

# The effects of labour income taxes on labour market performance: an empirical analysis

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## Abstract

This paper provides an empirical analysis of the relationship between labour income taxation and labour market performance for a sample of 30 OECD countries over the period 1979-2014. The call to reduce the tax wedge on labour income has gained renewed prominence in the political debate at the EU level given high tax wedges in several countries and dismal labour market performance.

Our results confirm expectations of the negative relationship between the level of the tax wedge and employment. In particular, we find that the effect is more detrimental for single earners and low-skilled labour force and this is even more so if to begin with the country has a very high tax burden. When looking at the speed of labour market reactions to changes in the tax wedge, we find that an increase in the tax wedge has an immediate and large negative effect already after one year; this immediate adjustment is much stronger than the positive effect of a cut in the tax wedge of the same magnitude. Finally, when looking at the time variation of the effects of the tax wedge on (un)employment we find that while it seems relatively stable over time for the full sample, for the euro area we observe that in the more recent period, the size of the effects of the tax wedge on (un)employment has increased.

**Keywords:** labour taxation, tax wedge, unemployment, panel data

**JEL codes:** H2, E2, E32, E62, C23, C26

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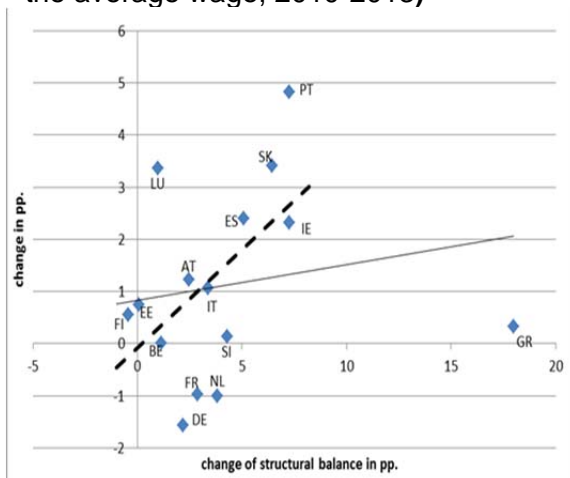
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## 1. Introduction and motivation

The effect of labour income taxation on employment and growth has recently regained central importance in the political and economic debate on how to spur euro area growth and reduce the high levels of unemployment many countries are experiencing as a legacy of the financial and sovereign debt crisis. Indeed, within the EU calls to reduce the tax burden on labour, as a tool to foster employment creation, have featured at the core of the Country Specific Recommendations (CSRs) addressed by the European Commission to EU countries since 2011.

The global financial crisis of 2007 caused one of the deepest post-war recessions in several advanced economies. For the euro area the toll of the crisis was particularly heavy as starting from 2010 what had begun as a global phenomenon morphed into a euro area sovereign debt crisis that threatened the existence of the EMU itself. The sovereign debt crisis exposed significant weaknesses in the common architecture of the monetary union, but more importantly, it showed how far some member states were from building solid economies that could withstand the effect of adverse shocks. Almost ten years after the start of the financial crisis, the real GDP level in some euro area countries has not yet fully returned to its pre-crisis level and in particular the rate of unemployment remains stubbornly high and significantly above the pre-crisis level in several countries.

**Chart 1 – Change in the tax wedge and consolidation efforts in euro area countries (single worker earning 100% of the average wage, 2010-2013)**



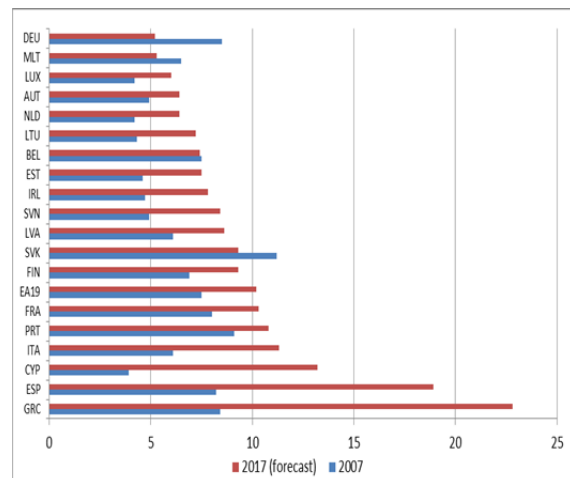
Source: OECD and AMECO

Notes: Change in the tax wedge for a single worker earning 100% of average wage and consolidation efforts in the period 2010-2013.

Solid line: trend line.

Dashed line: trend line excluding Greece.

**Chart 2 – Unemployment rate in euro area countries (% of labour force)**



Source: AMECO and European Commission 2016 Winter Forecast

The size and intensity of the crisis prompted euro area countries to step up reform efforts especially with regard to increasing labour market flexibility as well as the degree of competition in product markets. Last, but not least, they embarked on sizeable fiscal consolidation efforts aimed to address the large fiscal imbalances built as a consequence of the crisis. In this regard, during the period 2010-2013, countries with large consolidation needs tended to increase the labour taxation. More recently, given that fiscal consolidation have started to wane in several countries and concerns

about growth and equity raised in the public debate, countries have pursued more growth friendly measures such as reducing the tax burden on labour in order to boost growth and employment.

Inspired by the ongoing policy debate, this paper aims to empirically assess the effects of labour income taxes on labour market performance from an aggregate perspective. The analysis is based on a sample of 30 OECD countries over the period 1979-2014. We are primarily interested in the effects of changes in the tax wedge on both the employment and the unemployment rate.

In addition to the role of the tax wedge and in line with the empirical literature on the determinants of unemployment, our analysis controls also for a number of variables that capture different labour market policies and institutions.

Our paper contributes to the literature in the following ways: 1) by using a very long dataset we identify the long term effects of the tax wedge on labour market performance. Moreover, inclusion of the recent crisis period allows us to test for the presence of structural breaks in such relationship; 2) we pay particular attention to the channels through which labour income taxation affects (un)employment. To this purpose we test whether the effects of the tax wedge differ across groups of countries, categories of workers (by level of skills) and family types (single versus couple), characteristics of fiscal policies and direction of the labour tax change. Explicitly accounting for such heterogeneous effects provides important insights about the interactions between the tax wedge and country specific features and helps to better orient labour tax reform recommendations; 3) we look at the time variation in the relationship between the tax wedge and the labour market performance and find that for the euro area the sensitivity of (un)employment to the tax wedge has increased in recent years.

Our results confirm expectations that labour taxation is an important determinant of labour market performance. Higher labour taxation has a detrimental influence on (un)employment, the effect is stronger for single earners, low-skilled workers and is more significant for euro area countries. Our paper is structured as follows. Section 2 presents a review of the empirical literature on the determinants of unemployment and the macroeconomic effects of reducing the tax wedge. Section 3 presents the data and some stylised facts about the main variables of interest. Section 4 presents the results of the empirical analysis and the robustness checks. Section 5 concludes.

## **2. The effects of labour income taxation on labour market performance: evidence from the literature**

Two main strands of literature are relevant for our paper. The first strand looks at the growth effects of labour income taxation and the tax system as a whole. This stream mainly provides the theoretical basis for our analysis and it generally supports the view according to which reductions in the labour tax wedge which are compensated by a shift towards less distortionary taxes (e.g. indirect taxes) or by a reduction in expenditures are beneficial for economic growth and ultimately employment. The second one looks at the large variety of determinants of unemployment, focussing on the impact of key labour market features such as its structure, the institutions, the level and structure of taxation and their interactions. This literature is relevant as it identifies further determinants of labour market outcomes which are not related to taxation.

## 2.1 The effect of labour income taxation on economic growth

The tax wedge (i.e. the sum of personal income taxes and social security contributions) influences labour market performance as it creates a gap between the firms' labour costs and the workers' take home pay. Consequently, labour taxes may influence both, labour supply and labour demand, even though the literature suggests that the former is the more relevant channel as the economic incidence of labour taxes is generally found to be higher for workers than for employers (see Melguizo and González-Páramo (2013) for an overview). Individuals' decisions may be affected regarding either the choice to enter the labour market (i.e. the extensive margin of labour supply) or the number of hours they decide to work (i.e. the intensive margin of labour supply).. The net effect of the level of labour income taxes on labour supply is theoretically ambiguous as it works via two opposite effects: an income effect, i.e. higher taxation leads to higher labour supply, as lower disposable income reduces demand for leisure, and a substitution effect, i.e. lower labour supply owing to lower return on hours worked.

In general, the empirical evidence suggests that the negative effect of labour taxation on employment prevails, even though, as discussed in Attinasi et al. (2015), estimates of the elasticity of labour supply to taxation are quite heterogeneous depending on the approach that is adopted. Typically, men are found to react rather inelastic to labour taxation though the elasticities are found to be more negative in the case of temporary tax measures. Labour supply elasticities for women are more negative; however, the heterogeneity of estimates is quite large which makes it rather difficult to report one single figure. Nevertheless, Meghir and Phillips (2010) state that the consensus labour supply elasticity for women measured at the annual level – which allows to account for several margins of adjustments (hours, as well as participation) – is probably close to minus one, i.e. an increase of labour taxes by 1% reduces labour supply by 1%.

As concerns the elasticity of labour demand to labour taxes, existing empirical evidence is quite limited. Available evidence suggests that labour demand elasticity is higher in the longer run, as firms can more easily change the production mix, and for the low-skilled workers. Hamermesh (1993) estimates the responsiveness of conditional labour demand to the cost of labour to fall within the -0.15 to -0.75 interval. A recent meta-analysis by Lichter et al (2014) suggests that labour demand elasticities are increasing over time. Increased economic integration and mobility of firms supposedly make employers more responsive also to labour costs.

Empirical estimates for the overall effect of labour taxation are available from panel studies which estimate the effect of the overall structure of taxes and revenues on economic growth. Such analyses provide some useful insights. Most studies confirm the expectation of a negative effect of labour taxes on GDP growth rates, even though the estimates are in some cases not robust (see Table A1 in the annex). In addition to the aggregate effect, some further interesting results emerge: Romero-Ávila and Strauch (2008) show that labour taxes affect growth rates mainly via their impact on private investment. Angelopoulos et al. (2007) find that while the effect of the effective labour tax rate is negative, the effect of the top rate is insignificant; this is in line with the expectation of a lower responsiveness of higher incomes to the labour tax burden. With respect to other instruments, most studies confirm that taxes on consumption and property have less-detrimental effects on economic growth, but the results are not sufficiently robust to obtain from these studies a clear-cut ranking of the growth-friendliness of fiscal instruments.

In contrast to these cross-country studies, a recent paper by Zidar (2013) investigates how tax changes for different income groups affect growth and

employment by using data from US states. He finds that the overall stimulative effect of labour tax cuts on growth in the US states is largely driven by tax changes for lower-income groups, whereas the effect of tax cuts for the top 10% of income earners on employment growth is only very small. In detail, a tax cut of one percentage point of GDP for the bottom 90% of income earners results in additional GDP growth of about 3 percentage points over a two year period. The growth effect can mainly be attributed to consumption growth, but investment is also reacting positively to labour tax cuts of the bottom 90%.

Finally, several studies have used structural macroeconomic models to analyse and quantify the growth effects of alternative labour tax wedge reduction scenarios. These model-based analyses in general find positive long-run effects from permanent reductions of labour tax wedges on output and employment. Coenen et al. (2008) use a calibrated two-country version of the New Area-Wide Model (NAWM) to examine the effects of a reduction in labour market distortions in the euro area to levels consistent with the tax structures prevailing in the USs. The reduction of the overall tax wedge to the US level is estimated to lead to a long-run increase of total output by about 12% and an increase in hours worked by about 14%. In particular, when the labour income tax rate along with employees' social security contribution rate is lowered, the after-tax real wage increases, leading to a rise in labour supply and an increase in private demand. The underlying mechanism as follows: The change in the labour supply schedule triggers a decline in the equilibrium pre-tax real wage (dampened by the increase in private demand), thereby reducing firms' effective labour costs. The implied rise in hours worked induces an increase in the long-run capital stock, sustained by a higher level of investment, that further raises total output. A reduction in employers' social security contribution rate has somewhat different implications for long-run labour market outcomes. In particular, a reduction in employers' social security contribution rate lowers first and foremost firms' effective labour costs and leads to an increase in labour demand.

## **2.2 The determinants of unemployment**

A second strand of literature which is relevant for our analysis studies the determinants of unemployment, in particular those which are induced by economic policy and institutional characteristics. While in the short run unemployment follows aggregate demand fluctuations over the business cycle, in the long run structural features such as labour market institutions and government policies, including personal and corporate income taxation, are likely to play an important role. More precisely, both labour demand and labour supply, and ultimately the equilibrium level of (un)employment, are influenced by factors related to the wage determination process, their rigidity, the bargaining power of employees. These factors tend to be country specific and difficult to influence in the short run.

One of the most relevant institutional factors are employment protection measures which are assumed to cause a disincentive for job creation as it makes layoffs of workers more difficult. In such cases firms tend to hire less employees in anticipation of the high firing costs which would reduce their flexibility in adjusting the workforce during economic downturns. Trade unions, their bargaining power and the level of coordination/centralization of the wage setting process are likewise assumed to influence the unemployment rate. Whether wages are set via collective bargaining between trade unions and firms at local or aggregate level is relevant to determine the effect on the aggregate economy. Strong unions with low level of coordination might request high wages which would increase the labour costs, reduce the output and ultimately result in higher unemployment. On the contrary, in presence of highly coordinated trade unions or highly centralised bargaining processes the aggregate

effects of the wage bargaining are likely to be taken into account thus pushing trade unions to accept lower wages in order not to harm the overall economy.

In the area of public expenditures, social benefits in form of unemployment benefit schemes or other welfare measures are expected to affect the labour market performance, as the better outside options reduce work incentives. In principle, unemployment benefits increase the workers' reservation wage, thus weakening the link between labour income and labour supply and reducing the incentives of unemployed to search for or accept a job. Therefore more generous unemployment benefits (i.e. those characterised by a high replacement ratio, or a long duration, a broad coverage) coupled with a high level of other types of social benefits create disincentives to exit unemployment. Long lasting benefits result in longer unemployment durations while in other cases the level of the unemployment benefit exceeds the wage income they would receive. Finally, the effect of active labour market policies on employment is assumed to be ambiguous, since it could be that active labour market policies from one side increase the possibility to find a job, but on the other side they can lengthen the unemployment spell, and for example the participation in trainings can increase the level and expectations of unemployed regarding the job.

Existing macroeconomic empirical studies apply panel data models to assess the effects of political and institutional factors on employment and/or unemployment exploiting cross-country and time variation. These analyses typically focus on EU countries or OECD member states and study, in addition to taxes, for the bulk of other influences on economic growth discussed above, such as labour market institutions, and in some cases country-specific time-invariant effects (fixed effects). A high level of employment protection has been found to be significant in explaining the level of unemployment only in some studies (see Nicoletti and Scarpetta, 2004) while no significant evidence of a relationship was found in others (Blanchard and Wolfers, 2000). Unemployment benefit generosity, trade union density and the replacement rate are found to have significant effects in most of the studies (among others Nickell, 1998, or Nunziata, 2002). On the contrary there is little evidence that active labour market measures and in general benefits targeted to unemployed person influence unemployment. Daveri and Tabellini (2000) found that trade unions have an effect on unemployment through wages only when the coverage is high and the level of coordination low. When the unions are powerful they can influence the level of wages, if the union is not large enough to consider the general wealth of the economy but only the interest of the single companies, its influences might result in inefficient choices at aggregate level. The strong union will exert higher pressure on wages increasing unit labour cost which affect negatively labour demand. In most of the studies, interactions between institutions are found to be significant, suggesting that it is important to assess the overall labour market settings and not only single elements.

When it comes to the variable of our main interest, the effect of the tax wedge interestingly the results are not robust. Some of the studies support the assumption that labour taxation is an important determinant of labour supply and demand (Belot and van Ours, 2004; Nickell, 1997) while others do not identify any significant effect (Scarpetta, 1996; Nunziata, 2002). However, one drawback of panel data studies is that by focusing on the aggregate they do not provide insights as to the role of country-specific features on how taxes affect economic growth and/or labour market performance. Nonetheless, in an attempt to take into account cross country heterogeneity, Daveri and Tabellini (2000) report results for countries grouped by union density and level of coordination and centralisation of wage setting. They find that labour taxation can explain unemployment only for "Continental Europe" countries, characterised by strong but decentralised unions. Bassanini and Duval

(2006), in a macroeconometric study on the institutional and policy determinants of unemployment find that high and long-lasting unemployment benefits, high tax wedges and stringent anti-competitive product market regulation are found to increase aggregate unemployment. By contrast, no significant impact of employment protection legislation on aggregate unemployment is found. Highly centralised and/or co-ordinated wage bargaining systems as well as some categories of public spending on active labour market programmes, such as labour market training, are estimated to be associated with lower unemployment.

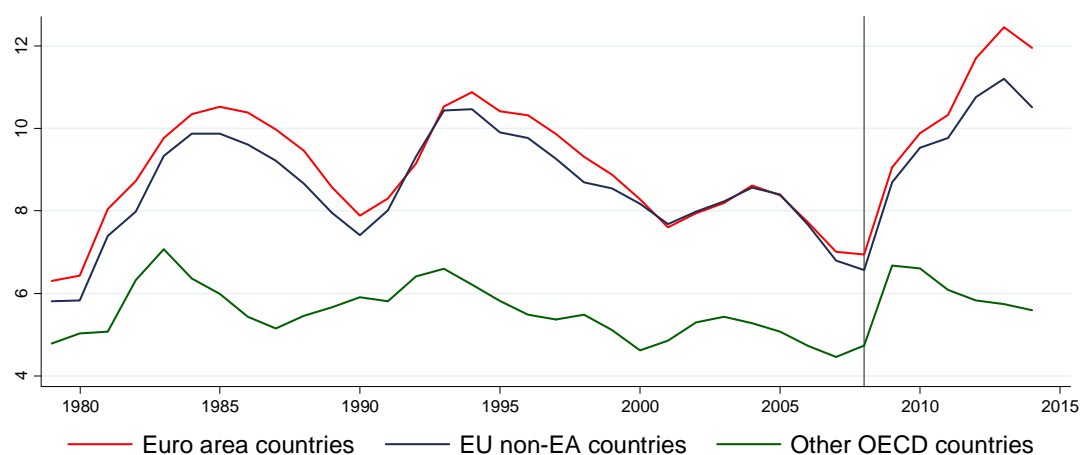
### 3. Data and stylised facts

#### 3.1 Unemployment and employment rates

Unemployment and Employment are the two variables of interest which reflect labour market performance. Although both indicators capture movements in and out of the labour market, they have certain advantages and disadvantages for our analysis. The rate of unemployment, especially at elevated levels of unemployment, is influenced also by the so-called discouraged worker that is people who become discouraged and stop looking for work. Since these people are excluded from the labour force, this implies that the unemployment rate may fall, or stop rising, even though there has been no underlying improvement in the labour market. On the other hand, the rate of employment, which is calculated as the ratio between employed people and the working age population, is not affected by the issue of discouraged workers. For this reason, our choice in this paper is to look at both indicators as changes in the employment rate better capture movements in the labour market.

The unemployment rate rose sharply as a consequence of the financial and sovereign debt crisis with EU and euro area countries being particularly adversely affected compared to other OECD countries (chart 3). Starting from 2008 euro area countries started to decouple from the rest of the EU countries with unemployment levels reaching unprecedented levels in 2012-2013.

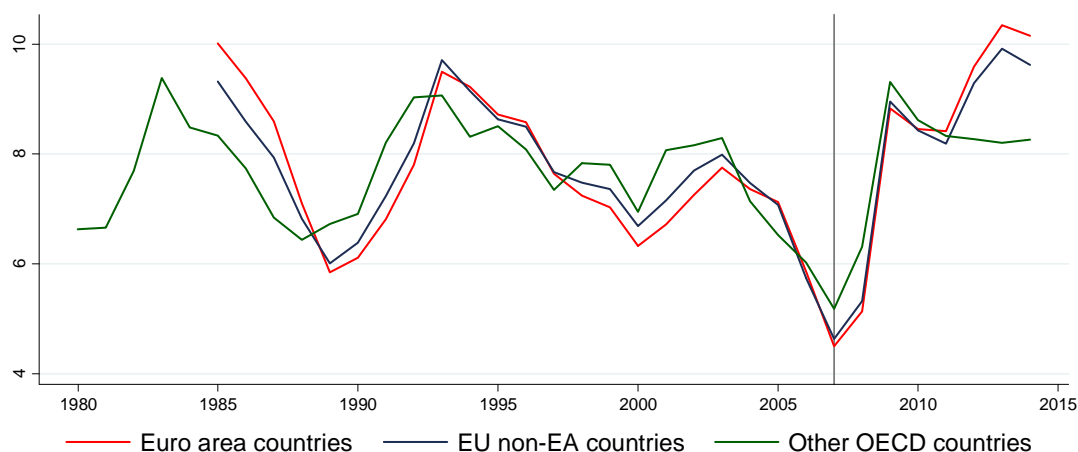
**Chart 3 – Unemployment rate (% , annual)**



Source: own elaboration on OECD data. The vertical line corresponds to 2008.

The spike in unemployment that occurred since the start of the crisis seems to have been only partly of a cyclical nature. One way to look at this is by plotting the residual of a regression of the unemployment rate on the output gap. The residual represents the part of unemployment which is not explained by cyclical developments. As shown in chart 4, even after controlling for the impact of cyclical factors, a double spike in the unemployment rate occurs for the EU countries and more so in the euro area after 2009. Such a double spike is not observed for the other OECD countries for which the unemployment rate starts to decline following the peak in 2009.

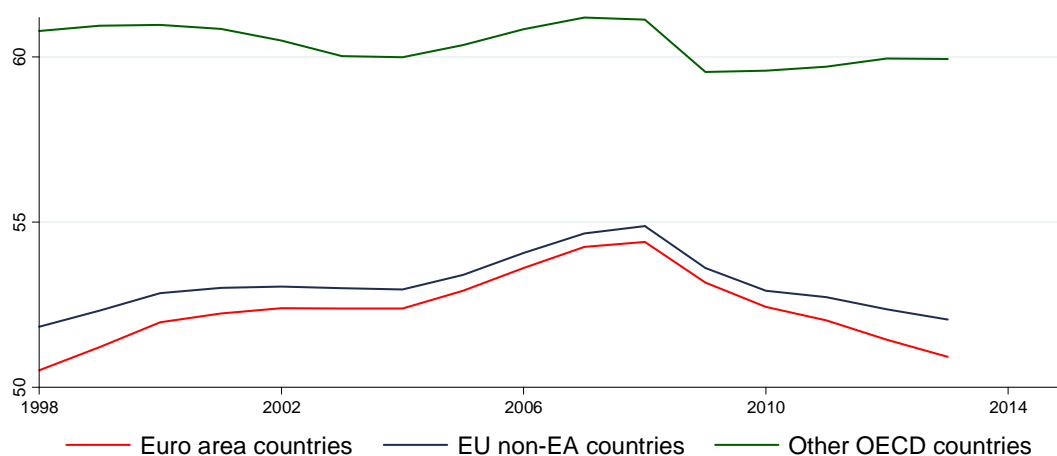
**Chart 4 – Adjusted unemployment rate (% , annual average)**



Note: adjusted unemployment is the residual of a regression of the unemployment rate on the output gap. It captures the part of unemployment that is not explained by cyclical developments and we consider it as a proxy for structural unemployment. The vertical line corresponds to 2007.

A specular picture emerges when looking at the employment rate across the group of countries considered in this paper. Over the period of analysis, average employment rates in the EU and euro area are lower than in other OECD countries, and why in the latter the drop in employment rate following the 2007 financial crisis appears to have stabilised, in the EU/euro area countries it seems to be still on a declining trend reflecting weaker recovery in GDP growth (chart 5).

**Chart 5 – Employment rate (% , annual averages)**



Source: World Bank



### 3.2 Labour tax wedge

Labour income taxation is measured by the tax wedge on labour income, tax wedge is a measure of the difference between the net take home pay of a representative worker and total labour costs for the employer. As such it comprises the sum of personal income taxes and employee and employer social security contributions net of family allowances, expressed as a percentage of total labour costs. Data on the total tax wedge are available from the OECD as of 1979 for two family compositions. As of 2004<sup>5</sup> the OECD started to collect data for different family compositions, different levels of average earnings and the breakdown of the tax wedge in the three main components listed above is available. Unfortunately, such a wealth of data is not available for the previous years and 2004 constitutes a break in the series owing to the change in the OECD definition of average worker. Therefore, in order to cover a period of analysis which is sufficiently long to meaningfully capture the long term effects of changes in the tax wedge, we take data on the tax wedge for the single worker earning 100% of the average wage and for a married couple and two children with one earner earning 100% of the average wage and extend it forward up to 2014 applying the growth rate of the newest series. One limitation of this approach is that we cannot assess whether different components of the tax wedge influence labour market outcomes differently. Indeed, although reductions in the labour tax wedge can be achieved via lowering taxes on the employees' or on the employers' side or via a mix of both, in our analysis we do not distinguish among the various instruments<sup>6</sup>.

For the purpose of this paper the focus will be on the tax wedge for the single earner earning 100% of the average wage and the tax wedge of a married couple and two children with one earner earning 100% of the average wage. In what follows we will describe the main variables used in the econometric analysis presented in section 4.

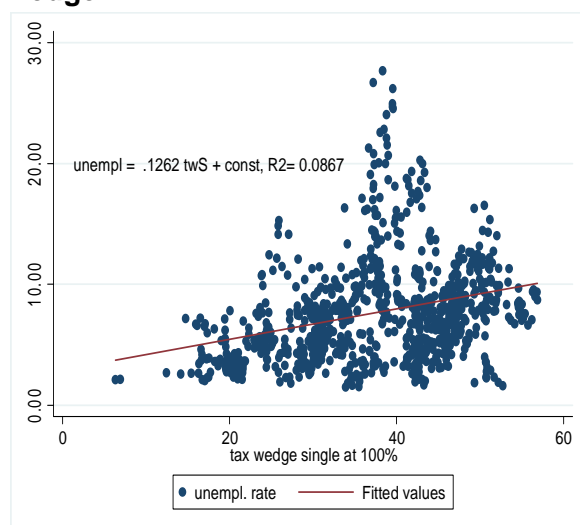
The central relationship we want to test in this paper is the effect of the tax wedge on labour market performance. As discussed above, we look at two complementary measures of labour market performance, namely the employment and the unemployment rates. As shown in the scatterplots below (Chart 6 and chart 7) the effects of the tax wedge may differ for the two variables, with the effect being stronger on employment compared to unemployment.

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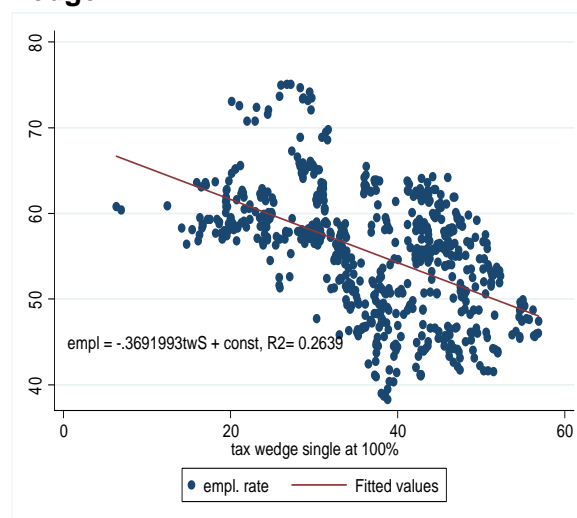
<sup>5</sup> The OECD extended the dataset backward with the new methodology until 2001.

<sup>6</sup> This approach presents also other limitations. First, it does not allow to clearly identifying the labour demand and supply channels, as we look at aggregate (un)employment. Second, the paper does not touch upon the issue of a budget neutral cut in the tax wedge and corresponding financing means which is a relevant topic in the ongoing discussions about ways to increase the growth-friendliness of the tax system.

**Chart 6 – Unemployment rate and tax wedge**



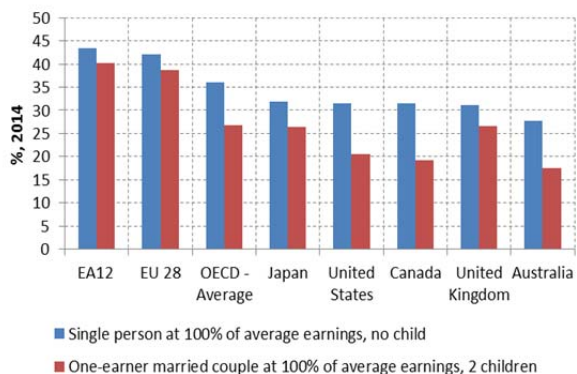
**Chart 7 – Employment rate and tax wedge**



Turning to the tax wedge, in EU countries, and euro area countries in particular, the tax wedge is high by international standards (Chart 8 and chart 9). In the euro area and EU countries the tax wedge started to decline since the mid-1990s. However, as of 2010 the tax wedge started to increase again reflecting the fact that several countries needed to adopt fiscal consolidation measures owing to the impact of the sovereign debt crisis. The increase in the tax wedge seems to have been more marked in euro area countries as they started to decouple from the other EU countries. Indeed, hikes in personal income taxes and employees' social contributions often featured in the consolidation packages adopted during the crisis (chart 9).

Although assessing the causes of the high tax wedge in EU member states and euro area countries is outside the scope of this paper, it is interesting to note that in these countries a high tax wedge on labour appears to be associated to a high rate of social expenditures (chart 10). Moreover, in some countries, there appears to be scope to shift taxation from labour income to indirect taxes, as a high taxation of labour does not necessarily go hand in hand with a high tax burden on consumption (chart 11).

**Chart 8 - The tax wedge on labour income (2014, % labour costs)**



Source: OECD and European Commission.

Note: The EU12 aggregate includes: Belgium, Germany, Ireland, Greece, France, Italy, Spain, Luxembourg, Netherlands, Austria, Portugal, Finland.

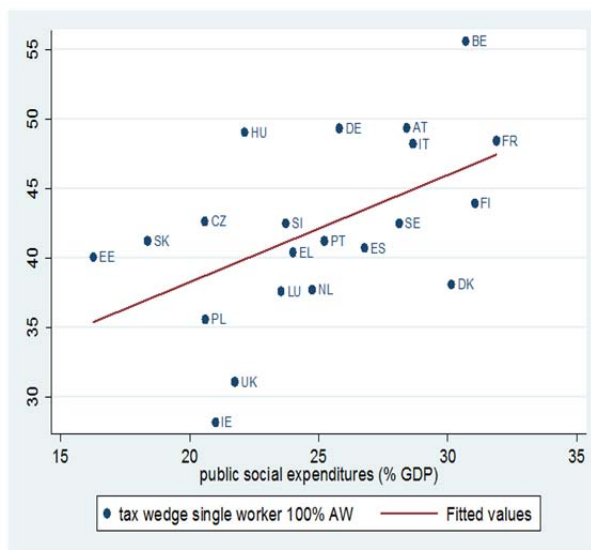
**Chart 9 - Evolution of tax wedge on labour income (cross-country average, % of labour costs)**



Source: OECD, European Commission and own calculations.

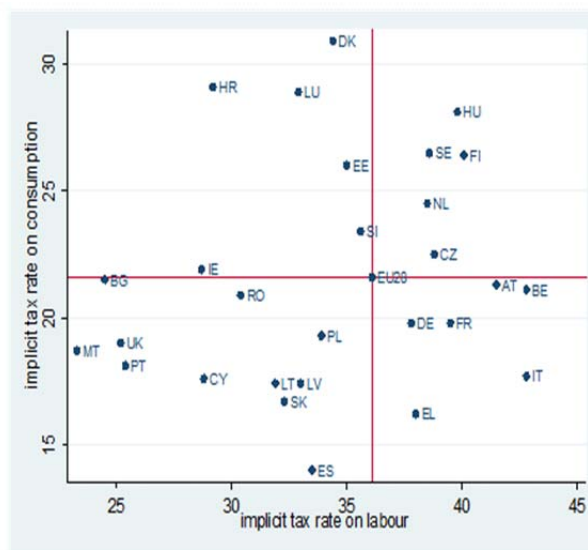
Note: the chart illustrates the evolution of the average tax wedge for the single person at 100% average earnings without children. The vertical line is in correspondence of the year 2010.

**Chart 10 – Tax wedge on the single worker and public social expenditures as % GDP (2014)**



Source: European Commission and OECD Social Expenditures update. Data refer to 2014.

**Chart 11 – Implicit tax rate on labour and consumption (% , 2012)**



Source: EC Taxation trends in EU 2014. Data refer to 2012.

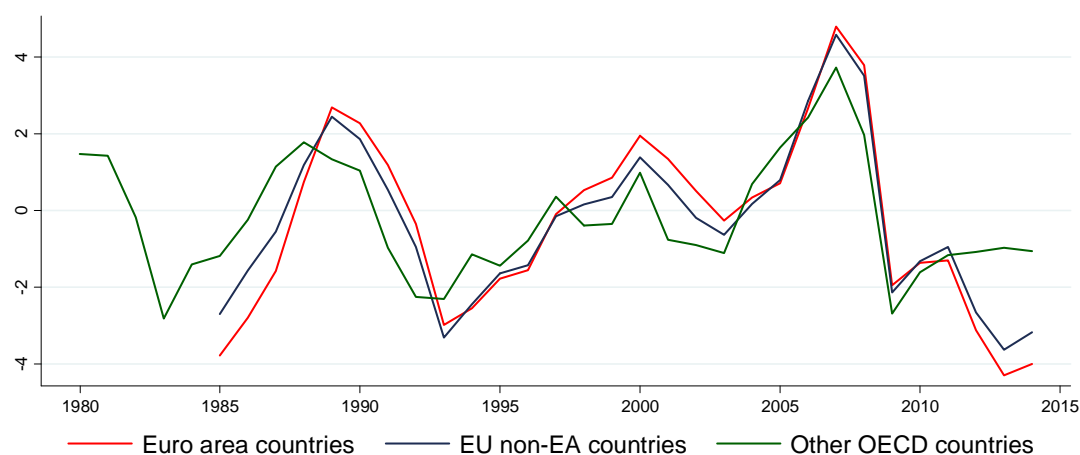
### 3.3 Other control variables

In line with the existing literature discussed in the previous section, we control in our analysis for a number of other factors which may explain labour market performance. In addition to the measure of the tax wedge, we consider four other groups of variables, namely: 1) cyclical factors; 2) factors specific to a country's labour market; 3) factors affecting wage determination and 4) political orientation of the government.

Table 1 below summarises the correlation matrix for the variables considered in the analysis. A detailed description of the data used in the analysis is contained in Appendix 1.

Our measure of cyclical influences on labour market outcomes is the output gap. As shown in the table, this variable has a quite high correlation with the unemployment rate, but less so with the rate of employment. Chart 12 shows that compared to the other groups of countries, euro area countries over the period under consideration tend to display on average a slightly more negative and volatile output gap than the other two groups. Moreover, both EU and euro area countries have started to recover only recently from the double dip recession of 2009 and 2013.

**Chart 12 – Output gap (%)**



**Table 1 – Correlation matrix of the main variables used in the empirical analysis**

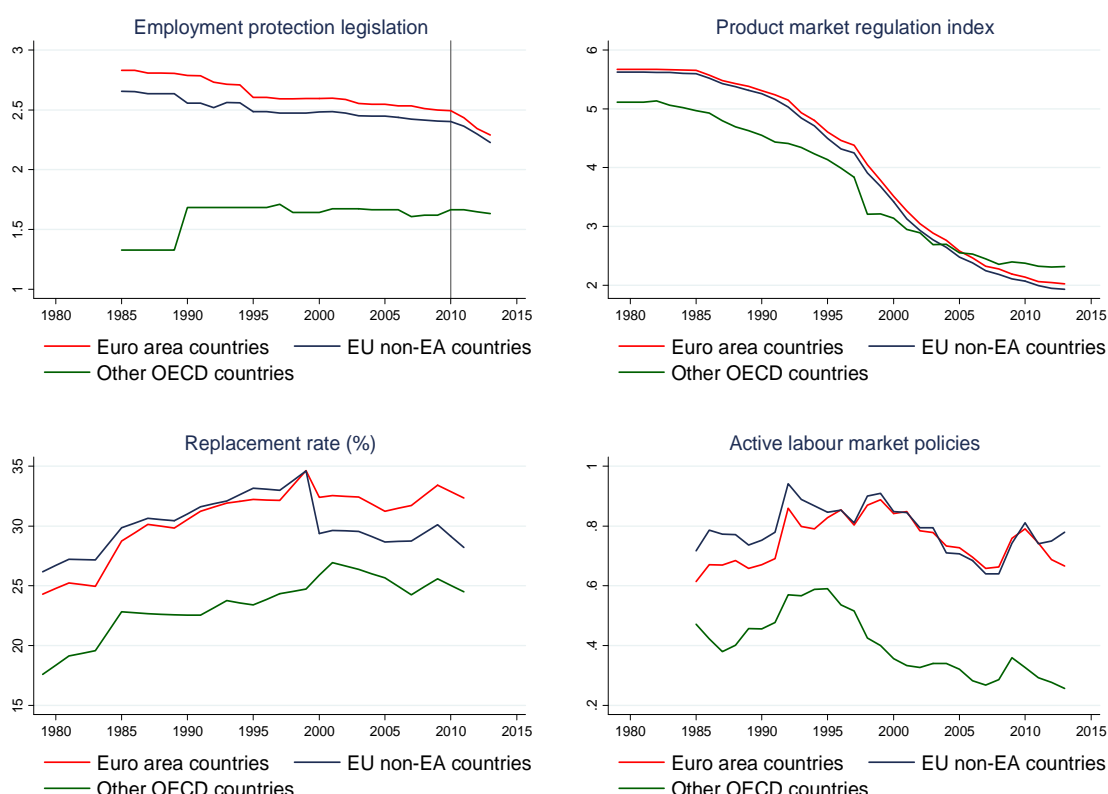
	UN rate	Empl rate	Output gap	Tax wedge (single)	Tax wedge (couple)	RR	EPL	PMR	ALMM	UD	Coord	Political Orientation
UN rate	1.00											
Empl rate	-0.76	1.00										
1 Output gap	-0.41	0.19	1.00									
2 Tax wedge (single)	0.30	-0.51	-0.12	1.00								
2 Tax wedge (couple)	0.37	-0.52	-0.18	0.89	1.00							
3 RR	-0.06	0.09	0.04	0.35	0.28	1.00						
3 EPL	0.09	-0.16	0.03	0.33	0.37	0.26	1.00					
3 PMR	0.19	-0.23	-0.16	0.06	0.13	0.11	0.24	1.00				
3 ALMM	0.10	0.03	-0.19	0.52	0.49	0.52	0.19	0.16	1.00			
4 UD	-0.03	0.14	-0.15	0.39	0.36	0.45	-0.01	0.09	0.61	1.00		
4 Coord	-0.25	0.08	0.11	0.32	0.25	0.33	0.07	0.13	0.38	0.51	1.00	
5 Political Orientation	0.10	0.00	0.05	0.03	0.01	-0.04	0.19	0.03	0.00	0.03	-0.10	1.00

Note: UN rate= unemployment rate; empl rate= employment rate; RR=replacement ratio; EPL= employment protection legislation; PMR= product market regulation; ALMM= active labour market measures; UD= union density; Coord= wage bargaining coordination

The second group of control variables includes factors that influence the incentives of workers to take up a job (*replacement ratio*), the rigidities firms face in their hiring and firing decisions (*employment protection legislation* and *product market regulation*, with the latter capturing entry barriers in the product sector which in turn influences employment creation) or policies which support unemployed people to find a job (*active labour market policies*).

On average, euro area countries tend to display more generous unemployment benefits than both the other EU and OECD countries, as well as a higher degree of employment protection and product market regulation which all tend to hamper job creation. On the other hand, other OECD countries have a lower index of active labour market policies. Over the past few years, however, both the employment protection legislation and the product market regulation indices have declined on average for euro area countries, reflecting the reform efforts adopted in many countries in response to the sovereign debt crisis and the need to foster the resilience of domestic economies. Also the replacement ratio has set on a declining trend though it remains still above the corresponding ratios for the two other groups of countries.

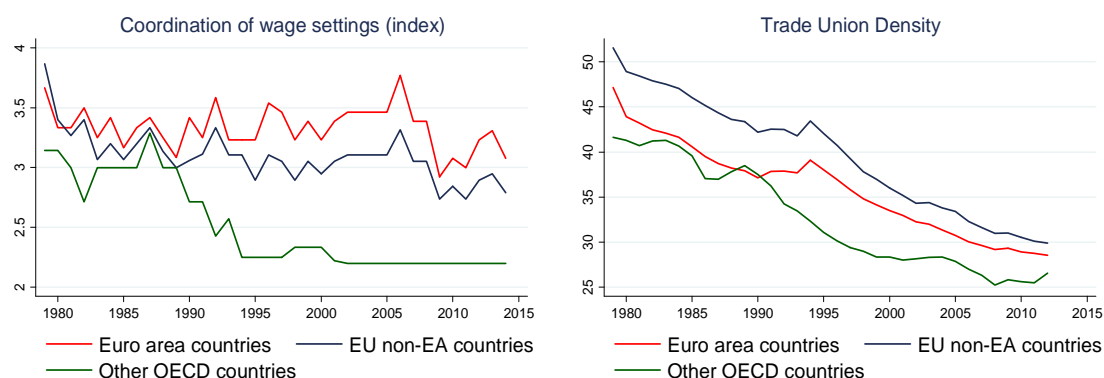
**Chart 13 – Evolution over time of structural factors that may affect employment creation**



Source: OECD

Among the factors affecting the wage determination process we consider: the trade union density and the index of coordination of the wage setting process. 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 and are compiled by the OECD Labour Force Statistics. The wage coordination index captures to what degree the wage negotiation process is centralised at the national level or fragmented (ranging from 1=very fragmented to 5=highly centralised). The charts below summarise the evolution of both variables for the group of countries analysed in this paper. In this case as well the group of euro area and EU countries stands up as the countries with the most centralised degree of wage setting and the largest union density compared to other OECD countries. However, the past few years have witnessed a move towards more decentralised wages settings and lower union density. Finally the political orientation is a variable taking value 1 in case the chief executive party has a right majority, 2 if it is centre majority and 3 if it is left majority.

**Chart 14 – Evolution of variables influencing the wage setting process**



## 4. Empirical analysis

### 4.1 Empirical methodology

We first analyse the determinants of unemployment and employment, in particular the effect of the tax wedge, through a pooled econometric analysis. A static reduced-form equation in line with the literature (e.g. Bassanini and Duval 2006) is estimated for a sample of 30 OECD countries over the period 1979-2014. Unemployment ( $U$ ) and Employment ( $Emp$ ) are the two variables of interest which reflect labour market performance.

Each equation is estimated for the tax wedge ( $TW$ ) of two family types namely (i) the single earner with no child and wage level equal to 100% of the average production worker (APW) annual gross wage earnings and (ii) the couple with two children and only one earner at 100% of the APW wage level. In the equations the two family types are referred to respectively as  $twS$  and  $twC$ . The set of other explanatory variables  $X$  is mostly based on the literature of the labour market performance determinants and they can be classified in few broad categories, as discussed above:

- i. Business cycle factors: the output gap ( $OUTGAP$ ) accounts for the effect of the cyclical fluctuations of aggregate demand on unemployment.
- ii. Labour market institutions are key factors to influence labour supply and demand incentives. The variables included in the analysis are: employment protection legislation ( $EPL$ ), product market regulation ( $PMR$ ), trade union density ( $UD$ ), level of coordination of bargaining ( $CORD$ ) and political orientation ( $PO$ ).
- iii. Targeted government expenditures and social benefit can have significant impact on work incentives and on labour force participation. We use government expenditure on active labour market measures ( $ALMM$ ) and unemployment benefit replacement rate ( $RR$ ) which measures the difference between unemployment benefits received when not working and wages earned when employed.

## 4.2 First evidence from the pooled sample

In a first step, the following equations are estimated using a pooled OLS methodology with clustered standard errors to allow for correlation of error terms within countries while time dummies control for common shocks, such as related to global factors.

$$U_{it} = \lambda_t^u + \beta_f^u TW_{it}^f + \sum_j \gamma_j^u X_{it} + \varepsilon_{f,it}^u \quad (1)$$

$$Empl_{it} = \lambda_t^e + \beta_f^e TW_{it}^f + \sum_j \delta_j^e X_{it} + \varepsilon_{f,it}^e \quad (2)$$

The suffixes  $i$  and  $t$  represent respectively the country and the time,  $\lambda_t$  are the year dummies while  $f$  refers to the family type for which the tax wedge is defined.

Even accounting for a large set of country-specific control variables and time-variant influences, it is still reasonable that this specification does not account for country-specific unobservable factors. Therefore, in the second approach, we address remaining within-group correlation with applying a fixed effect pooled estimator. This choice is also supported by the robust Hausman test (Sargan-Hansen statistics) which points to the presence of fixed effect. Still standard errors account for country specific residual serial correlation and time dummies are included. The second set of estimated equations below includes country fixed effect  $\alpha_i$  :

$$U_{it} = \alpha_i^u + \lambda_t^u + \beta_f^u TW_{it}^f + \sum_j \gamma_j^u X_{it} + \varepsilon_{it}^u \quad (3)$$

$$Empl_{it} = \alpha_i^e + \lambda_t^e + \beta_f^e TW_{it}^f + \sum_k \gamma_k^e X_{it} + \varepsilon_{it}^e \quad (4)$$

Finally, we address the potential problem of endogeneity of the labour taxes with respect to (un)employment. The labour supply or demand can be affected by the level of the tax wedge. For example, it is possible that the government uses labour tax cuts as an instrument to tackle high unemployment. In the presence of such reverse causality the estimates would be biased. We address this endogeneity issue by using an instrumental variable estimator. The instruments to be used should be correlated with the contemporaneous level of taxation and not correlated with the contemporaneous unemployment or employment rate. In the analysis we use the lagged values of the tax wedge as instruments. The instruments are valid and the results are robust to this specification.

Table 2 reports the estimated effect of the level of tax wedge on the unemployment and employment rate for the two family types. The results are estimated using the three different estimation methods: pooled OLS estimates, fixed effect and instrumental variables. All methods are based on cluster robust standard error and time dummies.

Table 2. Baseline equation based on three estimation methods.

Estimation method	Pooled OLS				Fixed effect				IV			
	[1a]	[1b]	[2a]	[2b]	[3a]	[3b]	[4a]	[4b]	[5a]	[5b]	[6a]	[6b]
Dependent variable	Employment		Unemployment		Employment		Unemployment		Employment		Unemployment	
twS	-0.49 [-7.81]***		0.15 [3.50]**		-0.43 [-4.01]***		0.18 [2.55]*		-0.48 [-5.21]***		0.19 [2.84]**	
twC		-0.50 [-4.22]***		0.18 [2.49]*		-0.28 [-4.09]***		0.14 [3.27]**		-0.43 [-5.62]***		0.21 [3.06]**
rr	0.06 [0.95]	0.02 [0.38]	0.00 [-0.07]	0.01 [0.20]	0.00 [-0.03]	-0.01 [-0.20]	0.05 [1.60]	0.06 [1.65]	0.01 [0.18]	-0.01 [-0.26]	0.04 [1.58]	0.05 [1.64]
pmr	-2.74 [-2.23]*	-2.53 [-1.72]	0.94 [1.19]	0.88 [1.00]	-0.47 [-0.58]	-0.70 [-0.91]	-0.12 [-0.27]	0.01 [0.02]	-1.00 [-2.35]*	-1.08 [-2.57]*	0.25 [1.28]	0.29 [1.47]
epl	0.88 [0.77]	1.28 [1.15]	-0.42 [-0.71]	-0.69 [-1.32]	-0.71 [-0.57]	-0.73 [-0.72]	-0.11 [-0.08]	-0.28 [-0.21]	-0.39 [-0.30]	-0.76 [-0.88]	-0.22 [-0.17]	-0.25 [-0.24]
ud	0.06 [1.24]	0.07 [1.29]	-0.04 [-0.91]	-0.04 [-0.96]	0.02 [0.36]	0.05 [0.75]	-0.02 [-0.40]	-0.03 [-0.55]	0.03 [0.37]	0.13 [1.37]	-0.01 [-0.10]	-0.04 [-0.77]
outgap	0.20 [1.75]	0.12 [0.74]	-0.54 [-5.25]***	-0.50 [-5.32]***	0.30 [6.00]***	0.39 [6.52]***	-0.59 [-6.54]***	-0.60 [-7.27]***	0.35 [8.49]***	0.37 [8.11]***	-0.56 [-7.86]***	-0.56 [-8.03]***
cord	0.59 [1.32]	0.29 [0.56]	-0.83 [-2.75]*	-0.77 [-2.44]*	0.78 [2.01]	0.81 [2.22]*	-0.76 [-2.21]*	-0.81 [-2.53]*	0.72 [2.25]*	0.85 [3.05]**	-0.73 [-2.41]*	-0.81 [-2.96]**
almm	2.78 [1.70]	2.75 [1.29]	0.25 [0.22]	0.02 [0.01]	1.15 [1.08]	0.53 [0.50]	-0.43 [-0.49]	-0.26 [-0.31]	0.98 [0.93]	0.26 [0.25]	-0.04 [-0.05]	0.10 [0.13]
po	0.17 [0.40]	-0.14 [-0.36]	0.43 [0.89]	0.50 [1.05]	0.03 [0.19]	-0.05 [-0.24]	0.05 [0.25]	0.09 [0.42]	0.07 [0.41]	-0.07 [-0.37]	0.03 [0.15]	0.05 [0.25]
_cons	73.85 [21.16]***	69.36 [17.33]***	2.02 [0.62]	3.17 [1.02]	71.03 [9.15]***	63.09 [9.73]***	3.77 [0.77]	6.78 [1.57]				
N. obs.	404	404	484	484	404	404	484	484	386	386	466	466
Adj. R <sup>2</sup>	0.55	0.52	0.40	0.42	0.65	0.66	0.62	0.63	0.64	0.61	0.60	0.60
Country effects	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	no

Absolute value of t statistics in brackets

\*, \*\*, \*\*\*, significant at the 10%, 5% and 1% levels respectively.

Time dummies are not reported.

IV estimates are based on 2SLS method. Instruments are the lagged values up to three lags of the tax wedge and the replacement rate. The p-values for the Hansen J over-identification test are above 0.01 for regressions [5] and well above 0.05 regressions [6], thus we cannot reject the null hypothesis of valid instruments.

Overall, the results for all three approaches show that labour taxes have a strong and significant impact on the labour market performance. Interestingly, the estimated coefficients for the variables of our main interest are in all cases very similar in size and significance level, which points to a high robustness of the estimates.

Based on the fixed effect estimates, for a family composed by a single earner at 100% of APW, an increase of one percentage point in the tax wedge is estimated to increase the unemployment rate by 0.18 percentage points and decrease the employment rate by 0.43 percentage points (see equation 3a and 4a). The effect is qualitatively similar but smaller for a one earner couple, for which one percentage point increase of the tax wedge results in 0.14 percentage points higher unemployment rate and 0.27 percentage points lower employment rate (equation 3b and 4b). The elasticity of (un)employment to the taxation is lower for one-earner couple compared to the single earner as expected. A possible explanation is that the living costs of one family with a single earner and two children are higher than the benefits that the family would receive in case the earner would opt for non-participation. At the same time, for both family types, the effect of an increase in labour taxation to employment is larger compared to the effect on unemployment. It is possible that the higher taxation reduces the incentive to work because of the lower net wages and the worker would opt not only for non-participation but stop actively seeking for a job. This category is missing in the unemployment rate,



accordingly the latter reacts only to a minor extent to changes in labour taxation compared to the former.

In order to tackle the potential endogeneity problem inherent to the previous approaches, we estimate the same equation with instrumental variables. The Sargan-Hansen test of over-identifying restrictions supports the validity of the instruments. The IV estimates are in line or marginally higher in absolute term compared to the fixed effect estimates, and overall the results are robust. Given that the fixed effect estimators are robust with the findings based on the instrumental variable technique, in the following section we report only the results based on the former approach. The results based on the latter approach are reported in the sensitivity analysis at the end of this section..

Concerning the other explanatory variables, the output gap has the expected negative effect which is highly significant for both family types. The level of coordination seems to play a role, although the effect is small and not always statistically significant. The results suggest that the higher the level of coordination of the wage setting processes, the lower the unemployment. On the basis of this finding, the wage bargaining processes which have the lowest detrimental effect on labour supply appear to be the ones coordinated at central level. We do not find any evidence of a significant effect of the remaining institutional variables. This can be explained by measurement errors as some features of the institutions are difficult to capture with single indicators or by the very low variability of these variables, in the latter case the influence of the labour market institutions would be captured by the country specific effects. The interactions with institutional variables have been tested but the results are hardly significant and not robust therefore the estimates are not reported.

#### **4.3 Other specifications: groups' and time heterogeneity**

The previous estimates are based on the assumption that the relation between labour taxation and labour market performance is homogenous in all OECD countries. However, it is possible that labour market institutions or other country specific factors might influence the tax wedge effect. First, in order to take into account the heterogeneity across countries, we identify three groups: Euro area countries, European Union non-EA Member States and other OECD countries. The main reason for estimating the effect for specific geographic areas is because we are interested in understanding primarily the effects of labour income taxation on the labour market performance of the euro area countries where this issue features prominently in the policy debate.

Table 3. Estimates for country groups and workers skill

Estimation method	Fixed effects									
	[1a]	[1b]	[2a]	[2b]	[3a]	[3b]	[4a]	[4b]	[5a]	[5b]
Dependent variable	Total employment		Total unemployment		Low-skilled unemployment	Medium-skill unemployment	High-skill unemployment			
family type	twS	twC	twS	twC	twS	twC	twS	twC	twS	twC
<b>Labour tax</b>	-0.503	-0.362	0.300	0.224	0.755	0.529	0.170	0.081	0.162	0.098
<b>EA</b>	[-5.72]***	[-7.50]***	[4.19]***	[3.58]**	[4.71]***	[3.37]**	[1.41]	[0.92]	[2.45]*	[1.87]
<b>Labour tax</b>	0.074	-0.152	0.027	0.180	0.283	0.358	0.326	0.322	-0.012	0.031
<b>EU-non-EA</b>	[0.35]	[-1.28]	[0.14]	[1.04]	[0.87]	[1.16]	[1.56]	[1.63]	[-0.14]	[0.41]
<b>Labour tax</b>	-0.535	-0.199	0.050	0.036	0.380	-0.580	0.267	-0.004	0.081	0.045
<b>Other OECD</b>	[-6.81]***	[-2.46]*	[0.85]	[0.89]	[1.39]	[-0.63]	[1.18]	[-0.02]	[0.64]	[0.79]
<b>rr</b>	0.005	-0.023	0.054	0.071	0.203	0.236	-0.007	-0.002	0.013	0.017
	[0.11]	[-0.42]	[1.62]	[2.01]	[1.01]	[1.17]	[-0.15]	[-0.04]	[0.75]	[0.86]
<b>pmr</b>	-0.583	-0.359	-0.148	-0.336						
	[-0.82]	[-0.43]	[-0.35]	[-0.73]						
<b>epl</b>	-0.458	-0.486	-0.426	-0.361	2.881	2.749	2.162	2.202	0.553	0.562
	[-0.37]	[-0.45]	[-0.26]	[-0.27]	[1.61]	[1.59]	[1.68]	[1.76]	[0.39]	[0.41]
<b>ud</b>	-0.021	0.050	-0.016	-0.046	-0.255	-0.272	-0.157	-0.147	-0.079	-0.090
	[-0.41]	[0.68]	[-0.27]	[-0.76]	[-2.15]*	[-1.88]	[-1.47]	[-1.29]	[-0.84]	[-0.96]
<b>outgap</b>	0.287	0.362	-0.560	-0.572	-0.667	-0.700	-0.575	-0.591	-0.182	-0.200
	[4.25]***	[6.03]***	[-5.92]***	[-6.87]***	[-3.26]**	[-3.79]**	[-5.90]***	[-6.71]***	[-4.18]***	[-4.13]***
<b>cord</b>	0.922	0.984	-0.863	-0.898	-0.133	-0.377	-1.119	-1.129	-0.994	-1.007
	[2.55]*	[2.76]*	[-2.67]*	[-2.73]*	[-0.18]	[-0.61]	[-2.50]*	[-2.41]*	[-2.77]*	[-2.61]*
<b>almm</b>	1.370	0.724	-0.571	-0.393						
	[1.74]	[0.75]	[-0.74]	[-0.50]						
<b>po</b>	-0.127	-0.091	0.106	0.089	0.530	0.631	0.308	0.313	0.020	0.019
	[-0.83]	[-0.48]	[0.58]	[0.49]	[1.66]	[1.53]	[1.72]	[1.88]	[0.17]	[0.16]
<b>_cons</b>	69.800	60.930	4.911	8.094	-14.540	-1.232	3.600	8.094	4.862	7.094
	[10.79]***	[9.50]***	[1.12]	[1.90]	[-0.84]	[-0.08]	[0.60]	[1.48]	[1.54]	[2.23]*
<b>N. obs.</b>	404	404	484	484	371	371	371	371	371	371
<b>Adj. R<sup>2</sup></b>	0.694	0.676	0.634	0.640	0.412	0.431	0.634	0.636	0.475	0.466
<b>Country effects</b>	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
<b>Time dummies</b>	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Absolute value of t statistics in brackets

\*, \*\*, \*\*\*, significant at the 10%, 5% and 1% levels respectively.

Time dummies are not reported.

Pmr and almm have been excluded for the skill-specific specification in order to keep a sufficient number of observations.

Labour taxation appears to strongly influence employment and unemployment only in the Euro area countries (see equations [1] and [2] in table 3). The size of the parameters is higher in absolute term compared to the pooled results. For this country group, the results suggest that a cut in the tax wedge would have a strong and positive effect on the economy. On the contrary, for the other European Union countries a similar relation seems not to exist. The results for other OECD countries are mixed, labour taxation appear to influence strongly employment but not unemployment.

In the following, we disentangle the estimated effects further. Changes in labour taxation can affect differently unemployment of specific categories of workers. We disentangle the overall unemployment rate by workers skill level. The data is derived from the World Bank estimates which provide the contribution to the overall unemployment rate by level of education. The unemployment rate is decomposed for labour force with primary, secondary and tertiary education which we use as a proxy respectively of low, medium and high-skill workers unemployment. The same

analysis could not be computed for employment due to lack of data. The results show that the effect on unemployment is not homogeneous across categories (equations 3-5 in table3). An increase in the tax wedge for both family types in Euro Area countries has a much higher effect on the unemployment for low-skilled workers while the magnitude of the effect decreases for medium and high-skills categories and it is mostly not statistically significant. In line with the theory, this suggests that a change in labour taxation is more likely to affect labour decision for low-skills workers. In fact higher taxes reduce their incentive to work as net wages becomes lower than their reservation wages. As for the previous results, the high taxation gives the workers the wrong incentives to move out from the active labour force and stop looking for a job. The same effect is not visible for the other country groups, consistently with the aggregated unemployment results. The results should be interpreted with caution. First the level of education is only a proxy for the level of skills of the workers. Second the number of observations drop considerably undermining the robustness of the results.

The effect of labour taxation can depend also on other factors more broadly related to tax and benefit system. For example, firms' incentives to hire can be affected by the overall level of corporate income taxation or by the subsidies they receive from the government. In fact a high corporate income tax can make it more difficult for a firm to be profitable, in this situation an increase in the tax wedge could be more difficult to sustain and result in a weaker incentive to create jobs. Likewise, workers incentives to take up a job depend not only on net wages but also on transfers (e.g. unemployment benefits) they may receive from the government with the latter affecting their reservation wage. To test this hypothesis we estimate the effect of tax wedge conditional on the level of overall tax burden, the level of social transfers or the output gap. High tax burden or social transfers refer to taxes and expenditures above the unweighted OECD average (as a % of GDP), output gap is split into positive and negative episodes. The results are mixed. It appears that an increase in the tax wedge when the tax burden is already high have an additional detrimental effect on unemployment compared to a situation when the tax burden is lower. The effect albeit limited is significant; therefore this would suggest that governments should avoid excessive taxation not to increase further the detrimental effect of labour taxation on unemployment. The same results are not visible for social transfer. The lack of significant effect could be due to the broad definition of social transfers which might be targeted to other groups and not be used necessarily to support employment<sup>7</sup>. Finally the effect of the tax wedge should be influenced also by the business cycle. In good times (un)employment can be assumed to be more resilient to changes in labour taxation while during a recession an increase in the tax wedge can be perceived as unsustainable by both employers and workers and can depress more labour demand and supply compared to periods of positive growth. Again, there is no evidence of non-linear effect of labour taxation with regard to business cycle fluctuations. The results are qualitatively similar with respect to employment, which is not reported in Table4.

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<sup>7</sup> More disaggregated information on social transfers could not be used due to data availability. The OECD Social expenditure database (SOCX) provides public spending disaggregated by type of programs, however the time series are available with a frequency of only 5 years before 2009

Table 4. Non-linearities with respects to tax burden, social spending and output gap.

UNEMPLOYMENT			UNEMPLOYMENT			UNEMPLOYMENT		
twS	0.145		twS	0.23		twS	0.185	
	[2.08]*			[2.91]**			[2.61]*	
TWS * High tax burden	0.0293		TWS * High Social benefits	-0.0113		TWS * Positive output gap	-0.0105	
	[3.06]**			[-0.72]			[-1.61]	
twC		0.111	twC		0.151	twC		0.151
		[2.72]*			[2.57]*			[3.24]**
TWC * High tax burden		0.041	TWC * High Social benefits		-0.0141	TWC * Positive output gap		-0.0201
		[4.57]***			[-0.66]			[-1.88]
rr	0.052	0.053		0.022	0.027		0.052	0.054
	[1.60]	[1.59]		[0.68]	[0.96]		[1.60]	[1.63]
pmr	-0.018	0.092		-0.554	-0.717		-0.169	-0.055
	[-0.04]	[0.22]		[-0.96]	[-1.25]		[-0.40]	[-0.13]
epl	0.147	0.075		-2.772	-3.133		-0.047	-0.200
	[0.10]	[0.06]		[-2.00]	[-2.11]*		[-0.03]	[-0.15]
ud	-0.032	-0.045		-0.062	-0.056		-0.020	-0.030
	[-0.56]	[-0.77]		[-1.18]	[-0.83]		[-0.35]	[-0.49]
outgap	-0.587	-0.598		-0.480	-0.504		-0.539	-0.530
	[-6.35]***	[-7.02]***		[-5.12]***	[-5.26]***		[-6.13]***	[-6.82]***
cord	-0.792	-0.823		-0.610	-0.670		-0.783	-0.849
	[-2.35]*	[-2.60]*		[-1.79]	[-1.94]		[-2.31]*	[-2.69]*
almm	-0.443	-0.275		-0.715	-0.382		-0.465	-0.320
	[-0.53]	[-0.34]		[-0.56]	[-0.31]		[-0.52]	[-0.37]
po	0	0		0	0		0	0
	[0.14]	[0.28]		[0.79]	[0.87]		[0.27]	[0.45]
cons	3.532	5.971		9.622	15.100		3.760	6.836
	[0.81]	[1.45]		[2.30]*	[4.19]***		[0.78]	[1.61]
N.obs.	484.000	484.000		381.000	381.000		484.000	484.000
Adj. R <sup>2</sup>	0.627	0.635		0.61	0.603		0.622	0.633
Country effects	yes	yes		yes	yes		yes	yes
Time dummies	yes	yes		yes	yes		yes	yes

Absolute value of t statistics in brackets

\*, \*\*, \*\*\*, significant at the 10%, 5% and 1% levels respectively.

Time dummies are not reported.

These non-linearities of the effect of labour taxation with regard to the tax burden could partially explain the variations over time of the estimated parameter  $\beta_f^u$ . We estimate the country groups specific parameters based on a ten year rolling window, including all variables as in the previous specifications. For the pooled sample we find that the tax wedge effect on unemployment has not changed significantly over time, the point estimate has remained between 0.1 and 0.4 with not extremely large confidence bands except for the period including the crisis. Interesting conclusions can be drawn for the Euro Area countries group where the time series of the estimated parameter presents the highest variability among the groups considered. The tax wedge effect (point estimate) has moved from peak level of about 1 in the 1980s to about 0.25 in the period starting in the late 1990s. A possible answer is related to the effects observed above on the influence of the tax burden. Broadly in the same period in which the effect increases, the euro area tax burden surged compared to the OECD average. In addition, the size of the effect is negatively correlated with the evolution of the output gap over time, supporting our hypothesis that the business cycle influences as well the relation between labour taxation and unemployment. However, we could not find any evidence of significant interaction effect which could validate this theory, suggesting that further work is needed. Nonetheless, the influence of the labour taxation in the Euro area seems to have increased again in the last fifteen years. This supports the increasing attention and call of the European Commission to decrease labour taxation in the European countries.

Chart 15. The effect over time of labour taxation on unemployment



Note: The chart report the estimated effect of one percentage point increase of tax wedge on unemployment.  
The year in the x-axis refer to the starting year of the 10 year moving window.

#### 4.4 The short term effect of the tax wedge

In the following, we report the results for a specification in which all variables are transformed to their first differences. The purpose of this analysis is to identify the short term effect of changes in the tax wedge to changes in the labour market performance. This allows us to analyse whether the negative effect of labour taxation on labour market performance, which we reported in the previous sections, can already be observed shortly after a legislative change to the tax wedge, or whether it is merely a long-term outcome. The following equations are estimated:

$$\Delta U_{it} = \lambda_t^u + \beta_f^u \Delta TW_{it}^f + \sum_j \gamma_j^u \Delta X_{it} + \epsilon_{it}^u \quad (5)$$

$$\Delta \text{Empl}_{it} = \lambda_t^e + \beta_f^e \Delta TW_{it}^f + \sum_k \gamma_k^e \Delta X_{it} + \epsilon_{it}^e \quad (6)$$

The findings of the previous section are confirmed. However, owing to the different specification, the significant level is reduced compared to the previous estimates. Interestingly, the short term effect of a change in labour taxation is quantitatively strong and statistically significant when one considers the reaction of the labour market performance to tax wedge changes in the same year. A cut in the tax wedge by 1 pp. immediately leads to a decrease in employment (increase in unemployment) by 0.1 pp. However, it has to be stressed that this specification already implicitly includes a lag structure, as tax changes typically come into force already at 1 January, and are anticipated even before. For the second lag, the quantitative effect is broadly half of the effect of the contemporaneous effect, and it is close to zero after two years. This result implies that a change of the tax wedge can already lead to visible labour market responses after a relative short time.

Table 5. Specification in first differences

Estimation method	Fixed effects							
	Δ Employment				Δ Unemployment			
Dependent variable								
Δ twS	-0.12 [-2.78]*	-0.11 [-2.75]*			0.12 [2.17]*	0.11 [2.09]*		
Δ twS.L1		-0.08 [-2.43]*				0.05 [1.41]		
Δ twS.L2		-0.006 [-0.17]				-0.026 [-0.60]		
Δ twC			-0.09 [-3.34]**	-0.08 [-3.37]**		0.07 [2.43]*	0.07 [2.40]*	
Δ twC.L1				-0.03 [-1.31]			0.00 [0.07]	
Δ twC.L2				0.00 [0.13]			-0.01 [-0.22]	
Δ rr	0.01 [0.71]	0.01 [0.55]	0.01 [0.69]	0.01 [0.61]	-0.01 [-0.47]	-0.01 [-0.40]	-0.01 [-0.39]	-0.01 [-0.37]
Δ pmr	0.09 [0.28]	0.05 [0.14]	0.11 [0.37]	0.10 [0.31]	-0.22 [-1.06]	-0.23 [-1.06]	-0.24 [-1.19]	-0.25 [-1.18]
Δ epl	0.89 [1.62]	0.96 [1.50]	0.91 [1.65]	1.00 [1.58]	-0.68 [-1.00]	-0.70 [-0.95]	-0.70 [-1.01]	-0.72 [-0.96]
Δ ud	-0.15 [-3.15]**	-0.15 [-3.25]**	-0.15 [-3.08]**	-0.16 [-3.17]**	0.11 [2.43]*	0.11 [2.44]*	0.11 [2.46]*	0.11 [2.45]*
Δ outgap	0.23 [8.36]***	0.22 [8.11]***	0.24 [7.88]***	0.23 [7.78]***	-0.33 [-9.05]***	-0.33 [-8.81]***	-0.34 [-8.70]***	-0.34 [-8.58]***
Δ cord	0.29 [2.01]	0.30 [2.03]	0.32 [2.05]	0.32 [2.07]	-0.29 [-2.11]*	-0.29 [-2.08]*	-0.31 [-2.15]*	-0.31 [-2.13]*
Δ almm	-0.60 [-1.48]	-0.64 [-1.58]	-0.55 [-1.38]	-0.59 [-1.48]	0.24 [0.45]	0.28 [0.51]	0.19 [0.35]	0.20 [0.36]
Δ po	0.00 [-0.06]	-0.01 [-0.13]	0.01 [0.07]	0.00 [-0.05]	-0.02 [-0.26]	-0.02 [-0.23]	-0.03 [-0.37]	-0.03 [-0.33]
_cons	0.28 [1.46]	0.29 [1.55]	0.30 [1.55]	0.30 [1.56]	-0.02 [-0.10]	-0.03 [-0.15]	0.00 [0.00]	0.00 [0.01]
N	375	371	375	371	454	450	454	450
Country effects	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes

Absolute value of t statistics in brackets

\*, \*\*, \*\*\*, significant at the 10%, 5% and 1% levels respectively.

Time dummies are not reported.

Interestingly, this effect is not symmetric for tax increases and decreases. If we restrict the analysis to the increases in the tax wedge only, we observe a higher effect in absolute term on unemployment compared to the one associated with a decrease in the tax wedge. A possible explanation for this asymmetry is related to the degree of wage rigidities. In fact, since wages are downward rigid, a lower labour taxation is less likely to be quickly passed on to lower labour costs compared to an increase in the tax wedge of a similar magnitude. In the latter case it is more likely that higher labour taxes are quickly passed on to higher labour costs, thus decreasing firms' competitiveness. In particular, we find that a 1 percentage point *increase* in the tax wedge of one-earner couple with children has a negative effect on employment in the same year which is twice the size of the estimated coefficient for a *decrease* in the tax wedge. Therefore we conclude that the short-term effect of the change in labour taxes should be carefully considered by governments in the design of consolidation or expansionary measures.

Table 6. Non-symmetric effect with respect to the direction of tax wedge change

Dependent variable	Fixed effects							
	Δ Employment				Δ Unemployment			
	Positive change		Negative change		Positive change		Negative change	
<b>ΔtwS</b>	-0.27 [-3.69]**		-0.06 [-0.83]		0.28 [2.51]*		0.05 [0.75]	
<b>ΔtwC</b>		-0.16 [-2.46]*		-0.08 [-2.66]*		0.14 [1.74]		0.07 [1.55]
<b>Δrr</b>	0.01 [0.67]	0.01 [0.74]	0.01 [0.75]	0.01 [0.69]	-0.01 [-0.42]	-0.01 [-0.47]	-0.01 [-0.44]	-0.01 [-0.39]
<b>Δpmr</b>	0.13 [0.41]	0.20 [0.65]	0.12 [0.37]	0.20 [0.69]	-0.25 [-1.20]	-0.26 [-1.41]	-0.25 [-1.21]	-0.26 [-1.42]
<b>Δepl</b>	0.90 [1.86]	0.92 [1.56]	0.93 [1.79]	0.93 [1.56]	-0.70 [-1.13]	-0.74 [-1.03]	-0.72 [-1.08]	-0.74 [-1.03]
<b>Δud</b>	-0.15 [-3.22]**	-0.17 [-3.21]**	-0.15 [-3.14]**	-0.16 [-3.23]**	0.11 [2.45]*	0.12 [2.59]*	0.11 [2.51]*	0.12 [2.60]*
<b>Δoutgap</b>	0.22 [7.34]***	0.24 [8.31]***	0.24 [7.14]***	0.24 [8.16]***	-0.33 [-8.51]***	-0.34 [-9.10]***	-0.34 [-8.36]***	-0.34 [-8.89]***
<b>Δcord</b>	0.28 [1.96]	0.32 [2.17]*	0.31 [2.04]	0.32 [2.16]*	-0.28 [-2.16]*	-0.32 [-2.30]*	-0.31 [-2.16]*	-0.32 [-2.30]*
<b>Δalmm</b>	-0.63 [-1.54]	-0.37 [-0.89]	-0.52 [-1.21]	-0.40 [-0.99]	0.22 [0.41]	0.08 [0.15]	0.13 [0.24]	0.11 [0.23]
<b>Δpo</b>	-0.01 [-0.15]	0.01 [0.18]	0.00 [0.06]	0.01 [0.21]	-0.02 [-0.26]	-0.04 [-0.61]	-0.03 [-0.36]	-0.04 [-0.66]
<b>_cons</b>	0.38 [1.88]	-0.05 [-0.26]	0.41 [1.94]	-0.06 [-0.29]	-0.12 [-0.57]	0.15 [0.52]	-0.04 [-0.18]	-0.18 [-1.22]
<b>N</b>	375	383	375	383	454	474	454	474
<b>Country effects</b>	yes	yes	yes	yes	yes	yes	yes	yes
<b>Time dummies</b>	yes	yes	yes	yes	yes	yes	yes	yes

Absolute value of t statistics in brackets

\*, \*\*, \*\*\*, significant at the 10%, 5% and 1% levels respectively.

Time dummies are not reported.

#### 4. 5 Robustness check

As mentioned in the previous section, the fixed effect estimates could be biased due to the endogeneity of the tax wedge with respect to employment and unemployment. The bias can be accounted for using the lagged values of the policy variables (tax wedge and unemployment replacement rate) as instrumental variables for the contemporaneous policy variables. The estimates based on fixed effect are consistent with the instrumental variable approach (table7) also for the specification with country groups' specific effects.

Table 7. Results based on different specifications

Estimation method	Fixed effects - full sample				IV - full sample				IV - Excluding crisis period [1979-2007]			
	[1a]	[1b]	[2a]	[2b]	[3a]	[3b]	[4a]	[4b]	[5a]	[5b]	[6a]	[6b]
Dependent variable	Total employment		Total unemployment		Total employment		Total unemployment		Total employment		Total unemployment	
family type	twS	twC	twS	twC	twS	twC	twS	twC	twS	twC	twS	twC
Labour tax	-0.50	-0.36	0.30	0.22	-0.54	-0.38	0.33	0.23	-0.54	-0.36	0.30	0.21
EA	[-5.72]***	[-7.50]***	[4.19]***	[3.58]**	[-8.21]***	[-6.48]***	[4.63]***	[3.67]***	[-7.08]***	[-5.70]***	[2.85]**	[2.31]*
Labour tax	0.07	-0.15	0.03	0.18	0.10	-0.23	-0.02	0.20	0.09	-0.24	-0.04	0.10
EU-non-EA	[0.35]	[-1.28]	[0.14]	[1.04]	[0.44]	[-2.07]*	[-0.12]	[1.12]	[0.32]	[-1.89]	[-0.17]	[0.55]
Labour tax	-0.54	-0.20	0.05	0.04	-0.67	-0.24	0.06	0.05	-0.65	-0.27	0.07	0.03
Other OECD	[-6.81]***	[-2.46]*	[0.85]	[0.89]	[-12.95]***	[-3.62]***	[1.03]	[1.43]	[-9.20]***	[-3.60]***	[0.76]	[0.54]
rr	0.01	-0.02	0.05	0.07	0.00	-0.02	0.05	0.06	0.01	0.02	0.05	0.05
	[0.11]	[-0.42]	[1.62]	[2.01]	[0.03]	[-0.38]	[1.66]	[1.90]	[0.26]	[0.31]	[1.37]	[1.36]
pmr	-0.58	-0.36	-0.15	-0.34	-1.02	-0.95	0.31	0.24	-0.94	-0.77	0.29	0.21
	[-0.82]	[-0.43]	[-0.35]	[-0.73]	[-2.75]**	[-2.35]*	[1.82]	[1.24]	[-2.29]*	[-1.80]	[1.18]	[0.82]
epl	-0.46	-0.49	-0.43	-0.36	-0.32	-0.34	-0.52	-0.36	-0.23	-0.22	0.25	0.24
	[-0.37]	[-0.45]	[-0.26]	[-0.27]	[-0.26]	[-0.31]	[-0.35]	[-0.31]	[-0.21]	[-0.23]	[0.17]	[0.20]
ud	-0.02	0.05	-0.02	-0.05	-0.03	0.05	0.00	-0.02	-0.05	0.01	0.00	-0.01
	[-0.41]	[0.68]	[-0.27]	[-0.76]	[-0.48]	[0.65]	[0.09]	[-0.47]	[-0.88]	[0.11]	[0.03]	[-0.17]
outgap	0.29	0.36	-0.56	-0.57	0.32	0.37	-0.53	-0.55	0.32	0.38	-0.56	-0.57
	[4.25]***	[6.03]***	[-5.92]***	[-6.87]***	[6.67]***	[8.36]***	[-7.98]***	[-8.90]***	[4.90]***	[5.02]***	[-6.36]***	[-6.70]***
cord	0.92	0.98	-0.86	-0.90	0.83	0.93	-0.84	-0.86	1.03	1.17	-0.93	-0.99
	[2.55]*	[2.76]*	[-2.67]*	[-2.73]*	[2.52]*	[2.92]**	[-2.98]**	[-2.99]**	[2.11]*	[2.55]*	[-2.29]*	[-2.55]*
almm	1.37	0.72	-0.57	-0.39	1.23	0.38	-0.22	0.10	1.45	0.73	-0.24	-0.04
	[1.74]	[0.75]	[-0.74]	[-0.50]	[1.67]	[0.42]	[-0.32]	[0.13]	[1.96]*	[0.89]	[-0.29]	[-0.04]
po	-0.13	-0.09	0.11	0.09	-0.12	-0.06	0.09	0.05	-0.17	-0.21	0.00	0.00
	[-0.83]	[-0.48]	[0.58]	[0.49]	[-0.88]	[-0.35]	[0.48]	[0.27]	[-1.23]	[-1.07]	[0.01]	[-0.03]
_cons	69.80	60.93	4.91	8.09								
	[10.79]***	[9.50]***	[1.12]	[1.90]								
N. obs.	404	404	484	484	386	386	466	466	296	296	372	372
Adj. R <sup>2</sup>	0.69	0.68	0.63	0.64	0.68	0.66	0.62	0.62	0.71	0.70	0.65	0.65
Country effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	no	no	no	no	no	no	no	no

Absolute value of t statistics in brackets

\*, \*\*, \*\*\*, significant at the 10%, 5% and 1% levels respectively.

Time dummies are not reported.

IV estimates are based on 2SLS method. Instruments are the lagged values up to three lags of the tax wedge and the replacement rate. The p-values for the Hansen J over-identification test are well above 0.05 for all regression, thus we cannot reject the null hypothesis of valid instruments.

Finally, we test for the sensitivity of the findings with respect to the choice of the sample. The financial crisis followed by the sovereign debt crisis was accompanied by an unprecedented increase in unemployment rates since 2009 in all OECD countries included in the panel. The estimates of the parameters could be driven by few large outliers or the absence of significant effects might be the results of a structural change in the economy which might have changed the relations between labour taxes and institutions and labour market performance. In order to check for the robustness of the results, the same equations with country groups' individual effects have been estimated only for the period excluding the recent crisis 1979-2007. The key findings are both qualitatively and quantitatively consistent with the estimates based on the full sample. For this reason we are fairly confident that the results are not biased by the exceptional circumstances during the crisis.



## 5. Conclusions and way forward

Inspired by the ongoing policy debate and the call from the European Commission and the Eurogroup to reduce the tax wedge on labour income to tackle the poor performance of the labour market in the EU Member States, this paper aims to empirically assess the effects of labour income taxes on labour market performance from an aggregate perspective. Our estimates support the expectation that labour income taxation is an important determinant of (un)employment and provide new insights concerning the quantitative relevance for EU countries, the underlying channels and the dynamic relationship. The results suggest that governments should strive towards a more growth-friendly composition of their tax system, e.g. by shifting the tax burden from labour taxes to less mobile tax bases, while providing for sufficient revenues to service their expenditures and ensuring fiscal sustainability.

In particular, our analysis has demonstrated how high labour income taxation tends to be more detrimental for the occupational prospects of single earners, low-skilled workers and this is even more so if the country has a very high tax burden. These effects appear to be more significant for euro area countries while less clear cut conclusions can be drawn for other EU and OECD countries. We explain this finding with the fact that euro area countries tend to display a particularly high tax burden on labour compared to other countries, which intensifies the causal relationship. Another important finding of our analysis is that the speed of adjustment after a change in the tax wedge is found to be asymmetric with an increase in the tax wedge having a double (negative) effect on (un)employment in the same year compared to the positive effect of a cut in the tax wedge of the same magnitude. Finally, when looking at the time variation of the effects of the tax wedge on (un)employment we have found that while it seems relatively stable over time for the full sample, for the euro area we observe that in the more recent period, the size of the effects of the tax wedge on (un)employment has increased. This might to some extent reflect cyclical developments and/or increases in the tax burden.

Looking forward, more dimensions of the labour income taxation should be further analysed. A positive effect on labour market performance could be achieved not only by lowering the overall level of taxation, but also by changing the taxation system. First, how the tax wedge is distributed between personal income tax and social security contributions can play a major role. Whether the composition of the tax wedge is more biased towards employers or employees might make the labour taxation more or less distortive. Second, also the distribution of the tax across income levels can be assumed to be crucial for the labour market performance. A more progressive tax system has a lower burden on low income workers compared to the ones on the income upper bound, thus influencing the sensitivity of (un)employment to labour taxation. The rich dataset compiled by the OECD, albeit relatively short, offers the necessary details to answer to these relevant and prominent questions. More work is therefore warranted in this direction.

## Annex

**Table A1: Overview of empirical studies**

Study	Coverage	Measures for labour tax burden	Effect of labour taxation	Other results
<b>Afonso and Alegre (2011)</b>	EU countries 1971-2006	Share of direct taxation (personal plus corporate income tax) and social security contributions in GDP	Social contributions have negative effect on GDP growth, results for direct taxation close to zero	Public investment (social transfers) have positive (negative) effect on GDP growth, effect of subsidies and compensation of employees insignificant; effect of indirect taxation positive, but insignificant
<b>Arnold et al. (2011)</b>	21 OECD countries, 1971–2004	Share of labour taxes in total tax revenues	Negative effect of labour taxes	Negative effect of corporate income taxes, positive effect of consumption and property taxes
<b>Romero-Ávila and Strauch (2008)</b>	EU countries 1961-2001	Share of direct taxation (personal plus corporate income tax) and social security contributions in GDP; average effective tax on labour	Average effective tax on labour affects GDP growth via lower private investment; results for other measures inconclusive.  After controlling for private investment, direct taxes and social security contributions do not significantly affect GDP growth.	Consumption tax has positive effect on investment, effect of average effective tax on capital insignificant  Government consumption (investment) has negative (positive) effect of GDP growth, effect of transfers ambiguous
<b>Angelopoulos et al. (2007)</b>	23 OECD countries, 1970-2000	effective tax rate on labour, top individual income rate	Effect of effective labour tax rate negative; effect of top rate is insignificant	Results for other taxes insignificant

## **Data, definitions and sources**

*The countries in the sample are:*

Australia	Denmark	Hungary	Luxembourg	Poland	Turkey
Austria	Finland	Iceland	Mexico	Portugal	United Kingdom
Belgium	France	Ireland	Netherlands	Slovak Republic	United States
Canada	Germany	Italy	New Zealand	Sweden	
Czech Republic	Greece	Korea	Norway	Switzerland	

*Unemployment rate:*

Unemployed workers as share of the total labour force (working age population 15-64 years old) in %.

*Source:* OECD, Database on Labour and Force Statistics.

*Unemployment rate by skill level:*

Unemployed persons divided by the labour force by 3 different groups of educational attainment (primary, secondary and tertiary education).

*Source:* World Bank, World Development Indicators.

*Employment:*

The employment-to-population ratio is defined as the proportion of an economy's working age population that is employed. The working age population used in this paper is represented by persons aged 15 years and older.

*Source:* World Bank, World Development Indicators.

*Tax wedge (TW):*

The tax wedge measures the different between the labour costs to the employer and the corresponding net take-home pay of the employee as a percentage of total labour cost. The tax wedge data used in this paper refer to two family situations: an average single worker without children (*twS*) and to a married one-earner couple with two children (*twC*) with earnings equal to 100% of an average production worker.

The time series exhibit a change in the methodology after 2002 as data are based on a broader definition of average worker that includes all full-times

employees. Under the previous methodology average income is measured by taking as reference manual full-time workers in the manufacturing sector. To overcome this methodological difference between the old and new definition of average income worker, data have been adjusted by using the historical data until 2001 and by applying the growth rates of the new methodology to the old time series until 2014. Finally missing observations for odd years have been interpolated for the period 1979-1993.

*Source:* OECD, Taxing wages.

*Product Market Regulation (PMR):*

This OECD index measures the regulation barriers in seven non-manufacturing sectors (telecoms, electricity, gas, post, rail, air passenger transport, road freight).

*Source:* Koske, I., I.Wanner, R. Bitetti and O. Barbiero (2014), "The 2013 update of the OECD product market regulation indicators: policy insights for OECD and non-OECD countries", OECD Economics Department Working Papers, 1200/2015.

*Employment Protection Legislation (EPL):*

Synthetic indicator of the strictness of regulation on dismissal and temporary contracts.

*Source:* OECD, Employment database.

*Union density (UD):*

Percentage of employees who are members of a trade union.

*Source:* OECD e J.Visser, ICTWSS database (Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pact, 1960-2013).

*Unemployment benefit replacement rate (RR):*

This summary indicator of gross unemployment benefit levels as a percentage of previous gross earnings. The average indicator used in this paper measures the gross unemployment benefit replacement rates for two earnings levels, three family situations and three durations of unemployment.

Data for even years are obtained by linear interpolation.

*Source:* Benefits and Wages Database.

*Coordination index (CORD):*

This variable measures on a five-point scale the coordination of wage-setting. The coordination index is equal to one if the wage bargaining process is

fragmented, confined largely to individuals firms or plants. On the other side, the maximum value corresponds to highly centralised wage bargaining systems, with or without government involvement.

*Source: ICTWSS Database.*

*Active Labour Market Policies (ALMM):*

Measure of public and mandatory private expenditures on active labour market programmes, as share of GDP.

*Source: OECD, Employment Outlook*

*Political orientation index (PO):*

Summary index of the chief executive party orientation with respect to economic policy. Left refers to parties that are defined as communist, socialist, social democratic or left-wing. Right is used for parties that are defined as conservative, Christian democratic or right-wing. Finally, Center denotes parties that are defined as centrist or when party position can best be described by centrist.

*Source: World Bank, Database of Political Institutions.*

*Output gap:*

Measure of the gap between actual and potential output as percentage of potential output.

*Source: OECD, Economic Outlook 98, November 2015.*

*Debt:*

General government gross financial liabilities as a percentage of GDP.

*Source: OECD, Economic Outlook 98, November 2015.*

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