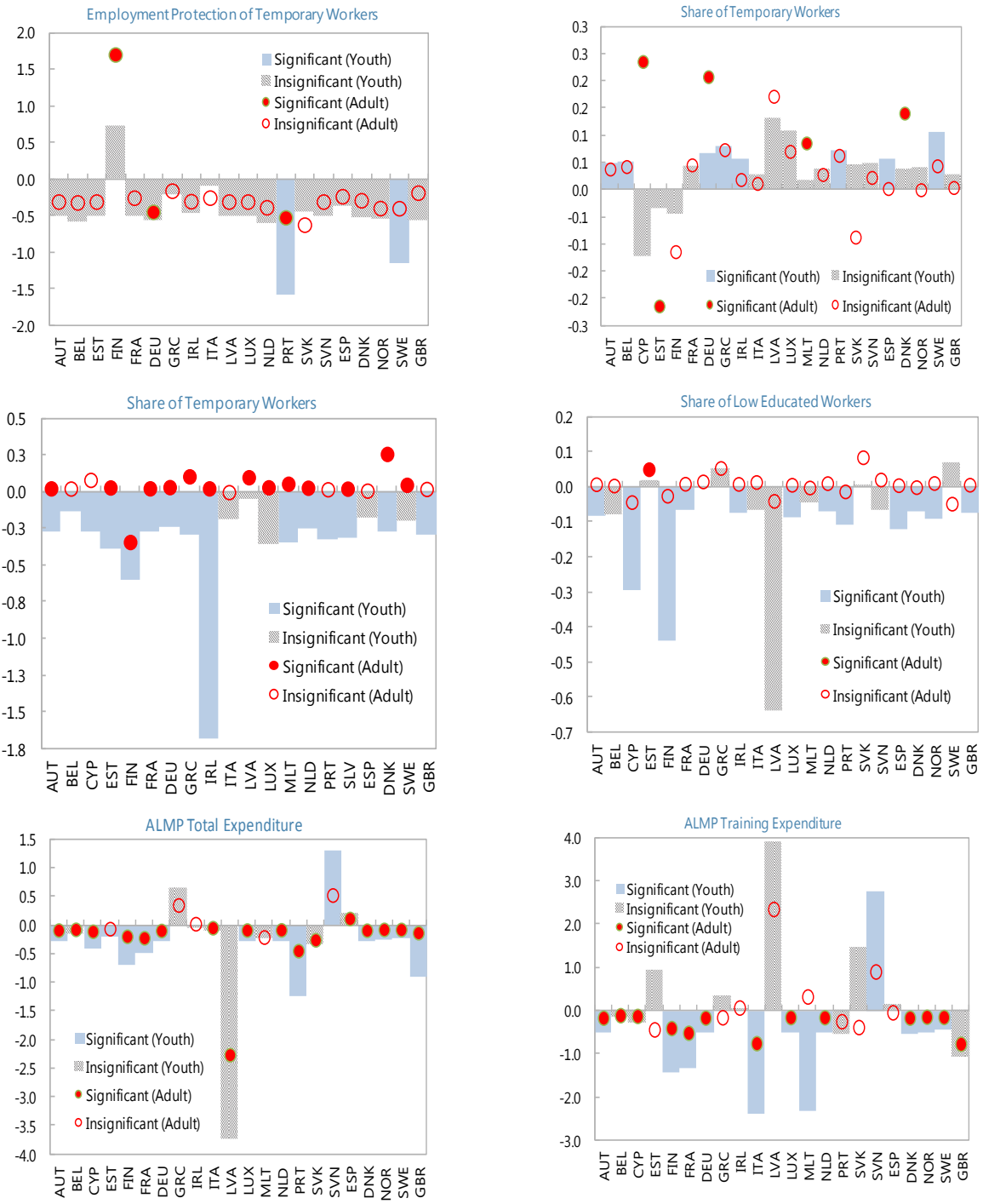


Figure 2. Marginal Impacts of Labor Market Institutions on Unemployment Rates, percentage point (concluded)



Source: Authors' estimates