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The Gender Unemployment Gap Across the Euro Area: The Role of Macroeconomic Shocks and Labour Market Institutions

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The Gender Unemployment Gap Across the Euro Area: The Role of Macroeconomic Shocks and Labour Market Institutions

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Abstract

We examine the gender unemployment impact from four types of macroeconomic shocks under single monetary policy in the Euro Area. We also explore the role in shock absorption and transmission played by different labour market institutions. We apply panel data estimation to 11 Euro Area countries over the 2000-2013 period, disaggregated by age, marital status and education. We find that adverse macro-shocks, such as reductions in labour demand, similar to those experienced during the current COVID-19 pandemic, or a contractionary monetary policy, as in the build-up to the global financial crisis of 2007-2009, are associated with a larger increase in unemployment rates for women than for men, specifically for the young and less-educated. However, labour market institutions, in particular unionisation or labour tax wedge abatement, mitigate the widening of the gender unemployment gap.

Keywords: gender unemployment gap, demographic composition of unemployment, macroeconomic shocks, labour market institutions, monetary policy, Euro Area

JEL codes: E24, E32, E52, F45, J16, J24

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1 Introduction

Two major shocks, such as the global financial crisis (GFC) of 2007-2009 and, more recently, the COVID-19 pandemic, have once again brought unemployment problems to the forefront of academic and policy discussions. To introduce the rationale behind our present empirical study and to illustrate its relevance, let us imagine a few typical personal cases, or stories. That is, let us imagine now meeting three men and three women from three different European countries. First, Sophie and Pierre, a couple with two young children, living in Lyon. Sophie works for a car-manufacturing company, which has been severely affected by an adverse labour demand shock, and risks being fired. She is a member of a trade union in a highly unionised sector. So is her husband, who is a primary school teacher. France is a country with relatively strong active labour market policies and average employment protection regulations. Second, meet Adele and Tobias, both from North-Rhine-Westphalia, Germany. While Adele has just completed her university degree and has never been in paid work, Tobias has recently lost his job, after having been employed by a coal-mine company for 35 years. The sector has suffered from a substantial productivity shock. Tobias was part of a trade union in a country with relatively strong active labour market policies and average employment protection regulations. Finally, meet Susan and Pauric, both from Dublin. Susan is a doctor and Pauric is a manager of a retail company. They have both been affected by the COVID-19 pandemic but in different ways. While Susan's productivity has spiralled, Pauric has been asked to move to a part-time employment. While Susan is a member of a trade union, Pauric is not. Ireland is a country with relatively weak active labour market policies and relatively low employment protection regulations.

These six individuals are different in many ways, in their gender, but also their age, education, the jobs they do, their household composition. Moreover, they are different in the wider labour market and government policies they face. One thing they have in common is that their countries are all part of the European Monetary Union (EMU) and, therefore, are subject to the same monetary policy.[1]

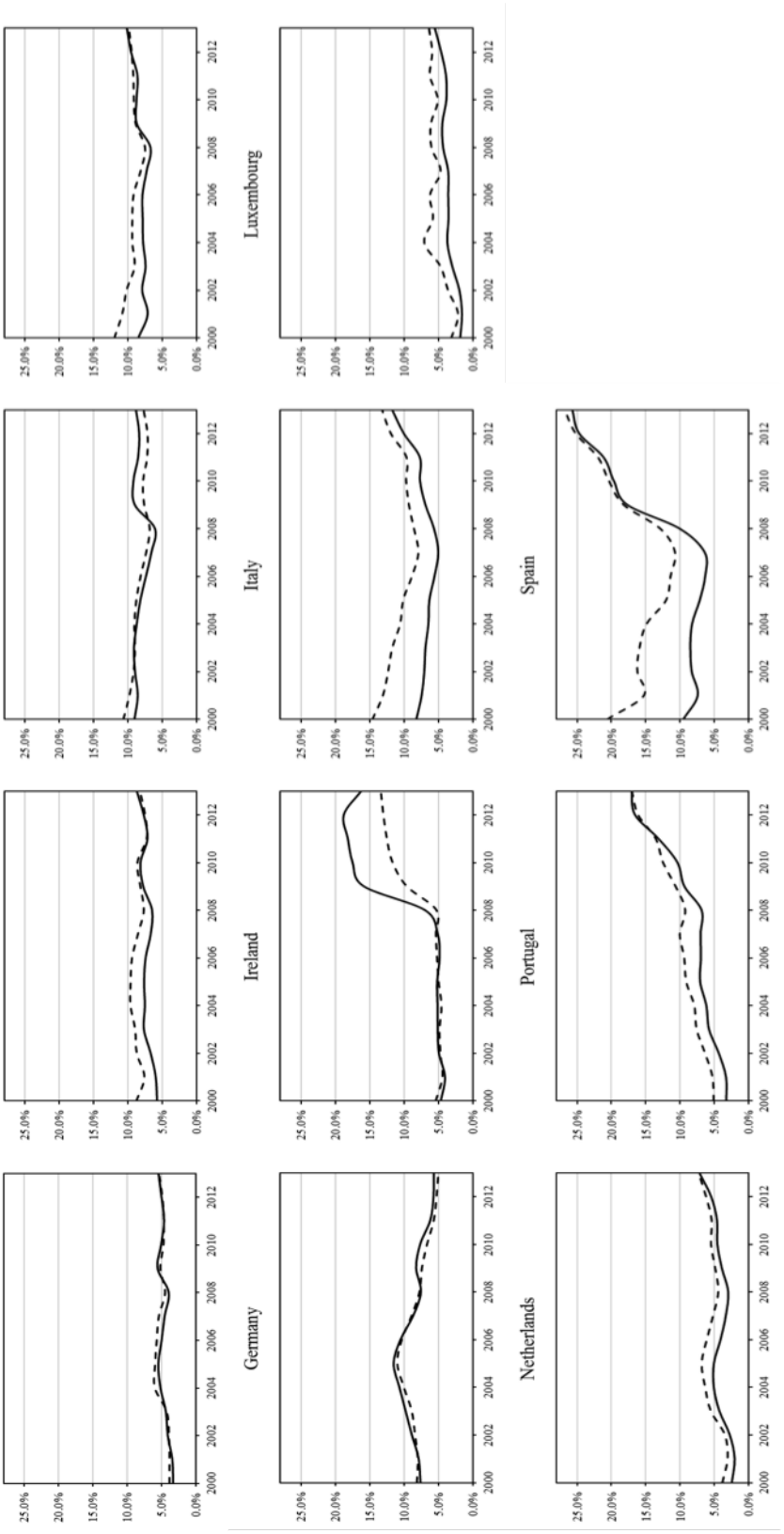
In this paper, we aim to assess the gender impact that four types of commonly studied macroeconomic shocks have on the unemployment rate in countries that belong to the EMU. Our particular focus of empirical analysis is two-fold: first, we consider whether the monetary policy conducted by the European Central Bank (ECB) has contributed, or not, to widening the gender unemployment gap; second, we explore the role in shock absorption and transmission played by different labour market institutions. Both these aspects of our enquiry have not been analysed by the related literature, which justifies our interest and aims with the present study.

Figure 1 displays the evolution of unemployment rates by gender,[2] over the 2000-2013 period, in the 11 countries that have been part of the EMU from its onset (denoted as a group by EA11): Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. In some countries, the gap in unemployment rates between women and men is very small or even negative, such as in Austria, Finland and Germany. Other countries that used to have large gaps, more recently have had small gaps, for example, Italy and Spain. Interestingly, Ireland has witnessed a negative gender gap since the outbreak of the GFC, but did not have a gender gap earlier.

[1] We use the acronyms EMU and EA (Euro Area) interchangeably.

[2] The gender gap in unemployment rates is defined as the difference between female and male unemployment rates.

Figure 1: Unemployment rates by gender over time for the EA11 countries



Notes. The solid line represents the male unemployment rate and the dashed line represents the female unemployment rate (see Appendix B for definitions, constructions and sources).

An extensive literature has explained European unemployment patterns, at least since the seminal paper by Blanchard and Summers (1986), which studied the secular rise in the unemployment rates in Europe in the 1970s and 1980s. Their analysis indicated that theories that allowed for hysteresis – the high dependence of current unemployment on past unemployment – were necessary to explain the European unemployment problem, which could not be explained simply by the standard natural rate theories. In revisiting the issue, Galí (2015) suggested that none of the three hypotheses he put forward to understand the time series properties of the unemployment rate for the longer 1970-2014 period – the natural rate, the long-run trade-off and the hysteresis hypotheses – could, on its own, account for the evidence on unemployment and wage inflation over the period. More specifically, while the long-run trade-off hypothesis could in principle account for the secular rise in unemployment in the 1970s and 1980s as a consequence of the disinflation experienced over that period, the large decline in the unemployment rate was hard to rationalise. The hysteresis hypothesis, instead, could potentially account for the remarkable stability of wage inflation over the post-1994 period.

Similarly, an influential strand of studies provide evidence on the significant effect of macroeconomic shocks on the unemployment rate in Europe, along with interactions with labour market institutions.[3] Galí (1999) showed that a positive permanent neutral technology shock is associated with a decline in hours worked, which is consistent with monopolistic competition and sticky prices and not with standard real business cycle models. Blanchard and Wolfers (2000) argued that the interaction between shocks and institutions could explain European unemployment patterns, as well as countries' heterogeneous experiences, since the 1960s. In particular, the way in which institutions influenced the relationship between the unemployed and the wage setting mechanism was fundamental in determining the evolution of the equilibrium unemployment rates following a shock. More recently, Mihailov et al. (2019) studied the effects of monetary policy shocks, risk premium shocks, wage markup shocks and labour supply shocks on labour market variables, such as labour force participation and real wages, in the four largest economies of the EMU: France, Germany, Italy and Spain. In all of these major economies, monetary policy shocks were found to be the second largest source of unemployment rate variability in the short, medium and long run, only preceded by risk premium shocks. The analysis also confirmed that the zero lower bound (ZLB) environment for nominal interest rates that followed the GFC rendered ECB's interest rate policy much less powerful in affecting unemployment rates.

The labour market position of different demographic groups has always been an important issue in light of widespread concerns about the integration of women into the labour market, youth employment problems, as well as the employment of the less-educated.[4] For instance, earlier research on gender unemployment gaps focused on the United States (US) (Barrett and Morgenstern, 1974; Niemi, 1974; Johnson, 1983; Şahin et al., 2010; Albanesi and Şahin, 2018), while more recent analyses included other countries, such as Spain, Italy and Argentina[5] and comparative investigations across countries on gender unemployment differences (Baussola et al., 2015; Razzu and Singleton, 2016). These papers typically focused on labour market flows, industry composition and human capital characteristics as the determinants of the gender unemployment gap. Furthermore, some multi-country studies added important insights into the effect of labour market institutions. Azmat et al. (2006), for instance, assessing the cross-country differences in the gender unemployment gap in 15 countries among the members of the Organisation for Economic Co-operation and Development (OECD), find that the interaction between gender differences in human capital accumulation and labour market institutions are an important part of the explanation. Similarly, Bertola et al. (2007) and Dieckhoff et al. (2015), based on data from 17 OECD and 18 European Union (EU) countries, find that some labour market institutions, such as trade unions, significantly influence gender employment gaps.

[3] Amongst others, see Blanchard and Wolfers (2000); Bassanini and Duval (2007); Bertola (2017).

[4] Amongst others, see Blau and Kahn (1997) and Ruhm (1998) on women's employment; Blanchflower and Freeman (2007) on youth employment; and OECD (2011) on the employment of the less-educated.

[5] Ortega Masagué (2008) explores the factors explaining the gender gap in unemployment rates in Argentina; Belloc and Tilli (2013) study unemployment by gender in the Italian regions; De la Rica and Rebollo-Sanz (2017) focus on the case of Spain during the GFC.

However, how does the employment of these groups respond to adverse shocks to the economy? Indeed, the economy's aggregate unemployment rate is a weighted average of the unemployment rates of various demographic groups, which are all influenced by the groups' flows into and out of unemployment. Many factors are related to these flows, which also differ by demographic groups, as the cases of our six individuals above suggested. For instance, (Albanesi and Şahin, 2018) show that countries with relatively low gender participation gap in the 1970s display a subsequent monotonic decline of the gender unemployment gap. In countries with relatively high initial participation gap instead, the unemployment gap tends to first rise, sometimes sharply, and then fall.[6] More specifically for the US, the authors find that the rising gender unemployment gap, associated with the initial fast growth in female labour force participation, was driven by the low levels of labour market experience and relatively young age of the women newly entering the labour force, as well as by the fact that married women were more likely to enter than unmarried women. The former tend to have lower labour market attachment than the latter, who have historically been prevalent in the female labour force (Goldin, 1990). In this account, other factors, such as age and skill composition, then stopped playing a role in explaining the gender unemployment gap.

Moreover, the gender unemployment gap is shaped by labour market institutions. These have been found to be relevant in at least two ways: (i) through their impact on wages; and (ii) by affecting the likelihood of workers who are less firmly attached to the labour force to stay in employment. There may be institutions common to both ways. For example, strong trade unions, represented by large-scale union membership and collective bargaining agreement coverage, may have the ability to exert upward pressure on wages, at the cost of lower employment (Layard et al., 2005). The job losses incurred may fall primarily on those groups with lower levels of labour market attachment.[7] Likewise, the labour tax wedge, which measures the difference between the labour cost to the employer and the corresponding net take-home pay of the employee, may increase the reservation wage and reduce the incentive of the employer to hire workers with lower levels of labour market attachment. Furthermore, employment protection laws, which can be considered as proxies for the costs that firms face when they dismiss an employee, seem to reduce involuntary separations and hence lower inflows into unemployment, especially for workers with long job tenures. However, stricter employment protection laws may also make firms more cautious about filling vacancies and reduce the hiring rate. This reduction in hiring will tend to increase the gap in unemployment rates between workers with high and low levels of labour market attachment. As for active labour market policies, they may narrow the gap in unemployment rates across demographic groups, through enhancing the ability of labour market attachment for low-skilled workers. Finally, generous unemployment benefits, on the one hand, may decrease the likelihood of workers who are less firmly attached to the labour force to stay in employment; on the other hand, they may push up the reservation wage due to the lower opportunity cost of unemployment, which may be associated with higher unemployment rates for workers with low levels of labour market attachment.

It is for all these reasons that a given shock originating in the macroeconomy produces differential impacts on the gender unemployment rates and that various labour market intuitions may intermediate these impacts in different ways. It is these effects we aim to study in the present paper. More specifically, we examine the direct impact of four sources of macro-shocks on unemployment rates by gender across the EA: (i) the rate of TFP growth; (ii) the real long-term interest rate; (iii) labour demand by firms; and (iv) ECB's monetary policy.[8] We further consider the intersection between gender, age, marital status and education to assess the extent to which the effects of the initial macro-shocks on gender unemployment are intermediated by various labour market institutions, categorised into four types: (i) the wage setting system; (ii) the labour tax wedge; (iii) the employment protection laws; and (iv) the unemployment benefit system.

[6] The first pattern applies to the English-speaking countries – except for the United Kingdom (UK) and Ireland – the Nordic countries, and the northern European countries, except for the Netherlands. The second pattern prevails in the southern European countries and the Netherlands.

[7] Bertola et al. (2007) do find evidence that unionisation raises the unemployment rates of women and young people.

[8] See, for instance, Blanchard and Wolfers (2000) and Rumler and Scharler (2011).

The empirical work we present here is based on a panel data set of 11 European countries over the course of a whole business cycle, covering the period between 2000 and 2013. Our approach allows for a novel analysis of the interaction between macro-shocks and labour market institutions on female and male unemployment rates under the same monetary policy. We find that adverse macroeconomic shocks, such as abrupt labour demand reductions, similar to those experienced during the COVID-19 pandemic, or a tight monetary policy environment such as the one generally employed to fight inflation scares, do have a differential impact on the unemployment rate of various demographic groups. Labour market institutions play a role too in shaping out the severity of these shocks on the unemployment rate of men and women, thereby contributing to the dynamics of the gender unemployment gap.

More precisely, we highlight a number of novel results. First, positive long-run real interest rate shocks are significantly associated with higher unemployment rates, with larger increases for men than for women, particularly young, married, or less-educated, thus dampening the gender unemployment gap. Second, a decrease in the labour demand by firms – typical in times of economic recessions and crises – tends to correlate with a relatively larger increase in unemployment rates for women, especially for young or less-educated women, in turn amplifying the gender unemployment gap. Third, and intriguingly, ECB monetary policy shocks display strongly significant one-year lagged effect on the unemployment rate of women, but not on that of men. A contractionary monetary policy is likely to increase the unemployment rate of women, particularly young and less-educated, thereby widening the gender unemployment gap. Fourth, and perhaps surprisingly, the impact of TFP shocks on unemployment rates is found statistically insignificant, for both women and men. Fifth, strong trade unions tend to mitigate the impact of macroeconomic shocks on the unemployment rates of both men and women, the more so for prime age and older workers. However, higher tax wedges, specifically, personal income taxes and social security contributions from employers, amplify the effects of macro-shocks on unemployment for both women and men, yet by a relatively stronger influence on the unemployment rates of women and single individuals. These results stand the robustness tests, despite the high variations in the sample data during the GFC.

While some results on the unemployment gender gap have been discussed in earlier work, we are the first, to our knowledge, to reveal robustly the gender effect of monetary policy, which, in our sample, appears especially strong on the youngest and on single women. This, we would argue, is not surprising, having in mind the well-known gendered nature of labour market outcomes. Because of this, it appears that employers tend to lay off women less reluctantly than men in times of economic downturns and to hire them less willingly while the economy recovers and booms. Such an interpretation seems to fit and explain the essence behind most of our key empirical findings.

The remainder of the paper is organised as follows. Section 2 looks at the data and methodology used for the empirical analysis. Section 3 presents the main results on the impact of shocks on unemployment rates by gender and on the interaction between labour market institutions and macro-shocks. Section 4 further disaggregates unemployment rates and analyses the impact of shocks on unemployment rates of various demographic groups. Finally, Section 5 concludes. A supplementary appendix, in three sections, provides further details: Appendix A describes our variable definitions and sources; Appendix B presents robustness analysis; and Appendix C documents the analysis by demographic composition.

2 Data and Methodology

In order to assess the impact of macro-shocks on unemployment rates by gender, we use a panel data set of 11 EA countries over the course of a whole business cycle, covering the period between 2000 and 2013. The sample includes the first group of countries that joined the EMU at the official launch of the Euro on 1 January 1999, listed in Figure 1 and in the Introduction. The sample period thus covers the economic expansion period preceding the GFC as well as its aftermath.

Blanchard and Wolfers (2000) find empirical evidence that three country-specific shocks can significantly affect the unemployment rate, namely TFP shocks, shocks to the real long-term interest rate and labour demand shocks – and, accordingly, we focus on them.[9] The TFP shock is measured by the rate of TFP growth. The (ex-post) real long-term interest rate is proxied by the long-term nominal interest rate less the yearly growth rate of the GDP deflator. The measure of the labour demand shock is the sum of the adjusted log wage indicator and the adjusted log employment indicator, less the log of real GDP.[10]

The measure of the fourth macro-shock we examine, the common monetary policy shock, follows Rumler and Scharler (2011), who estimate an interest rate rule as in equation (1):

$$r_t = \alpha + \beta \pi_t + \lambda y_t^g + \sigma r_{t-1} + \mu_t^M \tag{1}$$

More precisely, we estimate a regression with the ECB short-term nominal interest rate (r_t) as the dependent variable while the current inflation rate (π_t) and the current output gap (y_t^g) are the independent variables. In addition, we allow for an inertial response of monetary policy by including one-period lagged values of the dependent variable. By employing the residuals μ_t^M as a proxy for the common monetary policy shock, we in effect capture the unsystematic component of ECB's monetary policy, as is typical under rational expectations. Under the latter hypothesis, the regression is estimated by the generalised method of moments (Clarida et al., 2000; Gerlach and Schnabel, 2000), and passes the weak instrument tests and overidentifying restriction tests. As instruments, according to conventional wisdom and practice, we use the lags of all right-hand-side variables up to lag four.

2.1 The data

Data on ECB short-term nominal interest rates are nominal interest rates on ECB marginal lending facilities. Data on inflation rates and output gaps are expressed by the percentage change of CPI on the same period of the previous year and the ratio of the output gap to potential GDP, respectively.[11] Data for all variables are quarterly time series covering 1999Q1-2012Q4 and the yearly ECB unsystematic monetary policy shock is measured as the average of the quarterly residuals.

Figure 2 plots the time paths of these four macro-shocks. Since 2000, TFP growth fluctuates frequently in the run-up to the GFC and then suffers a large decrease during the GFC, followed by a subsequent upswing. The real long-term interest rate remains relatively stable in most countries, except for a sharp rise in Ireland and Portugal after the GFC. The labour demand shock displays heterogeneous trends across countries, e.g., a continuous upward trend in Italy and a downward trend in Portugal. Other countries experience a recovery in labour demand after the GFC. The noticeable change in ECB's unsystematic monetary policy component occurs from the high interest rate policy to boost the Euro in the early 2000s to the ZLB environment of negative shocks around the GFC signalling expansionary monetary policy in response to the financial turmoil.

[9] Data for constructing the country-specific shocks are sourced from the OECD and European Commission AMECO databases. Their respective websites are `http://stats.oecd.org` and `https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm`.

[10] Following Blanchard and Wolfers (2000), the technology is characterised by a standard Cobb-Douglas production function $Y = (aN)^{\alpha} K^{1-\alpha}$, where technological progress is assumed to be labour-augmenting. Under perfect competition in both goods and labour markets, the marginal product of labour is equal to the real wage, that is, $\alpha \times a(Y/aN) = w$. Taking logs on both sides yields $log(\alpha) = log(w/a) + log(aN) - log(Y)$, so that a decrease in the log of the labour share, $log(\alpha)$, leads to an equal decrease in the log of the adjusted employment, $log(aN)$, given output and the real wage. Thus, labour demand shocks could be measured by the log of the adjusted labour share, that is, the sum of the adjusted log wage indicator and the adjusted log employment indicator, less the log of real GDP. See Appendix A for more details.

[11] Data on ECB short-term nominal interest rates are obtained from the ECB Statistical Data Warehouse. Data on inflation rates and output gaps are taken from the OECD Economic Outlook No 105 (version May 2019).

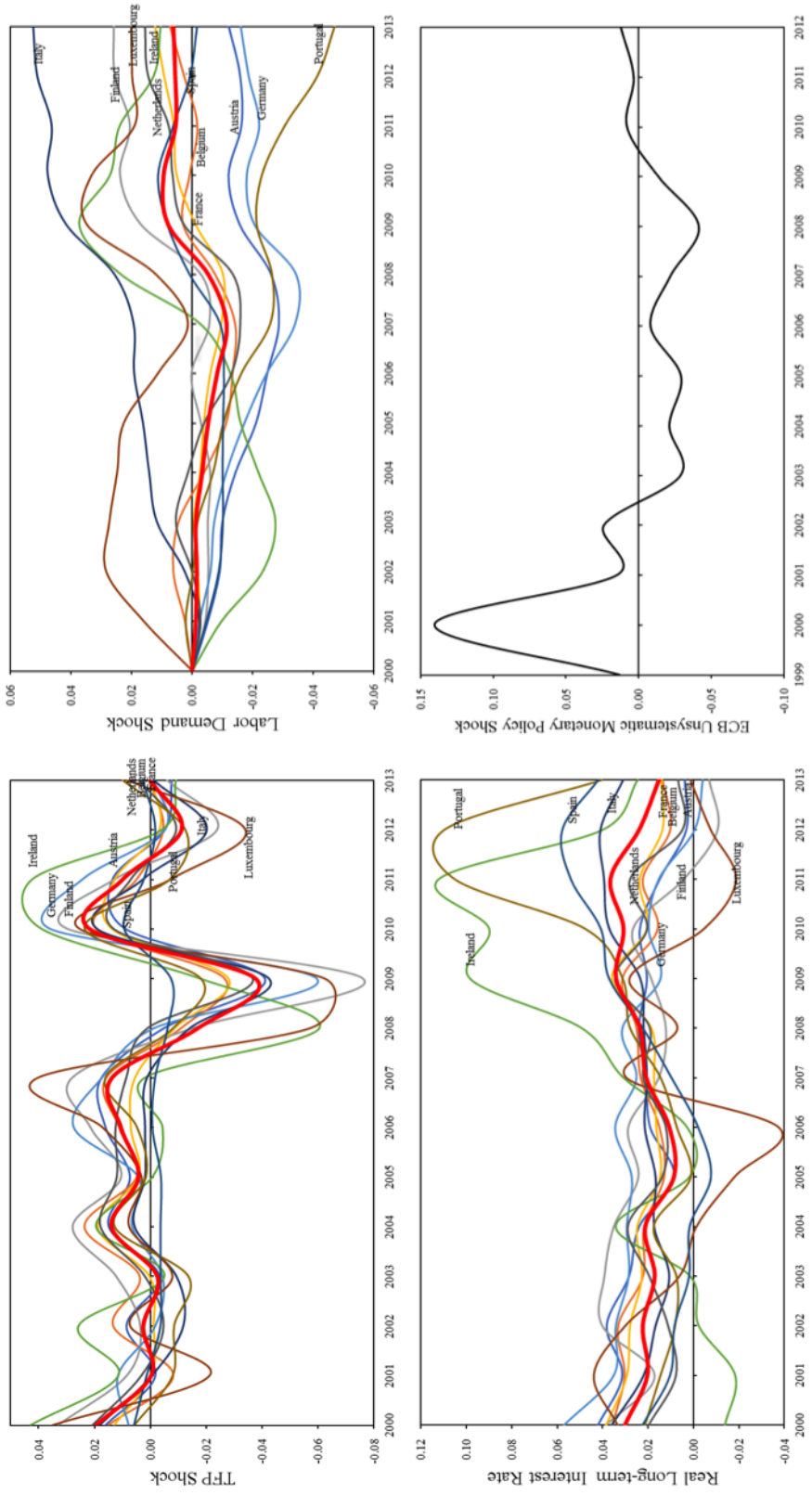


Figure 2: Time paths of annual macro-shock indicators for the EA11 countries

Notes.- Red lines plot unweighted averages. Labour demand shocks are normalised to equal zero in 2000. See Appendix A for definitions, constructions and sources.

Additionally, labour market institutions are also involved in the estimations, as they are expected to channel and shape out the intermediated response of female and male unemployment rates to a macroeconomic shock. In this study, labour market institutions include the system of wage determination, the labour tax wedge, employment protection laws (EPLs), active labour market policies (ALMPs) and the unemployment benefit system.[12] The system of wage determination is measured by the percentage of employees who are union members (union density), the proportion of employees covered by collective agreements (union contract coverage) and the degree of coordination of wage bargaining. The measure of the labour tax wedge consists of personal income taxes, social security contributions from employees, and social security contributions from employers (as a percentage of total labour cost). As for EPLs, the OECD reports indicators measuring the strictness of the regulation covering the individual dismissal of employees on regular contracts and temporary contracts, respectively. Moreover, the indicator of ALMPs is measured as public expenditures on ALMPs per unemployed worker as a share of GDP per member of the labour force. Finally, the measure of the unemployment benefit system includes the benefit replacement rate during the 1st year of unemployment and the benefit duration.[13]

2.2 Benchmark model

Following Blanchard and Wolfers (2000), we regress unemployment rates by gender on four sources of macro-shocks, controlling for interactions between shocks and labour market institutions. The benchmark equation used is the following:

$$u^i_{ct} = A_{ct} + (\gamma' LMI_{ct} * A_{ct}) + c_c + t_t + \varepsilon_{ct} \tag{2}$$

where $i \in (f,m)$ with $f = female$ and $m = male$ and $A_{ct} = \beta_1 TFP_{ct} + \beta_2 RIR_{ct} + \beta_3 LD_{ct} + \beta_4 ECB_{ct-1}$, and the subscripts c and t are country index and period index, respectively. The dependent variable is the female or male unemployment rate.[14] TFP_{ct} is a TFP shock, RIR_{ct} is a shock in the real long-term interest rate, LD_{ct} is a labour demand shock, and ECB_{ct-1} is a monetary policy shock in the EA. Note that the values of the ECB monetary policy shock are lagged one period (year), since unemployment is expected to be affected by monetary policy with a usual lag of a year or so. β is the parameter vector capturing the impact of macro-shocks on unemployment rates by gender. LMI_{ct} is a vector of labour market institutions, including the following elements:

$$\begin{aligned}\gamma' LMI_{ct} = {} & \gamma_1 UD_{ct} + \gamma_2 UC_{ct} + \gamma_3 CO_{ct} + \gamma_4 IT_{ct} + \gamma_5 SSCEE_{ct} \\ & + \gamma_6 SSCER_{ct} + \gamma_7 EPLR_{ct} + \gamma_8 EPLT_{ct} + \gamma_9 BRR_{ct} + \gamma_{10} BD_{ct} + \gamma_{11} ALMP_{ct}\end{aligned} \tag{3}$$

where UD_{ct} is union density, UC_{ct} is union contract coverage, CO_{ct} is wage bargaining coordination, IT_{ct} is personal income taxes as a percentage of total labour costs, $SSCEE_{ct}$ is social security contributions from employees as a percentage of total labour costs, $SSCER_{ct}$ is social security contributions from employers as a percentage of total labour costs, $EPLR_{ct}$ is the strictness of EPLs on regular contracts, $EPLT_{ct}$ is the strictness of EPLs on temporary contracts, BRR_{ct} is the unemployment benefit replacement rate during the 1st year of unemployment, BD_{ct} is the

[12] The data for constructing the labour market institution variables are obtained from the OECD database and the ICTWSS database, which are publicly available on the web at http://stats.oecd.org and https://www.ictwss.org. Appendix A presents the details on how to construct the measure for each indicator of labour market institutions.

[13] The OECD reports data on the net unemployment benefit replacement rate at two earnings levels for three different family types in 14 different duration categories, which are used to derive the average net replacement rate during the 1st year of unemployment and an index of benefit duration, equal to [0.6 * (2nd and 3rd year replacement rate) + 0.4 * (4th and 5th year replacement rate)] / (1st year replacement rate). See Appendix A for further details.

[14] The sample is restricted to the working-age population.

unemployment benefit duration, and $ALMP_{ct}$ is the measure of active labour market policies. Note that all institutional variables are time-varying measures (see Appendix A). γ is the parameter vector capturing the effect of labour market institutions on the female and male unemployment rates from changing the transmission of shocks. In addition, country fixed effects c_c and period fixed effects t_t are included in equation (2). ε_{ct} is the estimated residual vector.

The data for all variables are at the annual frequency. All the measures of the shocks and institutions are constructed as deviations from their sample mean across time and countries. The regressions are estimated by nonlinear least squares, in line with the literature (Blanchard and Wolfers, 2000; Bertola et al., 2007). We use nonlinear least squares estimation because the shock coefficients in equation (2) are simultaneously estimated both for the shocks alone and for the interaction with institutions.

3 Shocks, Institutions and Unemployment Rates by Gender

3.1 Benchmark regression results

3.1.1 Direct effects of macro-shocks on unemployment rates by gender

Benchmark regression results are presented in Table 1. Columns I and II report the coefficient estimates for the female and male unemployment rate respectively.

The top panel reports the estimates of the different impact of shocks on the unemployment rates by gender. To start with, we do not find any statistically significant impact of the TFP shock on the unemployment rates of both women and men. However, the real long-term interest rate reveals a significantly positive correlation with the unemployment rates for both women and men. A rise in the real interest rate (RIR), for instance of 8 percentage points (pp) as in the case of Ireland and Portugal between 2007 and 2011, is associated with an increase in the female unemployment rate of 6.8 pp, and in the male unemployment rate of 10.6 pp. The response of the male unemployment rate is elastic whereas that of the female unemployment rate is inelastic, thus narrowing the gender gap in unemployment rates following RIR shocks. Second, the labour demand shock is statistically significant too but negatively and inelastically associated with both the female and male unemployment rates. A decrease in the labour demand of 10 pp translates into an increase in the unemployment rate of about 2.2 pp for women and 2.1 pp for men, with only a slight contribution to widening the gender gap following adverse shifts in labour demand. Third, and notably, ECB monetary policy shocks are found to have a statistically significant one-year lagged effect on the female – but not male – unemployment rate. An increase in the measure of the ECB monetary policy shock of 3 pp, that is, a contractionary monetary policy such as that implemented in the heat of the GFC between 2008 and 2009, is associated with an increase in the female unemployment rate of 0.4 pp and no significant effect on the male unemployment rate. Therefore, gender unemployment rate differences are likely to be amplified under a tight monetary policy environment. Two points are worth stressing here: first, even a single monetary policy prudently conducted by the ECB contributes to widening the unemployment gender gap during recessions and mitigating it during booms; second, monetary policy does have – even if unintentional – gender-biased real effects on economic activity, in this case captured by the female unemployment rate only, and not the male unemployment too.

3.1.2 Indirect effects of macro-shocks on unemployment rates by gender as intermediated by labour market institutions

The bottom panel in Table 1 reports the effect of labour market institutions (LMIs) on unemployment rates by gender, that is, the estimates of γ' in equation (2). As noted, we look at four subgroups of LMIs (the underlined entries in the table): the first one is the system of wage determination, which, overall, tends to mitigate the impact of macro-shocks on the unemployment rate. In this subgroup, union contract coverage displays a significantly negative

Table 1: Benchmark model – regression results for unemployment rates by gender

	Dependent Variable	
	I	II
Independent Variables	u^f_{ct}	u^m_{ct}
Direct impact of shocks (β')		
TFP shock	-0.0348	0.0471
	(-0.36)	(0.33)
Real interest rate	0.849***	1.324***
	(7.53)	(10.57)
Labour demand shock	-0.222***	-0.205***
	(-3.46)	(-3.36)
Lagged ECB unsystematic shock	0.124***	0.0303
	(2.64)	(0.61)
Interaction of LMIs with shocks (γ')		
Wage determination system		
Union density	-0.0135	-0.0203***
	(-1.45)	(-2.68)
Union coverage	-0.0371***	-0.0219***
	(-2.35)	(-2.07)
Coordination	-0.0151	-0.0226
	(-0.69)	(-0.35)
The labour tax wedge		
Income taxes	-0.0826**	0.0785**
	(2.05)	(2.39)
Employee SSC	-0.00839	0.0401
	(-0.23)	(1.44)
Employer SSC	0.133***	0.0927***
	(3.45)	(3.66)
Employment protection laws		
EPLs on regular contracts	0.117	-0.114
	(0.77)	(-1.09)
EPLs on temporary contracts	0.0967	0.198*
	(0.70)	(1.78)
Unemployment benefit system		
Replacement rate, 1st year	-0.0153**	-0.00844
	(2.14)	(-1.30)
Benefit length	-1.907	-0.107
	(-1.55)	(-0.10)
Active Labour market policies	0.0147	-0.0268
	(0.59)	(-1.05)
Time effects	yes	yes
Country effects	yes	yes
Adjusted R^2	0.866	0.841
Parameters	40	40
Observations	154	154

Nonlinear least squares estimation. The sample is restricted to those aged 15-64 inclusive. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich information. * p<0.10 ** p<0.05 *** p<0.01.

but weak interaction effect with macro-shocks for the unemployment rate of both women and men. Higher degree of union coverage by 1 pp tends to reduce slightly the impact of shocks on the female (by 0.04 pp) and male (by 0.02 pp) unemployment rates. Furthermore, union density's interaction coefficient is also significantly negative, but still weak in economic terms, indicating that higher union density (by 1 pp) is associated with a smaller impact of shocks on the male unemployment rate (by 0.02 pp). One explanation for this impact across men and women could be that the objective of trade unions is to provide job security to their members, which leads to more moderate labour market reactions, with both lower worker inflows into unemployment in response to an adverse shock and lower worker outflows from unemployment under a favourable shock. Yet our estimates here show that union density helps mitigate the impact of macro-shocks differentially, i.e., only for men, who tend to be better represented in trade unions, and not women, who are less attached to labour markets and, hence, trade unions.

On the contrary, the second subgroup of tax wedges mostly tends to amplify the impact of macro-shocks on unemployment rates, more so for men than for women. Specifically, social security contributions from employers have significantly positive – yet still relatively weak in economic terms – shock-interaction coefficients for both the female (0.13) and male (0.09) unemployment rates. This is in line with the standard theoretical prediction according to which higher tax wedges are likely to reduce the incentive of the employer to hire workers with lower levels of labour market attachment, making female unemployment (slightly) more sensitive to shocks. With respect to personal income taxes, however, we find a differential gender effect: while an increase in income taxes by 1 pp is associated with an amplification on the impact of shocks on the male unemployment rate of 0.08 pp, the effect on the female unemployment rate is of same size but in the opposite direction, -0.08. This result may be explained partly by the weaker attachment of women to the labour market, and hence a weaker influence of personal income tax changes.

Similarly, in the third subgroup, stringent EPLs on temporary contracts appear to amplify the impact of macro-shocks on the male, but not female, unemployment rate, possibly reflecting the important contribution of temporary workers to male unemployment. The other independent variables in this subgroup are found not statistically significant.

Finally, in the fourth subgroup, higher replacement rate during the first year of unemployment is found to minimally mitigate the impact of macro-shocks on the female unemployment rate only. In addition, there is no significant effect of both ALMPs and benefit length on changing the impact of shocks on unemployment rates by gender.

3.2 Robustness analysis

Our benchmark results in Table 1 are supported by a high explanatory power, as measured by the adjusted R^2. However, they should be taken with some caution when considering the small size of the panel data set employed. In order to check the robustness of these results, we carry out a battery of sensitivity tests.[15]

First, we evaluate the cross-sectional stability of the results by eliminating one country at a time from the sample and re-estimating equation (2) for the resulting countries in the sub samples. Table B1 in Appendix B shows the coefficient estimate of each shock when one country at the time is dropped, as well as the country which is dropped. The top panel refers to the female unemployment rate. It can be observed that dropping one country at a time makes little difference to the results. The real interest rate and the ECB monetary policy shock are always positively significant, and the labour demand shock is always negatively significant. Additionally, the TFP shock is found to be insignificant in all subsamples. The bottom panel reports the results for the male unemployment rate, showing that the real interest rate is always significant with the correct sign, regardless of which country is excluded. The significance of the labour demand shock changes to the positive sign in only two cases, when Finland or Italy is

[15]The results are shown in the tables in Appendix B.

dropped from the estimation. Correspondingly, the coefficient of the TFP shock in these two subsamples becomes significant but has the unexpected sign. The ECB monetary policy shock becomes positively correlated with the male unemployment rate in two cases only, but now when Belgium or Spain is dropped. Overall, this confirms the benchmark results. Tables B2 and B3 also report the interaction coefficient estimates of each labour market institution for the 11 subsamples. The results are, again, stable and in line with the benchmark estimation discussed earlier.

Second, we similarly test the period stability of the results by removing one year at a time from the sample and re-estimating equation (2) on the 14 subperiods, to see if any specific year during the GFC influences the results. The re-estimation results are displayed in Table B4. Again, the coefficient estimates of the shocks for the female unemployment rate are very robust and do not appear to be driven by any particular year. For the male unemployment rate, the impact of the TFP shock is significant but unexpectedly signed in four cases, when the data in 2001, 2002, 2004 or 2013 are removed. The coefficient estimate of the labour demand shock changes its sign to be positive in three cases, when 2001, 2002 or 2013 are excluded. The ECB monetary policy shock significantly impacts the male unemployment rate only when 2011 is dropped. The impact of the real interest rate is always positive and significant in all of the subsamples. This consolidates the overall picture presented in our analysis of the benchmark results.

Third, one important concern for identification is any potential endogeneity of macroeconomic shocks and labour market institutions. Endogeneity arises from reverse causality between the evolution of the unemployment rates, on the one hand, and shocks and institutions, on the other hand. Put differently, changes in macro-volatility may be driven by changes in unemployment. Institutional reforms can take place as a reaction to adverse or favourable labour market conditions. Particularly, the time-varying measures of labour market institutions used for the benchmark estimations are potentially subject to an endogeneity problem. In order to deal with these issues, four strategies are followed: (i) macro-shock measures are lagged by one period; (ii) institution measures are lagged by one period; (iii) the sample period from 2000 to 2013 is split into five three-year subperiods (2000-2002, 2003-2005, 2006-2008, 2009-2011 and 2012-2013), with the institution measures being fixed at the values in the first year for each time window; (iv) institution measures are fixed at their values in the first year of the observation period, 2000.

First, we reduce the potential problem of endogeneity of the macro-shocks by using their respective one-year lagged values. The re-estimation results are presented in Table B5 and are generally robust. The exceptions are the labour demand shock, union coverage, and personal income taxes for the regression on the male unemployment rate. The amplification effect of EPLs on temporary contracts on the male unemployment rate becomes insignificant, while EPLs on regular contracts are found to lessen the impact of shocks on the female unemployment rate.

With respect to potential institutional endogeneity, Table B6 shows the estimated results by replacing labour market institutions with their one period lagged values. The results are consistent with the original results in Table 1, particularly in regards to the moderating role of trade unions and the amplifying role of labour tax wedges. The most noticeable difference is that the interaction coefficient of the replacement rate is significantly positive, increasing the impact of shocks on the female unemployment rate.

Furthermore, Table B7 shows the results from restricting the variation in the institutional variables by considering only their values in the first year for each subperiod and in the first year of the sample period (2000). It can be observed that the impacts of the shocks are overall very robust, although some labour market institutions change their signs when fixed at their values in 2000. On the whole, the results are robust against endogeneity.

Finally, multicollinearity among institutional measures arises if the indicators are strongly correlated with each other. As Table B8 shows, this is clearly an issue here. Typically, the consequences of multicollinearity are sensitive estimates and inflated standard errors. Hence, we run the benchmark model by involving only one institutional

variable at a time in the estimation, to check the stability of the estimates. The results are illustrated in Table B9. The impact of the real interest rate is consistent with the benchmark results for both the female and male unemployment rate, and the impact of the labour demand shock is also strongly robust for the female unemployment rate. The ECB monetary policy shock loses its significance on the female employment rate in most cases, as well as the labour demand shock on the male unemployment rate. Otherwise, and overall, the interaction effects of labour market institutions are very similar to those presented in Table 1.

4 Demographic Composition of Unemployment Rates by Gender

In this section, we further estimate the impact of macro-shocks on the gendered unemployment rates of different demographic groups, disaggregated by age, marital status and education. There are at least two reasons why this analysis is helpful. In fact, there exists heterogeneity in unemployment: for example, low-skilled and younger workers tend to have relatively higher unemployment rates (Mincer, 1991; Shimer, 1998). Moreover, while the gender unemployment gap outlines the gap *between* men and women, it does not tell anything about the gaps *within* the respective groups: who are the men and women whose labour market outcomes is mostly affected by the shocks? It is only through an assessment of intersectionality that we can provide depth to the previous results and shed light on the extent to which the gender gaps differ when the unemployment rate of men and women is interacted with other characteristics.

4.1 Age

Table C1 in Appendix C shows the unemployment rates by gender and three age groups, 15 to 24, 25 to 54, and 55 to 64 years old, in each EA country, averaged over 2000-2013. The youngest age group, for both male and female, tend to have the highest unemployment rate relative to the prime aged and the older, in all countries except Germany, where the unemployment rate of women in the oldest age group is the highest of all. Moreover, the prime age-female unemployment rate is higher than the older-female unemployment rate apart from Germany in all sample countries.

Table 2 reports the results of the benchmark model on the age subgroups of the female and male unemployment rates. The adverse impact of the higher real interest rate on both female and male unemployment rates is largest for the youngest age group and smallest for prime age workers. For each age subgroup, a rise in the real interest rate is related to a larger increase in the male unemployment rate than that in the female unemployment rate, in line with the benchmark results. Similarly, a decrease in the labour demand shock is correlated with a relatively larger increase in the youth unemployment rate compared with the increases in the unemployment rates of prime age and older workers. Again, the impact of the labour demand shock on the unemployment rate is larger in absolute value for females than for males for all age subgroups. Additionally, the lagged ECB monetary policy shock has a significant impact on the unemployment rate only for 15 to 24 and 25 to 54 years old females. To compare the magnitude of the impact, the ECB monetary policy has a greater impact on the youth female unemployment rate, that is, a contractionary monetary policy is likely to result in an increase in the unemployment rate of young female workers. There is no significant association between the ECB monetary policy shock and the male and older female unemployment rates. Overall, all adverse shocks, when they are significant, empirically lead to a larger increase in the youth unemployment rate for both women and men. Particularly, the labour demand shock and the ECB monetary policy shock result in a female youth unemployment rate rise that is higher than for any other subgroups.

With regard to labour market institutions, the role of trade unions on moderating the impact of shocks is mainly seen in the prime age and older age group. However, higher union density does significantly reduce the impact of shocks on the male unemployment rate of the youngest age group, and higher wage bargaining coordination tends to lessen the impact of shocks on the female unemployment rate of the same age group. The amplifying role of labour

Table 2: Benchmark model – regression results for unemployment rates by gender and age

	I u^f_{ct} 15-24	II u^f_{ct} 25-54	III u^f_{ct} 55-64	IV u^m_{ct} 15-24	V u^m_{ct} 25-54	VI u^m_{ct} 55-64
Direct impact of shocks (β)						
TFP shock	-0.073	-0.0421	0.0445	0.0952	0.0413	-0.0394
	(-0.35)	(-0.43)	(0.41)	(0.31)	(0.32)	(-0.32)
Real interest rate	1.852***	0.834***	1.044***	2.846***	1.208***	1.253***
	(7.46)	(8.07)	(9.25)	(10.56)	(10.63)	(10.88)
Labor demand shock	-0.584***	-0.186***	-0.297***	-0.395***	-0.161***	-0.231***
	(-2.65)	(-3.92)	(-3.45)	(-3.23)	(-3.25)	(-3.77)
Lagged ECB shock	0.415**	0.0864**	-0.0241	0.116	0.0195	0.0214
	(2.51)	(2.35)	(-0.41)	(1.12)	(0.47)	(0.38)
Interaction of LMIs with shocks (γ)						
Union density	0.00243	-0.0245**	-0.0107	-0.0214***	-0.0242***	-0.0145**
	(0.28)	(-2.59)	(-1.47)	(-2.79)	(-3.15)	(-2.09)
Union coverage	-0.00589	-0.0409**	-0.0147*	-0.0152	-0.0221**	-0.0270***
	(-0.54)	(-2.60)	(-1.71)	(-1.44)	(-2.05)	(-2.68)
Coordination	-0.126*	-0.0238	-0.0630	0.0140	-0.000444	-0.0205
	(-1.69)	(-0.32)	(-1.18)	(0.21)	(-0.01)	(-0.36)
Income taxes	0.0390	0.101**	0.0384	0.0950***	0.0809**	0.0682**
	(1.24)	(2.48)	(1.45)	(2.82)	(2.43)	(2.29)
Employee SSC	-0.0503	0.0146	0.0942***	0.0231	0.0427	0.0994***
	(-1.43)	(0.41)	(3.58)	(0.80)	(1.53)	(4.00)
Employer SSC	0.0879***	0.131***	0.0889***	0.0762***	0.0918***	0.105***
	(2.63)	(3.62)	(3.79)	(2.95)	(3.57)	(4.46)
EPLs on regular contracts	0.0451	0.111	-0.131	-0.0952	-0.124	-0.0764
	(0.39)	(0.72)	(-1.59)	(-0.87)	(-1.09)	(-0.79)
EPLs on temporary contracts	-0.171	0.220	-0.0257	0.132	0.257**	0.169
	(-1.63)	(1.54)	(-0.26)	(1.20)	(2.29)	(1.62)
Replacement rate, 1st year	-0.00631	-0.0174**	-0.00986*	-0.00826	-0.00846	-0.00696
	(-1.04)	(-2.40)	(-1.69)	(-1.25)	(-1.28)	(-1.19)
Benefit length	-2.938**	-1.346	-1.564	-1.053	0.172	0.588
	(-2.50)	(-1.06)	(-1.48)	(-1.00)	(0.16)	(0.59)
Active labour market policies	0.0424**	0.0139	0.0206	-0.0334	-0.0361	-0.00623
	(2.03)	(0.51)	(1.15)	(-1.26)	(-1.37)	(-0.28)
Time and country effects	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.874	0.875	0.815	0.860	0.844	0.824
Parameters	40	40	40	40	40	40
Observations	154	154	154	154	154	154

Nonlinear least squares estimation. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich formation. * p<0.10 ** p<0.05 *** p<0.01.

tax wedges is particularly reflected by the adverse effects of personal income taxes and social security contributions from employers on the male unemployment rate across all age groups. Furthermore, the amplification effect of EPLs on temporary contracts on the male unemployment rate, as observed in the benchmark results, mainly applies to prime age men. The moderating effect of unemployment benefits is found to work on women for all age groups. In addition, expenditures on ALMPs significantly enlarge the impact of shocks on the female unemployment rate of the young age group.

4.2 Marital status

Table C2 in Appendix C displays the female and male unemployment rates for each country averaged over the sample period, disaggregated by marital status: single/widowed/divorced and married/union/cohabiting. The unemployment rate for the single, either for women or for men, tends to be twice as high as for the married in all countries but in Spain. Amongst the married people, women report a higher unemployment rate than men, except in Ireland.

Table 3 shows that the impact of the real interest rate on the unemployment rate is larger for the married than for the single subgroup, and larger for men if comparing by gender. A reduction in labour demand is associated with a larger increase in the unemployment rate for single women than for married women. Moreover, in response to an adverse labour demand shock, the increase in the unemployment rate of single men is even larger than that for single women. Finally, a contractionary monetary policy is significantly correlated with a rise in the unemployment rate of single women. These results may suggest that the unemployment rate of married people is more sensitive to changes in the real interest rate, while the unemployment rate of single people appears to be more sensitive to the labour demand shock, with single women's unemployment rate appearing to be more sensitive to tighter monetary policy.

Turning to labour market institutions, wage bargaining coordination lessens the impact of shocks on the unemployment rate of the single group, while union density reduces the impact of shocks on the unemployment rate of the married group. However, the amplification effects of union coverage and wage bargaining coordination on the married male unemployment rate are unexpected. The amplifying role of personal income taxes and social security contributions from employers on the unemployment rate of single individuals is robust. In contrast, social security contributions from employees significantly reduce the impact of shocks on the unemployment rate of all subgroups. As for EPLs on temporary contracts, the results suggest that it amplifies the impact of shocks on the unemployment rate of married women and men. Besides, unemployment benefits tend to enlarge the impact of shocks on the male unemployment rate disaggregated by both marital statuses. ALMPs also significantly enlarge the impact of shocks on the unemployment rate of single people and married women.

4.3 Education

There are also considerable differences in unemployment across different levels of education. Table C3 in Appendix C shows the average unemployment rates disaggregated by gender and education.[16] For both women and men, as expected, the lower the level of education, the higher the unemployment rate, and vice versa. In most countries, the unemployment rate for people with basic education is two to four times that for people with higher (advanced) education. In addition, the unemployment rate for females is generally higher than for males with the same level of education.

Table 4 reports the estimated impact of shocks on the unemployment rate for each educational attainment subgroup. A rise in the real interest rate is correlated with an increase in the unemployment rate, with the larger increase reported for less-educated people and the smaller increase for more-educated people. In columns IV and V, the impacts of the labour demand shock and the TFP shock on the unemployment rate for men having basic and intermediate educational attainments are unexpectedly signed. For other subgroups, in response to a reduction in labour demand, the increase in the unemployment rate is larger for less-educated women than for more-educated women, and larger for more-educated women than for more-educated men. The results also suggest a significant impact of the ECB monetary policy shock on the unemployment rate of women with various educational attainments,

[16] Basic is primary and lower secondary education, ISCED 1-2; intermediate is upper secondary and post-secondary non-tertiary education, ISCED 3-4; advanced is tertiary education, ISCED 5-8

Table 3: Benchmark model – regression results for unemployment rates by gender and marital status

	I u^f_{ct} S/W/D	II u^f_{ct} M/U/C	III u^m_{ct} S/W/D	IV u^m_{ct} M/U/C
Direct impact of shocks (β')				
TFP shock	-0.0768	0.121	-0.0258	0.260***
	(-0.85)	(1.12)	(-0.22)	(2.68)
Real interest rate	0.718***	0.746***	1.000***	1.102***
	(5.78)	(6.50)	(6.80)	(10.14)
Labor demand shock	-0.446***	-0.171***	-0.510***	0.110***
	(-3.06)	(-3.13)	(-3.22)	(3.12)
Lagged ECB shock	0.211***	0.0246	0.0551	-0.0261
Interaction of LMIs with shocks (γ')				
Union density	0.000792	-0.0502***	-0.00724	-0.0441***
	(0.11)	(-4.07)	(-0.96)	(-5.54)
Union coverage	-0.00852	0.00927	0.00172	0.0723***
	(-0.84)	(0.58)	(0.20)	(5.79)
Coordination	-0.209***	-0.101	-0.291***	0.232***
	(-2.84)	(-1.11)	(-3.89)	(2.96)
Income taxes	0.0552**	0.114**	0.0689**	-0.0327
	(1.99)	(2.46)	(2.48)	(-1.16)
Employee SSC	-0.145**	-0.195**	-0.116**	-0.233***
	(-2.33)	(-2.53)	(-2.11)	(-5.27)
Employer SSC	0.0878***	0.0397	0.0598**	-0.0861***
	(2.71)	(1.01)	(2.20)	(-2.65)
EPLs on regular contracts	0.0652	-0.191	-0.103	-0.715***
	(0.53)	(-1.10)	(-1.03)	(-3.07)
EPLs on temporary contracts	0.0719	0.650***	0.227*	0.409***
	(0.61)	(3.20)	(1.77)	(4.41)
Replacement rate, 1st year	-0.000752	0.00512	0.00571	0.00759*
	(-0.19)	(0.56)	(1.29)	(1.70)
Benefit length	-0.237	2.171	2.208*	1.989*
	(-0.23)	(1.33)	(1.95)	(1.90)
Active labor market policies	0.0312**	0.0847***	0.0317*	-0.0550**
	(2.06)	(2.73)	(1.86)	(-2.59)
Time and country effects	yes	yes	yes	yes
Adjusted R^2	0.866	0.929	0.887	0.941
Parameters	39	39	39	39
Observations	140	140	140	140

S/W/D: Single/Widowed/Divorced; M/U/C: Married/Union/Cohabiting. Nonlinear least squares estimation. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich formation. * p<0.10 ** p<0.05 *** p<0.01.

but a insignificant impact on the male unemployment rate. Specifically, the unemployment rate of women with basic education or advanced education is more affected by monetary policy, compared with the unemployment rate of women having intermediate education. Generally speaking, the empirical evidence finds that the unemployment rate of less educated people, especially less educated women, are likely to be more vulnerable to adverse shocks.

For interactions between labour market institutions and shocks, the moderating role of trade unions and the amplifying role of tax wedges are still significant for all education subgroups, except for the unexpected signs in columns IV and V. Stricter EPLs on temporary contracts tend to amplify the impact of shocks on the unemployment

Table 4: Benchmark model – regression results for unemployment rates by gender and education

	I u^f_{ct} Basic	II u^f_{ct} Intermediate	III u^f_{ct} Advanced	IV u^m_{ct} Basic	V u^m_{ct} Intermediate	VI u^m_{ct} Advanced
Direct impact of shocks (β')						
TFP shock	0.00127	-0.0900	-0.0772	0.363***	0.211**	0.0519
	(0.01)	(-0.77)	(-1.02)	(2.63)	(2.35)	(0.75)
Real interest rate	1.104***	0.972***	0.417***	1.212***	0.846***	0.610***
	(6.81)	(7.52)	(4.82)	(7.34)	(7.35)	(10.14)
Labour demand shock	-0.260***	-0.230***	-0.216**	0.193***	0.242***	-0.123***
	(-3.43)	(-3.56)	(-2.24)	(3.06)	(3.58)	(-3.31)
Lagged ECB shock	0.138***	0.116**	0.137*	-0.0224	-0.0142	-0.0257
	(2.88)	(2.45)	(1.76)	(-0.41)	(-0.35)	(-1.01)
Interaction of LMIs with shocks (γ')						
Union density	-0.0270**	-0.0187*	0.00183	-0.0230**	-0.0123	-0.0244***
	(-2.43)	(-1.95)	(0.17)	(-2.35)	(-1.33)	(-3.13)
Union coverage	-0.0332*	-0.0375**	-0.0425**	0.0419***	0.0273**	-0.0350***
	(-1.93)	(-2.35)	(-2.16)	(3.11)	(2.50)	(-2.93)
Coordination	-0.0248	-0.0645	-0.118	0.378***	0.345***	-0.0763
	(-0.28)	(-0.84)	(-1.51)	(3.14)	(2.99)	(-1.27)
Income taxes	0.129**	0.108**	0.00195	-0.0892**	-0.125***	0.0677*
	(2.55)	(2.52)	(0.07)	(-2.29)	(-3.29)	(1.91)
Employee SSC	0.0240	0.0227	-0.0392	-0.131***	-0.132***	0.0385
	(0.57)	(0.61)	(-0.84)	(-2.96)	(-3.21)	(1.34)
Employer SSC	0.125***	0.114***	0.134**	-0.0123	0.0353	0.125***
	(2.96)	(3.13)	(2.50)	(-0.31)	(0.95)	(4.64)
EPLs on regular contracts	-0.0712	0.171	0.204	-0.839***	-0.662***	0.0134
	(-0.50)	(1.05)	(1.18)	(-2.77)	(-2.95)	(0.14)
EPLs on temporary contracts	0.306*	0.138	-0.223*	-0.0920	-0.210*	0.111
	(1.79)	(0.93)	(-1.86)	(-0.79)	(-1.87)	(1.00)
Replacement rate, 1st year	-0.0111	-0.0180**	0.00149	0.00108	0.000350	-0.0000853
	(-1.36)	(-2.41)	(0.27)	(0.20)	(0.09)	(-0.01)
Benefit length	-1.131	-1.449	0.0755	-0.638	0.540	0.116
	(-0.81)	(-1.11)	(0.06)	(-0.48)	(0.51)	(0.11)
Active labor market policies	-0.0262	-0.0111	0.0434*	-0.0443*	-0.0262	0.0152
	(-0.81)	(-0.39)	(1.67)	(-1.66)	(-1.20)	(0.83)
Time and country effects	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.841	0.856	0.829	0.844	0.846	0.875
Parameters	40	40	40	40	40	40
Observations	154	154	154	154	154	154

Nonlinear least squares estimation. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich formation. * p<0.10 ** p<0.05 *** p<0.01.

rate of women with basic education, but lessen the impact of shocks for women with advanced education. Generous unemployment benefit replacement rate is found to reduce the impact of shocks on the unemployment rate of women with intermediate educational attainment, whereas more expenditures on ALMPs are likely to increase the impact of shocks on the unemployment rate of women with advanced educational level.

5 Concluding Remarks

In this paper, we examined empirically the impact of macroeconomic shocks and labour market institutions on gendered unemployment rates, more generally and also disaggregated by age, marital status and education. The

analysis was based on a panel data set of 11 EA countries over the time period between 2000 and 2013, thus after the ECB began operating a single monetary policy in the EA. We considered four sources of macro-shocks, including shocks to TFP, real long-term interest rates, labour demand, and ECB monetary policy. We also assessed whether labour market institutions mitigate or amplify the impact of macro-shocks on the gender unemployment rates.

The following novel results from our empirical analysis stand out robustly. First, a rise in the long-run real interest rate is significantly correlated with an increase in unemployment rates, with larger increases for men, particularly for those who are young, married, or less-educated, thus dampening the gender unemployment gap. Second, a decrease in the labour demand by firms – typical in times of economic recessions and crises (such as the current COVID-19 pandemic) – is associated with a relatively larger increase in unemployment rates for women, especially for young or less-educated women, by contrast widening the gender unemployment gap. Third, the lagged ECB monetary policy shock has a strongly significant impact on the female unemployment rate, while it does not show any significant impact on the male unemployment rate. A contractionary monetary policy is, thus, likely to increase the unemployment rate of women, particularly young and less-educated women, thereby amplifying the gender unemployment gap. Fourth, the impact of the TFP shock on unemployment rates comes out as insignificant, for both women and men. Fifth, strong trade unions tend to reduce the impact of macroeconomic shocks on both female and male unemployment rates, and this is more so for prime age and older workers. However, higher tax wedges, specifically, personal income taxes and social security contributions from employers, tend to amplify the impact of macro-shocks on unemployment for both women and men, but by a larger extent on the unemployment rates of women and single individuals. Finally, the extensive modification and stability checks for our econometric specifications provide evidence that the summarised key findings are robust, despite the high variations in the sample data during the GFC.

Overall, therefore, adverse macroeconomic shocks, in particular labour demand reductions or tightening of monetary policy, do have a differential impact on the unemployment rate by gender, which is relatively stronger for the young and less-educated individuals. Labour market institutions, however, play a role too in shaping the severity of impact of these shocks on the unemployment rate of men and women, in general differentially, thereby contributing to the dynamics and demographic composition of the gender unemployment gap. Indeed, we have seen clearly and robustly in our empirical analysis that some policy initiatives on labour tax wedges or trade unions may mitigate the direct impact of macro-shocks.

Of course, our empirical study could be extended in several ways. An interesting analysis could proceed from the perspective of comparing national labour market institutions in the EA in their interaction with macro-shocks, common as well as country-specific. A related line of enquiry could involve analogous estimates based on other samples. Added demographic characteristics could potentially refine further the detail of our main findings.

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Supplementary Appendix
(for online publication)

The Gender Unemployment Gap Across the Euro Area: The Role of Macroeconomic Shocks and Labour Market Institutions

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Appendix A. Variables Description

Dependent variable:

Female unemployment rate
Definition: The percentage of unemployed 15-64 year-old females among the 15-64 year-old female labour force.
Source: Eurostat, unemployment rates by sex, age and educational attainment level (percent).

Male unemployment rate
Definition: The percentage of unemployed 15-64 year-old males among the 15-64 year-old male labour force.
Source: Eurostat, unemployment rates by sex, age and educational attainment level (percent).

Gender gap in unemployment rates
Definition: the difference between female and male unemployment rates (15-64 years old).

Age composition
Definition: The female/male unemployment rate is shown for three age groups: people aged 15 to 24 (those just entering the labour market following education); people aged 25 to 54; and people aged 55 to 64. For each age group, the female/male unemployment rate is measured in the number of the unemployed in one age group as a percentage of the labour force in the same age group.
Construction: For the missing values, I impute the nearest year's value which is available.
Source: Eurostat, unemployment rates by sex, age and educational attainment level (percent); OECD, LFS by sex and age.

Marital status composition
Definition: The female/male unemployment rate is disaggregated by marital status. ILOSTAT contains the statistics according to two kinds of marital status: single/widowed/divorced and married/union/cohabiting. For each category, the female/male unemployment rate (restricted to those ages 15-64 inclusive) is measured in the number of the unemployed with one marital status as a percentage of the labour force with the same marital status.
Source: ILOSTAT, unemployment rate by sex, age and marital status (percent) – Annual.

Education composition
Definition: The female/male unemployment rate is disaggregated by level of educational attainment. ILOSTAT contains the statistics according to three levels of education: basic, intermediate and advanced, corresponding to primary and lower secondary education (levels 1-2); upper secondary and post-secondary non-tertiary education (levels 3 and 4); and tertiary education (levels 5-8) in the International Standard Classification of Education (ISCED) 2011. For each education level, the female/male unemployment rate (restricted to those ages 15-64 inclusive) is measured in the number of the unemployed at one education level as a percentage of the labour force at the same education level.
Source: ILOSTAT, unemployment rate by sex, age and education (percent) – Annual.

Country-specific shocks:

Total factor productivity shock
Definition: The rate of TFP growth.
Construction: The logarithmic first difference of the AMECO database's total economy factor productivity series.
Source: The Annual Macroeconomic (AMECO) database, May 2019 update.

Real long-term interest rate
Definition: The nominal long-term interest rate less the current rate of inflation (unit: percentage).
Construction: Difference between the long-term nominal interest rate and the current rate of inflation. The inflation rate is measured by the growth rate of the GDP deflator.
Source: The Annual Macroeconomic (AMECO) database, May 2019 update.

Labour demand shock
Definition: Following Blanchard and Wolfers (2000), the technology is characterised by a Cobb-Douglas production function $Y = (aN)^{\alpha}K^{1-\alpha}$, with technological progress assumed to be labour augmenting. Under perfect competition in both goods and labour markets, the marginal product of labour is equal to the real wage, that is $\alpha \times a(Y/aN) = w$. Taking logs on both sides, this yields $log(\alpha) = log(w/a) + log(aN) - log(Y)$, so that a decrease in the log of the labour share, $log(\alpha)$, leads to an equal decrease in the log of the adjusted employment, log(aN), given output and the real wage. Thus, labour demand shocks could be measured by the log of the adjusted labour share, that is, the sum

of the adjusted log wage indicator and the adjusted log employment indicator, less the log of real GDP.
Construction: To obtain the data of labour demand shocks, we construct the adjusted log wage indicator log(w/a) , the adjusted log employment indicator log(aN) and the log of real GDP log(Y), respectively. First, the adjusted log wage indicator can be computed by the AMECO data: we begin to construct labour efficiency, that is log(a) above, by calculating the log of the ratio of "total factor productivity: total economy" to "adjusted wage share: total economy: as percentage of GDP at current prices". Then, we subtract labour efficiency from the log of "real compensation per employee, deflator GDP: total economy". Next, we follow Blanchard and Wolfers (2000) to adjust this wage measure by taking account of gradual adjustment of factor proportions. Thus, the final adjusted log wage indicator is an average of the adjusted wage with weight 0.8 on the current year and 0.2 on the previous year. Second, the adjusted log employment indicator also can be computed by the AMECO data: adding labour efficiency to the log of "employment, persons: all domestic industries (National accounts)" proxies the adjusted log employment indicator. Finally, the log of real GDP can be obtained by the OECD data, that is, calculating the log of "gross domestic product (output approach), OECD base year". Hence, the labour demand shock, measured by the log of the adjusted labour share, is the sum of the adjusted log wage indicator and the adjusted log employment indicator less the log of real GDP.
Sources: AMECO database, OECD.

ECB unsystematic monetary policy shock
Definition: The residuals from estimating an interest rate rule. Constructions: As shown in Equation 1, we use the nominal short-term interest rates r_t as the dependent variable and one period lagged values of the dependent variable r_{t-1} as the independent variable along with: constant, the current inflation π_t, and the current output gap y_t^g. As instruments, we use the lags of all right-hand-side variables up to lag four. The regression is estimated by the generalised method of moments and passes the weak instrument tests and over-identifying restriction tests. We can have some confidence that the instruments are exogenous and not weak.
The residuals are obtained by regressing Equation 1 using quarterly time series of all variables covering 1999Q1-2012Q4. The annual ECB unsystematic monetary policy shock is measured as the average of the quarterly residuals. Data on short-term nominal interest rates are nominal interest rates on ECB marginal lending facilities. Data on inflation rates and output gaps are expressed by the percentage change of CPI on the same period of the previous year and the ratio of the output gap to potential GDP, respectively.
Sources: ECB, Statistical Data Warehouse; OECD, Economic Outlook No 105 – May 2019.

Time-varying institutions:

The replacement rate of unemployment benefits
Definition: The net replacement rate in unemployment is the ratio of the net household income during a selected month of the unemployment spell to the net household income before the job loss. The original data are the net unemployment benefit replacement rate at two earnings levels (average and two-thirds of average earnings) for three different family types (single, with dependent spouse, with spouse at work) in 14 different duration categories (2 months, 4 months, 6 months, 8 months, 10 months, 12 months, 18 months, 24 months, 30 months, 36 months, 42 months, 48 months, 54 months and 60 months).
Construction: The average net replacement rate during the 1st year of unemployment, averaged over two income situations (100 percent and 67 percent of average earnings) and three family situations (single, with dependent spouse, with spouse at work). The data are available since 2001 for all countries of the sample. We impute the values for 2000 from the values in 2001.
Source: OECD, net replacement rates in unemployment.

Unemployment benefit duration
Definition: An index of benefit duration equal to [0.6 * (2nd and 3rd year replacement rate) + 0.4 * (4th and 5th year replacement rate)] / (1st year replacement rate).
Construction:
- 2nd and 3rd year replacement rate: the average net replacement rate during years 2 to 3 of an unemployment spell, averaged over all categories.
- 4th and 5th year replacement rate: the average net replacement rate during years 4 to 5 of an unemployment spell, averaged over all categories.
- 1st year replacement rate: the average net replacement rate during the first year of unemployment, averaged over all categories. The data are available since 2001 for all countries of the sample. We impute the values for 2000 from

the values in 2001.
Source: OECD, net replacement rates in unemployment.

Active labour market policies
Definition: The measures of ALMPs cover the expenditures on active programs excluding public employment services and administration , which include training, employment incentives, sheltered and supported employment and rehabilitation, direct job creation and start-up incentives.
Construction: The OECD reports "public expenditures on ALMPs, national currency units". We use this to calculate public expenditures on ALMPs per unemployed worker as a share of GDP per member of the labour force. The number of the unemployed and labour force are available on the OECD. The data on nominal GDP are also obtained from the OECD.
Source: OECD, public expenditure and participant stocks in LMP.

Employment protection index
Definition: The OECD reports indicators measuring the strictness of the regulation covering the individual dismissal of employees on regular contracts (EPRC) and temporary contracts (EPT) (excludes collective dismissals). We select version 1, keeping in line with the literature (Blanchard and Wolfers, 2000; Nickell et al., 2005; Bachmann and Felder, 2020).
Source: OECD, strictness of employment protection – individual dismissals (regular contracts)/temporary contracts.

Union contract coverage
Definition: Employees covered by valid collective bargaining agreements as a proportion of all wage and salary earners in employment with the right to bargaining, expressed as percentage, adjusted for the possibility that some sectors or occupations are excluded from the right to bargain.
Construction: For the missing values, I impute the previous nearest year's value which is available.
Sources: OECD, collective bargaining coverage

Union density
Definition: The ICTWSS database reports union density rate, which is net union membership as a proportion of wage and salary earners in employment. Net union membership indicates total union membership minis union members outside the active, dependent and employed labour force (i.e. retired workers, independent workers, students, unemployed).
Source: J. Visser, ICTWSS Database. version 6.0. Amsterdam: Amsterdam Institute for Advanced Labour Studies (AIAS), University of Amsterdam. June 2019.

Coordination in wage bargaining
Definition: The ICTWSS database reports an indicator of the degree of coordination based on a set of expectations about which institutional features of wage setting arrangements are likely to generate more or less coordination.
Source: J. Visser, ICTWSS Database. version 6.0. Amsterdam: Amsterdam Institute for Advanced Labour Studies (AIAS), University of Amsterdam. June 2019.

Tax wedge
Definition: The labour tax wedge measures the difference between the labour cost to the employer and the corresponding net take-home pay of the employee for a single-earner couple with two children earning 100 percent of average earnings. The OECD reports the indicators for specific taxes: personal income taxes as a percentage of total labour costs, social security contributions from employers as a percentage of total labour costs, and social security contributions from employees as a percentage of total labuor costs.
Source: OECD, Taxing wedges.

Appendix B. Robustness Analysis

Table B1: Cross-sectional stability

	Dependent Variables: u_{ct}^{f}										
	Austria	Belgium	Finland	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain
TFP shock	-0.0412	-0.0366	0.0221	-0.0865	0.00134	-0.0415	-0.0195	-0.00556	-0.0614	-0.152	-0.0741
	(-0.37)	(-0.34)	(0.19)	(-0.89)	(0.02)	(-0.57)	(-0.28)	(-0.04)	(-0.53)	(-1.62)	(-1.08)
RIR	0.912***	0.0901***	0.834***	0.782***	0.680***	0.750***	0.775***	0.996***	0.924***	0.888***	0.460***
	(7.69)	(7.52)	(6.66)	(6.78)	(5.69)	(6.67)	(6.94)	(7.58)	(7.74)	(7.54)	(4.90)
LD shocks	-2.242***	-0.229***	-0.171***	-0.196***	-0.214***	-0.148***	0.124***	-0.369***	-0.210***	-0.482***	-0.222***
	(-3.43)	(-3.39)	(-3.45)	(-3.38)	(-2.59)	(-4.21)	(-3.71)	(-2.97)	(-3.50)	(-4.34)	(-2.76)
ECB shocks	0.128**	0.119**	0.100**	0.112**	0.0947**	0.158**	0.117**	0.107**	0.110**	0.133**	0.195**
	(2.46)	(2.53)	(2.53)	(2.3)	(2.23)	(2.78)	(2.63)	(2.08)	(2.02)	(2.58)	(2.22)
	Dependent Variables: u_{ct}^{m}										
	Austria	Belgium	Finland	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain
TFP shock	0.0351	-0.00169	0.199**	-0.0995	0.140	-0.0615	-0.281**	0.116	0.0748	-0.128	-00776
	(0.23)	(-0.01)	(2.40)	(-0.71)	(1.07)	(-0.52)	(2.61)	(0.68)	(0.41)	(-1.14)	(-1.17)
RIR	1.336***	1.248***	0.921***	1.222***	1.189***	1.103***	1.003***	1.536***	1.452***	1.265***	0.663***
	(9.88)	(9.40)	(8.24)	(10.10)	(10.00)	(8.99)	(8.64)	(11.39)	(10.73)	(9.75)	(6.00)
LD shocks	-0.204***	-0.148***	0.165***	-0.212***	-0.146***	-0.127***	0.218***	-0.336***	-0.226***	-0.423***	-0.180***
	(-3.22)	(-3.25)	(3.93)	(-3.68)	(-2.56)	(-4.19)	(3.32)	(-3.19)	(-3.33)	(-4.57)	(-3.21)
ECB shocks	0.0314	0.0716**	0.0214	0.0115	-0.0520	-0.00960	-0.0274	-0.103	0.0223	0.0183	0.0878**
	(0.59)	(2.02)	(-0.67)	(0.23)	(-1.23)	(-0.22)	(-0.64)	(-1.28)	(0.33)	(0.43)	(2.21)

The table reports the coefficient of each shock variable when one country at a time is dropped, as well as the country which is dropped. Nonlinear least squares estimation. The sample is restricted to those aged 15-64 inclusive. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich information. * p<0.10 ** p<0.05 *** p<0.01

Table B2: Cross-sectional stability: labour market institutions - female unemployment rate

	Dependent Variables: u^f_{ct}										
	Austria	Belgium	Finland	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain
Union density	-0.0128	-0.0128	-0.0403***	-0.0218*	-0.0225**	-0.00770	-0.0111	-0.0141	-0.0170	0.00189	0.0101
	(-1.40)	(-1.35)	(-2.78)	(-1.91)	(-2.01)	(-0.69)	(-1.01)	(-1.40)	(-0.94)	(0.26)	(1.06)
Union coverage	-0.0333**	-0.0375**	-0.0468**	-0.0415**	-0.000426	-0.083***	-0.0569***	-0.0294**	-0.0444**	-0.0481***	-0.0563**
	(-2.20)	(-2.25)	(-2.41)	(-2.23)	(-0.03)	(-3.23)	(-2.73)	(-2.24)	(-2.29)	(-2.84)	(-2.55)
Coordination	-0.0535	-0.0413	-0.00691	-0.113	-0.185**	0.144	-0.0603	0.00352	-0.0106	-0.191***	-0.294**
	(-0.73)	(-0.55)	(-0.08)	(-1.25)	(-2.04)	(0.79)	(-0.63)	(0.06)	(-0.13)	(-3.48)	(-2.59)
Income taxes	0.0761*	0.0865**	0.0914*	0.102**	0.0978**	-0.0147	0.138***	0.0755*	0.103*	0.0216	0.0862**
	(1.96)	(2.09)	(1.95)	(2.12)	(2.14)	(-0.30)	(2.69)	(1.95)	(1.72)	(0.96)	(2.07)
Employee SSC	-0.000750	0.00680	0.0386	-0.00403	-0.200*[8]	-0.212***	0.0254	0.0207	-0.00270	-0.0989**	0.0521
	(-0.02)	(0.18)	(0.92)	(-0.10)	(-2.48)	(-3.07)	(0.62)	(0.65)	(-0.07)	(-2.26)	(1.22)
Employer SSC	0.125***	0.133***	0.126***	0.164***	0.0640	0.155***	0.188***	0.103**	0.132**	0.157***	0.151***
	(3.42)	(3.23)	(2.96)	(3.48)	(1.57)	(3.54)	(3.58)	(2.36)	(2.25)	(4.24)	(2.93)
EPLs regular	0.0887	0.111	0.134	0.0520	0.00691	0.281	0.259	0.0149	0.207	1.705***	0.496**
	(0.60)	(0.71)	(0.74)	(0.30)	(0.03)	(1.47)	(1.27)	(0.10)	(1.21)	(2.83)	(2.03)
EPLs temporary	0.0801	0.130	0.336*	0.186	0.412**	-0.321*	0.0582	0.151	0.191	-0.291**	-0.199*
	(0.59)	(0.85)	(1.85)	(1.11)	(2.10)	(-1.68)	(0.36)	(0.77)	(1.22)	(-2.36)	(-1.73)
RR, 1st year	-0.0143**	-0.0144**	-0.0190**	-0.0170**	-0.00356	-0.0252***	-0.0393***	-0.00775	-0.0151**	0.0207	-0.0110*
	(-2.08)	(-2.02)	(-2.20)	(-2.02)	(-0.47)	(-2.99)	(-3.12)	(-1.41)	(-2.00)	(1.40)	(-1.75)
Benefit length	-1.649	-1.395	0.0148	-1.899	0.447	2.651	-6.248***	-0.982	-1.520	1.141	-0.139
	(-1.32)	(-0.95)	(0.01)	(-1.31)	(0.30)	(1.28)	(-3.09)	(-0.93)	(-0.96)	(0.88)	(-0.12)
ALMPs	0.0147	0.00883	-0.00513	0.0265	0.0580**	0.0434	0.0267	-0.00802	-0.000280	0.0209	0.0228
	(0.60)	(0.33)	(-0.16)	(0.86)	(2.03)	(1.60)	(0.82)	(-0.42)	(-0.01)	(1.01)	(1.19)

The table gives the coefficient of each institution variable when one country at the time is dropped, as well as the country which is dropped, as well as the country which is dropped. Nonlinear least squares estimation. The sample is restricted to those aged 15-64 inclusive. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich information. * p<0.10 ** p<0.05 *** p<0.01

Table B3: Cross-sectional stability: labour market institutions - male unemployment rate

	Dependent Variables: u_{ct}^{m}										
	Austria	Belgium	Finland	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain
Union density	-0.0202**	-0.0178**	-0.0513***	-0.0287***	-0.0329***	-0.0187**	-0.0165**	-0.00634	-0.0112	-0.00473	0.0153
	(-2.56)	(-2.09)	(-4.02)	(-3.33)	(-4.29)	(-2.35)	(-2.21)	(-0.83)	(-0.73)	(-0.70)	(1.39)
Union coverage	-0.0219*	-0.0329**	0.0338***	-0.0231**	0.00942	-0.0472**	0.0262***	-0.00843	-0.0289**	-0.0325**	-0.0584**
	(-1.90)	(-2.44)	(3.05)	(-2.02)	(0.85)	(-2.61)	(2.63)	(-1.08)	(-2.08)	(-2.28)	(-3.04)
Coordination	-0.0207	0.0621	0.303***	-0.117*	-0.0772	0.474**	0.240***	-0.0545	0.00316	-0.158***	-0.311***
	(-0.30)	(0.77)	(3.16)	(-1.70)	(-1.20)	(2.39)	(2.74)	(-1.13)	(0.05)	(-3.37)	(-3.10)
Income taxes	0.0798**	0.105***	-0.125***	0.0869**	0.0945***	-0.0623	-0.0672**	0.0272	0.0592	-0.00327	0.114***
	(2.28)	(2.72)	(-3.58)	(2.49)	(2.97)	(-1.27)	(-2.38)	(0.95)	(1.24)	(-0.14)	(2.70)
Employee SSC	0.0454	0.0748**	-0.0899***	0.0395	-0.109**	-0.210***	-0.0861***	0.0720***	0.0383	-0.132***	0.143***
	(1.49)	(2.19)	(-2.63)	(1.33)	(-2.46)	(-3.41)	(-2.71)	(3.10)	(1.40)	(-3.12)	(3.20)
Employer SSC	0.0927***	0.113***	0.00274	0.126***	0.0159	0.0772***	0.0340	0.00989	0.113**	0.135***	0.122***
	(3.51)	(3.46)	(0.08)	(4.52)	(0.57)	(2.84)	(1.06)	(0.30)	(2.37)	(4.83)	(3.16)
EPLs regular	-0.121	-0.0628	-0.896***	-0.231**	-0.0667	0.106	-0.594***	-0.396***	-0.0531	1.754***	0.554**
	(-1.08)	(-0.45)	(-3.57)	(-2.07)	(-0.45)	(0.73)	(-2.86)	(-3.69)	(-0.47)	(2.90)	(2.39)
EPLs temporary	0.199*	0.327**	-0.101	0.252**	0.560***	-0.223	-0.140	0.492***	0.201*	-0.426***	-0.235
	(1.68)	(2.33)	(-1.06)	(2.05)	(4.30)	(-1.22)	(-1.58)	(2.78)	(1.73)	(-3.09)	(-1.60)
RR, 1st year	-0.00792	-0.00488	0.000614	-0.0113*	0.00423	-0.0179***	-0.00377	-0.00242	-0.00756	0.0432***	-0.0161**
	(-1.17)	(-0.67)	(0.14)	(-1.67)	(0.63)	(-2.64)	(-0.89)	(-0.45)	(-1.21)	(2.63)	(-2.18)
Benefit length	0.0235	1.534	0.553	-0.245	3.872***	2.911	-1.257	-0.276	0.469	2.233	0.242
	(0.02)	(1.07)	(0.52)	(-0.21)	(3.10)	(1.60)	(-1.13)	(-0.32)	(0.39)	(1.48)	(0.18)
ALMPs	-0.0285	-0.0703*	-0.0439**	-0.00482	0.00894	0.00229	-0.0285	-0.00389	-0.0441	-0.0367*	-0.0198
	(-1.04)	(-1.94)	(-2.04)	(-0.18)	(0.48)	(0.09)	(-1.48)	(-0.23)	(-1.52)	(-1.82)	(-0.67)

The table gives the coefficient of each institution variable when one country at the time is dropped, as well as the country which is dropped, as well as the country which is dropped. Nonlinear least squares estimation. The sample is restricted to those aged 15-64 inclusive. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich information. * p<0.10 ** p<0.05 *** p<0.01

Table B4: Period stability

	Dependent Variables: u^f_{ct}													
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
TFP shock	-0.0846	-0.0610	-0.00595	-0.0230	0.00764	-0.0322	-0.0251	-0.0373	-0.0347	-0.0316	-0.0197	-0.0361	-0.0686	-0.0712
	(-0.76)	(-0.65)	(-0.06)	(-0.23)	(0.07)	(-0.31)	(-0.24)	(-0.39)	(-0.36)	(-0.22)	(-0.18)	(-0.37)	(-0.73)	(-0.89)
RIR	0.889***	0.732***	0.855***	0.906***	0.875***	0.870***	0.854***	0.817***	0.836***	0.882***	0.883***	0.859***	0.821***	0.787***
	(7.41)	(6.52)	(7.19)	(7.66)	(7.76)	(7.38)	(7.17)	(7.11)	(7.22)	(7.21)	(7.33)	(7.20)	(6.52)	(7.16)
LD shock	-0.247***	-0.173***	-0.181***	-0.213***	-0.212***	-0.253***	-0.252***	-0.214***	-0.210***	-0.252***	-0.248***	-0.213***	-0.223***	-0.312***
	(-3.32)	(-2.96)	(-3.77)	(-3.58)	(-3.45)	(-3.32)	(-3.20)	(-3.45)	(-3.46)	(-3.38)	(-3.58)	(-2.82)	(-3.09)	(-3.73)
ECB shock	0.133**	0.443***	0.100***	0.110**	0.148**	0.132**	0.125**	0.116***	0.110**	0.115**	0.108**	0.128***	0.134**	0.107***
	(2.55)	(2.66)	(2.91)	(2.51)	(2.46)	(2.48)	(2.40)	(2.63)	(2.53)	(2.29)	(2.49)	(2.65)	(2.52)	(2.72)
	Dependent Variables: u^m_{ct}													
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
TFP shock	0.0719	0.211**	0.259**	0.0667	0.296*	0.0778	0.0457	0.0168	0.111	-0.105	0.00620	0.00733	-0.0958	0.218**
	(0.45)	(2.22)	(2.45)	(0.45)	(1.76)	(0.51)	(0.31)	(0.12)	(0.70)	(-0.53)	(0.04)	(0.06)	(-0.74)	(2.17)
RIR	1.428***	0.938***	1.000***	1.355***	1.307***	1.367***	1.357***	1.297***	1.336***	1.421***	1.369***	1.296***	1.311***	0.852***
	(10.35)	(8.17)	(8.76)	(10.37)	(10.56)	(10.45)	(10.27)	(10.04)	(10.38)	(10.55)	(10.24)	(9.90)	(9.64)	(7.69)
LD shock	-0.209***	0.189***	0.239***	-0.221***	-0.180***	-0.219***	-0.246***	-0.193***	-0.217***	-0.236***	-0.346***	-0.124***	-0.152***	0.224***
	(-3.16)	(3.52)	(3.75)	(-3.25)	(-2.64)	(-3.15)	(-3.29)	(-3.30)	(-3.30)	(-3.53)	(-4.34)	(-3.33)	(-2.63)	(3.24)
ECB shock	-0.0184	0.0102	-0.0640	0.0175	-0.0140	0.0281	0.0268	0.0445	0.0154	-0.00919	0.0145	0.0775**	0.0548	-0.0202
	(-0.29)	(0.11)	(-1.48)	(0.32)	(-0.22)	(0.50)	(0.48)	(0.96)	(0.28)	(-0.16)	(0.31)	(2.29)	(1.41)	(-0.55)

The table reports the coefficient of each shock variable when one year at a time is removed, as well as the country which is removed. Nonlinear least squares estimation. The sample is restricted to those aged 15-64 inclusive. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich information. * p<0.10 ** p<0.05 *** p<0.01

Table B5: Test for endogeneity: lagged shocks

	Dependent Variables	
	I	II
Independent Variables	u^f_{ct}	u^m_{ct}
Direct impact of shocks (β')		
TFP shock	-0.103	-0.000999
	(-1.34)	(-0.01)
Real interest rate	1.043***	1.006***
	(9.78)	(8.74)
Labour demand shock	-0.399***	0.451***
	(-4.72)	(4.36)
Lagged ECB unsystematic shock	0.0522*	-0.0655
	(1.88)	(-1.53)
Interaction of LMIs with shocks (γ')		
Union density	-0.0181***	-0.0227***
	(-2.76)	(-3.14)
Union coverage	-0.0124*	0.0172***
	(-1.78)	(2.68)
Coordination	-0.147***	0.0931
	(-3.40)	(1.45)
Income taxes	0.0477**	-0.0672***
	(2.47)	(-3.13)
Employee SSC	-0.0287	-0.146***
	(-1.00)	(-4.61)
Employer SSC	0.108***	0.0279
	(4.99)	(1.12)
EPLs on regular contracts	-0.185***	0.159
	(-2.93)	(0.86)
EPLs on temporary contracts	-0.0281	-0.0144
	(-0.40)	(-0.20)
Replacement rate, 1st year	-0.0152heightAdjusted R^2	0.910
0.867		
Parameters	40	40
Observations	143	143

This table shows the sensitivity of the results in Table 1 by replacing shocks with their one period lagged values. Nonlinear least squares estimation. The sample is restricted to those aged 15-64 inclusive. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich information. * p<0.10 ** p<0.05 *** p<0.01

Table B6: Test for endogeneity: lagged institutions

	Dependent Variables	
	I	II
Independent Variables	u^f_{ct}	u^m_{ct}
Direct impact of shocks (β')		
TFP shock	0.239	0.0635
	(1.62)	(0.42)
Real interest rate	0.983***	1.431***
	(8.07)	(10.35)
Labour demand shock	-0.713***	-0.181***
	(-4.42)	(-3.06)
Lagged ECB unsystematic shock	0.125**	0.0303
	(2.16)	(0.58)
Interaction of LMIs with shocks (γ')		
Union density	-0.00783	-0.0238***
	(-1.41)	(-3.06)
Union coverage	-0.00383	-0.0251**
	(-0.71)	(-2.05)
Coordination	-0.0971***	0.0458
	(-3.01)	(0.84)
Income taxes	-0.00201	0.0783**
	(-0.15)	(2.06)
Employee SSC	-0.0275	0.0511*
	(-0.92)	(1.71)
Employer SSC	0.0929***	0.0878***
	(4.32)	(3.38)
EPLs on regular contracts	0.0259	-0.0449
	(0.25)	(-0.34)
EPLs on temporary contracts	-0.138*	0.222*
	(-1.84)	(1.90)
Replacement rate, 1st year	0.0121*	-0.00814
	(1.74)	(-1.06)
Benefit length	-0.633	0.855
	(-0.97)	(0.79)
Active labour market policies	0.00656	-0.0430
	(0.64)	(-1.56)
Time and country effects	yes	yes
Adjusted R^2	0.855	0.850
Parameters	40	40
Observations	143	143

This table shows the sensitivity of the results in Table 1 by replacing labour market institutions with their one period lagged values. Nonlinear least squares estimation. The sample is restricted to those aged 15-64 inclusive. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich information. * p<0.10 ** p<0.05 *** p<0.01

Table B7: Test for endogeneity: restriction on variations in institutions

	Dependent Variables			
	I	II	III	IV
Independent Variables	u^f_{ct}	u^m_{ct}	u^f_{ct}	u^m_{ct}
Direct impact of shocks (β')				
TFP shock	-0.127	0.0764	0.0232	0.127
	(-1.43)	(0.54)	(0.22)	(1.09)
Real interest rate	0.945***	1.339***	0.967***	1.155***
	(7.98)	(10.68)	(8.64)	(8.82)
Labour demand shock	-0.475***	-0.188***	-0.613***	-0.339**
	(-4.60)	(-4.02)	(-4.09)	(-2.22)
Lagged ECB unsystematic shock	0.0797**	0.0515	0.160***	-0.0217
	(2.22)	(1.21)	(2.80)	(-0.43)
Interaction of LMIs with shocks (γ')				
Union density	-0.00833	-0.0267***	-0.601***	-0.936***
	(-1.12)	(-3.41)	(-3.50)	(-5.09)
Union coverage	-0.0206**	-0.0327**	0.0589**	0.0933***
	(-2.08)	(-2.53)	(2.18)	(2.97)
Coordination	-0.188***	0.0632	2.385***	2.416***
	(-3.58)	(0.86)	(3.20)	(2.98)
Income taxes	0.0524**	0.117***	1.720***	2.767***
	(2.18)	(3.22)	(3.44)	(5.23)
Employee SSC	0.0207	0.0636**	0.625***	0.991***
	(0.70)	(2.18)	(3.58)	(5.37)
Employer SSC	0.113***	0.0936***	-0.897***	-1.598***
	(3.85)	(3.20)	(-3.06)	(-4.91)
EPLs on regular contracts	-0.0894	-0.0423	-0.663***	-0.178
	(-1.02)	(-0.36)	(-4.36)	(-1.19)
EPLs on temporary contracts	0.0859	0.324**	1.017**	2.076***
	(1.00)	(2.60)	(2.25)	(4.38)
Replacement rate, 1st year	-0.0356***	-0.00738	0.156***	0.192***
	(-3.64)	(-0.69)	(3.41)	(4.05)
Benefit length	-3.154***	0.738	-1.123	17.20
	(-3.08)	(0.68)	(.)	(.)
Active labor market policies	0.0347**	-0.0562*	-0.927***	-1.516***
	(2.16)	(-1.86)	(-3.49)	(-5.21)
Time and country effects	yes	yes	yes	yes
Adjusted R^2	0.878	0.845	0.874	0.872
Parameters	40	40	40	40
Observations	143	143	143	143

This table shows the sensitivity test on endogeneity of institutions for the results in Table 1. Columns I and II present the re-estimation results of equation (2) using the values of the institution measures in the first year of each 3-year interval. Columns III and IV present the re-estimation results of equation (2) by fixing the institution measures to their values in the first year of the observation period, 2000. Nonlinear least squares estimation. The sample is restricted to those aged 15-64 inclusive. t statistics in parentheses. Standard errors are estimated using robust Huber/White sandwich information. * p<0.10 ** p<0.05 *** p<0.01

Table B8: Pairwise correlations across labour market institutions

	Union density	Union coverage	Coordination	Income taxes	Employee SSC	Employer SSC	EPLs regular	EPLs temporary	RR 1st year	Benefit length	ALMPs
Union density	1.00	0.08	0.40	0.69	-0.24	-0.11	-0.35	-0.16	-0.19	0.27	-0.07
Union coverage		1.00	0.08	0.41	0.23	0.70	0.24	0.22	0.04	0.13	0.04
Coordination			1.00	0.41	0.22	-0.17	-0.38	-0.52	-0.29	0.52	0.30
Income taxes				1.00	-0.32	0.08	-0.31	-0.35	-0.41	0.37	0.09
Employee SSC					1.00	-0.05	0.29	-0.09	0.33	0.05	0.31
Employer SSC						1.00	0.11	0.46	-0.12	-0.15	-0.40
EPLs regular							1.00	0.14	0.46	-0.44	0.02
EPLs temporary								1.00	0.36	-0.38	-0.30
RR, 1st year									1.00	-0.16	-0.01
Benefit length										1.00	0.35
ALMPs											1.00

Table B9: Test for multicollinearity

	Union density	Union coverage	Coordination	Income taxes	Employee SSC	Employer SSC	EPLs regular	EPLs temporary	RR 1st year	Benefit length	ALMPs
Dependent Variables: u_{ct}^{f}											
TFP shock	0.152	0.0809	0.0932	0.0160	0.0310	0.271*	0.0798	0.0759	0.0325	0.0962	0.0663
	(1.05)	(0.58)	(0.64)	(0.12)	(0.25)	(1.72)	(0.57)	(0.54)	(0.26)	(0.68)	(0.48)
RIR	0.747***	0.702***	0.763***	0.786***	0.702***	0.865***	0.736***	0.757***	0.809***	0.726***	0.765***
	(9.29)	(7.90)	(7.51)	(9.25)	(7.53)	(9.40)	(8.81)	(8.60)	(9.68)	(8.28)	(8.23)
LD shock	-0.441***	-0.467***	-0.398***	-0.413***	-0.283**	-0.445***	-0.383**	-0.431*8	-0.204***	-0.390***	-0.369***
	(-2.83)	(-3.06)	(-2.69)	(-3.18)	(-2.16)	(-3.55)	(-2.57)	(-2.46)	(-3.29)	(-2.82)	(-2.66)
ECB shock	-0.0347	-0.758	1.290	0.475	0.544	0.220**	-29.08	1.219	0.895*	0.147	-0.0419
	(-0.24)	(-0.35)	(0.39)	(1.49)	(1.31)	(2.38)	(.)	(0.32)	(1.72)	(0.16)	(-0.22)
Institution	-0.0141**	-0.00232	0.0209	0.0307**	-0.0513	0.0621***	0.00205	-0.0272	-0.0133**	0.434	0.0246
	(-2.36)	(-0.43)	(0.43)	(2.08)	(-1.40)	(5.09)	(1.20)	(-0.33)	(-2.06)	(0.49)	(1.22)
Dependent Variables: u_{ct}^{m}											
	Union density	Union coverage	Coordination	Income taxes	Employee SSC	Employer SSC	EPLs regular	EPLs temporary	RR 1st year	Benefit length	ALMPs
TFP shock	0.342**	0.373**	0.322**	0.218	0.209	0.389**	0.221	0.238	0.158	0.262*	0.244*
	(2.31)	(2.24)	(2.30)	(1.50)	(1.52)	(2.26)	(1.54)	(1.64)	(1.16)	(1.78)	(1.76)
RIR	0.992***	1.091***	1.103***	1.051***	0.955***	1.176***	1.003***	1.034***	1.112***	1.012***	0.896***
	(11.79)	(9.76)	(10.45)	(11.87)	(9.84)	(11.83)	(11.08)	(11.24)	(12.90)	(11.55)	(9.39)
LD shock	-0.0406	0.0627	0.0203	-0.0411	0.0137	-0.0621	-0.0301	-0.0778	c-0.0864	-0.0722	0.0939
	(-0.25)	(0.40)	(0.21)	(-0.28)	(0.09)	(-0.43)	(-0.15)	(-0.45)	(-0.80)	(-0.48)	(0.79)
ECB shock	-0.181	0.157	0.403	1.235	0.540	0.0833	0.594	1.580	1.045	0.531	0.0631
	(-1.17)	(0.39)	(1.29)	(0.93)	(1.25)	(0.62)	(1.05)	(0.59)	(1.61)	(0.72)	(0.74)
Institution	-0.0144***	0.00609*	0.137**	0.0154	-0.0374	0.0419***	-0.117	-0.0461	-0.0101**	0.720	-0.0549*
	(-2.66)	(1.70)	(2.07)	(1.01)	(-1.54)	(4.19)	(-1.38)	(-0.61)	(-2.02)	(0.98)	(-1.92)

The table gives the coefficient of each shock variable when only one institution is involved in the estimation, as well as the institution which is involved and its shock-interaction coefficient. Nonlinear least squares estimation. The sample is restricted to those ages 15-64 inclusive. t statistics in parentheses (Standard errors are estimated using robust Huber/White sandwich formation). * p<0.10 ** p<0.05 *** p<0.01

Appendix C. Analysis by Demographic Composition

Table C1: Unemployment rates by gender and age across the EA: 2000-2013 average

	Female			Male		
	15-24	25-54	55-64	15-24	25-54	55-64
Austria	8.77	4.44	3.50	9.20	4.29	4.65
Belgium	19.74	7.18	4.59	18.64	6.20	3.95
Finland	21.53	6.62	6.51	23.08	6.63	7.88
France	21.29	8.49	5.34	20.06	6.93	5.64
Germany	9.13	7.46	10.22	11.68	7.64	9.71
Ireland	12.46	6.14	4.60	18.17	8.08	5.61
Italy	30.59	9.60	3.63	24.96	6.04	4.19
Luxembourg	14.84	4.65	2.51	12.84	2.90	1.94
Netherlands	8.65	4.26	3.81	9.17	2.89	3.86
Portugal	21.65	9.11	6.22	17.42	7.26	7.74
Spain	32.62	15.88	11.40	28.76	11.49	9.59

Source: Eurostat, unemployment rates by sex, age and educational attainment level (percent); OECD, LFS by sex and age.

Table C2: Unemployment rates by gender and marital status across the EA: 2000-2013 average

	Female		**Male**	
	S/W/D	M/U/C	S/W/D	M/U/C
Austria	6.25	3.82	6.66	3.29
Belgium	11.13	5.70	10.69	4.24
Finland	12.00	5.54	13.36	4.21
France	12.23	6.86	12.11	4.45
Ireland	9.03	4.76	13.50	5.62
Italy	14.99	7.87	12.50	3.96
Luxembourg	6.08	4.71	5.99	2.01
Netherlands	6.47	3.55	5.80	2.24
Portugal	13.06	8.24	13.27	5.76
Spain	15.62	20.09	9.10	18.94

S/W/D: Single/Widowed/Divorced; M/U/C: Married/Union/Cohabiting. Source: ILOSTAT, unemployment rate by sex, age and marital status (percent) – Annual

Table C3: Unemployment rates by gender and education across the EA: 2000-2013 average

	Female			**Male**		
	Basic	Intermediate	Advanced	Basic	Intermediate	Advanced
Austria	8.80	4.25	2.95	10.43	4.48	2.30
Belgium	14.25	8.91	4.07	11.48	6.34	3.78
Finland	17.81	9.14	4.32	15.64	9.04	4.04
France	13.83	9.56	5.62	12.96	7.05	5.32
Germany	13.52	7.77	4.38	16.54	8.44	3.60
Ireland	11.30	8.04	4.38	14.45	9.66	4.43
Italy	14.01	10.04	7.16	8.89	6.59	4.16
Luxembourg	7.59	4.97	3.90	5.65	3.06	2.61
Netherlands	7.96	4.54	2.96	6.16	3.54	2.49
Portugal	10.64	10.54	7.28	8.73	7.98	5.74
Spain	22.62	17.52	11.41	16.49	11.82	7.69

Source: Eurostat, unemployment rates by sex, age and educational attainment level (percent); OECD, LFS by sex and age.