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### Working Paper Are unemployment differentials among advanced economies still explained by the Shocks-and-Institutions Hypothesis?

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# Are Unemployment Differentials Among Advanced Economies Still Explained by the Shocks-and-Institutions Hypothesis?

**Working Paper** 

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### Are Unemployment Differentials Among Advanced Economies Still Explained by

### the Shocks-and-Institutions Hypothesis?

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**Abstract**: The average unemployment rate in Europe has been consistently higher than in the United States since 1980. The main explanation offered by a rather large economics literature focuses on the interaction between institutions and shocks. The contribution of this paper is twofold: to assess whether this prevailing explanation still holds when we take into account recent shocks (globalisation, China, etc.) and time-varying labour market institutions; and to offer a decomposition (using the Shapley-Owen approach) of the relative contributions of shocks, institutions and their interactions. While our results confirm the general validity of the Shocks and Institutions Hypothesis, we argue that it is more complex and nuanced than originally formulated.

**Key words**: unemployment, labour market institutions, shocks, worker heterogeneity, gender, youth unemployment

**JEL codes**: E02, E24, J08, J21, J48, J64, F66, O43, P48

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#### 1. Introduction

Since the 1980s, the average unemployment rate in Europe has been consistently higher than in the United States. Economists have proposed, modelled and empirically tested a number of possible explanations for these higher unemployment rates in Europe. These include ideology, beliefs, culture and the political economy of insiders versus outsiders (see Saint-Paul 2002 for an overview).<sup>1</sup> We believe that one of the strongest explanations is what we call here the Shocking Institutions Hypothesis. In a series of papers, Blanchard (1991, 2006), among others, argues that the best way to understand the differences in unemployment rates between the US and Europe is to focus on the interaction between shocks and institutions. Shocks explain the rise in unemployment, institutions explain its persistence. This is a simple but comprehensive explanation. Defined relatively broadly, institutions and shocks can cover many of the reasons that have been put forward in the debate.

The first element of this explanation is adverse economic shocks. The importance of shocks is almost self-evident when we look at key moments in the economic history of the 1970s: Both European and US unemployment rates rose after the full impact of the two oil shocks of 1973 and 1979. As such, they provided a convenient explanation for the rise in unemployment, but not for its persistence. This left room for a potential role for labour market institutions.

Despite the appeal of an explanation centred on the oil shocks, it is important to note that Blanchard's narrative takes a broader view of shocks. For example, Blanchard and Wolfers (2000) include the level of TFP growth, the real interest rate, the change in inflation and shifts in labour demand. As broad as this list of shocks is, it can and probably should be expanded. For example, Bertola (2017) argues that shocks to international financial integration should be included. Moreover, we argue that such an analysis should also include

<sup>&</sup>lt;sup>1</sup> We do not discuss and analyse the impact of fiscal shocks on the labour market (as e.g. Pappa 2009), as we consider them to be deliberate responses (rather than exogenous shocks) to macroeconomic shocks such as demand shocks.

other potentially important shocks, such as the China import shock (Autor et al 2013), terms of trade, banking, debt and currency crisis shocks. This is one of the contributions we make in this paper.

The second element in the Shocking Institutions Hypothesis explanation is labour market institutions.<sup>2</sup> The Hypothesis argues that the rigidities that labour market institutions introduce into the labour market matter. If one believes that these institutions do not change (or change little) over time, then such rigidities would perpetuate higher unemployment rates. Indeed, in their influential study that popularised the importance of the interaction between shocks and institutions, Blanchard and Wolfers (2000) treat institutions as fixed over time, but warn that they should not be thought of as static. Indeed, Nickell et al (2005) argue that institutions alone have more explanatory power than their interaction with shocks, which are implicitly assumed to be constant across countries.<sup>3</sup>

The unemployment rates in Europe have been about three percentage points higher than in the United States (US). Yet this statement should be taken with at least four caveats in mind. First, from the end of the Second World War until the late 1970s, European unemployment was systematically lower than in the US. Since 1980, unemployment rates in European Union (EU) countries have been about three percentage points higher than in the US (Figure 1). The recession of 1991, the Global Financial Crisis of 2008/2009 and the first wave of the Covid-19 pandemic in 2020 led to rapid increases in US unemployment rates, which were sufficient to close the gap, but these closures were short-lived as the EU-US gap quickly reopened and reached the aforementioned three percentage point difference again. A

<sup>&</sup>lt;sup>2</sup> Blanchard and Wolfers (2000) include the replacement rate, the duration of benefit, active labour market policies (such as the provision of vocational training, government job search assistance programs, public works programmes, etc.), employment protection, the tax wedge, labour coordination, and, finally, union coverage and density. Employment protection includes the body of labour law that defines workers' rights on a range of issues, including working time, pay and discrimination, trade union membership and activity, dismissal and safety.

<sup>&</sup>lt;sup>3</sup> Nickell et al (2005) find that "changes in labour market institutions explain around 55% of the rise in European unemployment from the 1960s to the first half of the 1990s, much of the remainder being due to the deep recession ruling in the latter period. Second, interactions between average values of these institutions and shocks, captured by time dummies, make no significant additional contribution to our understanding of OECD unemployment changes." (2005, p. 22).

second important caveat is that there is a wide dispersion of unemployment rates across European countries, with some EU countries at various times having lower average unemployment rates than the US (see Appendix A, Figure A2).



Figure 1: Unemployment rates in Europe and the US since 1960

Notes: The sample is defined by the countries included in the respective European Union (EU) definition. The EU-6 (EU-9; EU-15) is defined by the 6 (9; 15) oldest EU members. EU member countries (time varying) includes EU member states in a given time and thus different sets of countries over time. We calculate the unemployment rates for the country (grouping) as the ratio between the number of unemployed people and the size of the labour force. Source: AMECO.

A third caveat is that the 1990s add two layers of complexity to the US-EU comparison. First, the fall of communism increased the number of capitalist countries in Europe (and brought about the largest increase in the number of EU member states after 2004), and second, the 1990s marked the introduction of the European single currency. Since the financial crisis of 2008/09, unemployment rates in the euro area have been systematically higher, by about one percentage point, than in the European Union as a whole (Figure 2). Boeri and Jimeno (2015) refer to the latter as the "unbearable divergence of unemployment in Europe."



Figure 2: Unemployment rates in the euro area compared to the US and the EU.

Notes: Euro area data reflect either the over time varying definition of the euro area, the 11 founding members, or the region covering the current 20 member countries (as of January 2023). We calculate the unemployment rates for the country (grouping) using the size of the labour force and the number of unemployed people. Source: AMECO.

A fourth and final caveat is that a large literature, arguably starting with Blanchard and Summers (1986), refers to this gap as the European Unemployment Problem. We are not entirely comfortable referring to the differences in unemployment rates between the US and Europe since 1980 as the European Unemployment *Problem*. Yet the term has currency: there is a huge literature associated with it and as such it clearly conveys our research question and topic.<sup>4</sup> In fact, if one searches *Google Scholar* for either "European unemployment" or "unemployment in Europe" (i.e. without even including the word "problem"), most of the top papers are on the US-Europe unemployment problem since 1980. Indeed, the second most

<sup>&</sup>lt;sup>4</sup> See Appendix B for a brief review of the literature.

highly cited paper (i.e. Blanchard and Summers 1986) has these exact words in its title, while the top most highly cited paper is on the role of the "Shocking Institutions Hypothesis," i.e. the interaction between shocks and labour market institutions in explaining the gap (i.e. Blanchard and Wolfers 2000).

These four caveats are important for a better understanding of the differences in unemployment rates between the US and Europe, but they do not diminish the serious concerns raised by the persistence of a three percentage point gap in unemployment rates.

This paper contributes to the debate by taking a long-term macro perspective on European unemployment to revisit the theoretical framework underlying the Shocking Institutions Hypothesis, taking into account the role of European integration and the heterogeneity of workers by age and gender, and deriving from it three testable hypotheses. In our econometric framework, we explicitly model the interactions between time-varying labour market institutions and a set of shocks that, for the first time in the framework of the Shocking Institutions Hypothesis, take into account the literature on the labour market effects of globalisation. Using this framework, we test for heterogeneous effects of shocking institutions for different types of workers and bring a discussion in the literature to the data by assessing the relative explanatory power of groups of explanatory variables (shocks, institutions, and their interactions) and different types of fixed effects.

Our main findings are that the interaction between shocks and labour market institutions has stood the test of time, but is more complex and nuanced than previously thought. It remains an important explanation for understanding differences in unemployment rates across countries, including between Europe and the US. We evaluate econometrically whether the Shocking Institutions Hypothesis withstands the inclusion of time-varying labour institutions and a rich set of new shocks (China, economic and financial globalisation, terms of trade, and crisis periods). Our results confirm its validity: institutions, shocks, and their interactions together explain about 30% of the cross-country variation in unemployment rates. We also examine the time structure of this relationship and find that the direct impact of shocks dissipates relatively quickly, but depending on the set of institutions, this process is delayed, while labour market institutions become increasingly important in the longer run. Regarding the gender dimension, we find that the Shocking Institutions Hypothesis is better at explaining female unemployment than male unemployment. However, we also find that not all labour market institutions should be regarded as rigidities: some interactions between shocks and institutions increase unemployment, while others reduce it. A surprising example is that in highly economically globalised countries, an increase in dismissal regulations significantly reduces unemployment rates, while the opposite is true for an increase in working time regulations in these countries. We also find that the interactions between shocks and institutions affect workers heterogeneously: some shocks hit men (or younger workers) harder, while some institutions are more closely associated with lower unemployment among women (or older workers).

The remainder of this paper is structured as follows. Section 2 presents a simple theoretical framework and three hypotheses that guide the econometric work that follows. Section 3 presents the econometric framework and data, covering not only the youth and gender dimensions (heterogeneities that have often been downplayed in this literature), but also a rich set of shocks (i.e. beyond the more standard "oil shocks") and dynamic (i.e. time-varying) labour market institutions. Section 4 assesses whether, in light of these new considerations, the explanatory power of what we call the "Shocking Institutions Hypothesis" stands the test of time. Section 5 concludes.

### 2. Theoretical framework

The purpose of this section is to present a simple theoretical model that illustrates the main potential mechanisms for the unemployment differentials across countries to spell out a set of working hypotheses.

In what follows, we present a simple theoretical model to illustrate some of the possible mechanisms through which shocks and labour market institutions may affect unemployment. The first building block focuses on the role of (real and nominal) price rigidities in shaping the impact of shocks on unemployment. A key distinction in this framework is that between "bargained" and "warranted" wages. Blanchard (2006) defines warranted wages as those consistent with stable employment on a balanced growth path. They are assumed to grow at the rate of technological progress (which is assumed to be Harrod-neutral) and to adjust to ensure that firms maintain zero net profits. In contrast, the wage determined by negotiations between workers and employers is called the "bargained wage". If the latter grows faster than the former, the natural rate of unemployment rises.

How do wage rigidities affect the impact of adverse shocks on unemployment? Suppose that firms operate under perfect competition with constant returns to scale and use only one input (labour) in production, so that y = a + n, where y is the log of output, a is the log of productivity and n is the log of employment. Furthermore, assuming a constant or zero mark-up, the real wage paid by firms is given by w - p = a, where w is the log of the nominal wage and p is the log of the price level. If a follows  $a = a_{.1} + \varepsilon$ , then an unexpected negative realisation of  $\varepsilon$  represents a shock due to a fall in productivity.

As an intermediate step, let us consider what determines the real bargained wage. Suppose that the bargained wage  $(w^b - p)$ , where the superscript *b* refers to bargained, is simply a function of both expected productivity (*E*[*a*]) and the unemployment rate (*u*), which are positively and negatively related such that:  $w^b - p = E[a] - \beta u$  where  $\beta$  is the sensitivity of the real bargained wage to changes in the unemployment rate. Expected productivity adjusts to actual productivity over time at a given rate  $(1 - \lambda)$ , where  $0 \le \lambda \le 1$ , such that  $E[a] = \lambda$  $E[a_{-1}] + (1 - \lambda)a$ .

Equating warranted and bargained wages gives an unemployment rate  $u = -(1/\beta) (a - E[a])$ , which shows how a negative productivity shock leads to a higher unemployment rate.

Furthermore, if we substitute the equation for expected productivity into this last expression, we obtain the following for the natural rate of unemployment:

$$u = \lambda u_{-1} - \varepsilon \left( \lambda / \beta \right) \tag{1}$$

This expression highlights the effects of two real rigidities (see Blanchard and Galí 2007 for more details). The first is that high values of  $\beta$ , a high sensitivity of real bargained wages to changes in the unemployment rate, increase the effect of the initial productivity shock on unemployment. The second is that the higher the productivity adjustment  $\lambda$ , the longer the effect of the productivity shock on unemployment.

Note that in this setup, a permanent fall in productivity leads to a temporary rise in the natural rate of unemployment. The increase in unemployment will not be permanent because the gap between actual and expected productivity will eventually close thanks to the bargaining process. This simple setup requires further mechanisms to explain the persistence of the effects of these negative productivity shocks over time. The one that has received the most attention is the wage bargaining process.<sup>5</sup> We therefore assume a fixed capital stock.

We extend this basic setup by adding the prominent mechanism that generates persistence in unemployment rates, namely collective bargaining, where unions care more about the (regular) employed than about the unemployed (insider-outsider dynamics). The effect of collective bargaining depends on the wage negotiated. A simple wage setting is to assume that a monopoly union sets the wage and allows firms to choose the level of employment. Suppose the union chooses the nominal wage so that all its members are employed, and union membership is given by  $m = n_{-1} + \theta (\tilde{n} - n_{-1})$ , where *m* is the logarithm of union membership. If  $\theta = 0$ , the union only cares about the employed, while for  $1 > \theta > 0$ the union gives some weight to the employment of the unemployed (though always less than to those currently employed). We assume that the union chooses the nominal wage taking into

<sup>&</sup>lt;sup>5</sup> While other mechanisms have been studied theoretically, such as for example capital accumulation (Blanchard 2006), they have received little empirical attention (especially compared to collective bargaining).

account the expected productivity and the expected price level and equate the warranted wage relation to the bargained wage. and rearrange for u (using  $u = \tilde{n} - n_{-1}$ ), yielding:

$$u = (1 - \theta)u_{-1} - \frac{1}{1 - \alpha} [(p - E[p]) + \alpha(a - E[a])]$$
(2)

Here, unemployment depends not only on expected prices and productivity, but also on the weight of the unemployed in the collective bargaining process. The lower this weight, the more persistent the effects of this labour market institution on unemployment.

The purpose of this subsection is to set out the working hypotheses that will guide our econometric investigation. They are based on our understanding of the theory discussed above and on our reading of the evidence published in the literature. The most widely accepted explanation for the differences in unemployment rates between the US and the EU since the 1970s is what we call the Shocking Institutions Hypothesis. According to Blanchard and Wolfers, "an account of the evolution of unemployment based on the *interaction* of shocks and institutions can do a good job of fitting the evolution of European unemployment, both *over time* and *across countries*" (2000, p. C32, italics added).

As we have seen in the theoretical discussion above, adverse economic shocks can increase the unemployment rate. However, explanations based solely on this factor quickly run into at least two major difficulties. First, it is hard to see why economies should not adjust to these effects in the medium term. We can observe that they do adjust, so shocks explain the rise in unemployment but not its persistence. The second difficulty relates to whether the shocks are systemic or idiosyncratic, since in the former case it is a puzzle of why different countries should react differently to the "same" shocks. Nevertheless, it seems clear that "the heterogeneity of shocks cannot account for much of the heterogeneity of unemployment evolutions" (Blanchard and Wolfers 2000 p. C27).

Explanations based solely on labour market rigidities are also problematic for two related reasons. One is that labour market institutions did not change much between 1960 and 1980, and the other is that labour market institutions changed a lot between 1990 and 2015

(Boeri and Garibaldi 2009). The constellation of labour market institutions in Europe in the 1980s, when US unemployment rates were half those in Europe, does not appear to be radically different from the constellation of labour market institutions in Europe in the 1960s, when US unemployment rates were twice those in Europe (this is particularly true when comparing the US with the four largest European countries, the UK, Germany, France and Italy). Since 1990, however, considerable political capital has been invested in the design and implementation of labour market reforms, leading to an overall increase in the homogeneity of labour market institutions across European countries. Bertola (2017) notes that it is easy to observe that labour market institutions started to be reformed in Europe right at the end of Blanchard and Wolfers' data coverage in 1996. One can even say that labour market institutions in Europe have changed quite dramatically since the mid-1990s, with the level of aggregate labour market regulations in Europe converging since then, reducing heterogeneity to the level last observed in 1970 (Figure 3). It should be noted, however, that we did not find any significant structural breaks in these series.



Figure 3: Mean and standard deviation of labour market institutions within Europe.

Notes: The average level of labour market institutions is alternatively specified as the average of the country-specific labour regulation indices or a weighted average of the country-specific labour market indices with weights corresponding to the size of the labour force. Source: CBR data (Adam et al, 2016).

Since shocks and institutions alone cannot explain the rise or persistence of unemployment, their interaction remains the preferred explanation. Some interactions between shocks and labour market institutions may be positive, while others may be negative. We have already highlighted collective bargaining as an example, so it is natural to think that if the coordination of the bargaining process is improved (for example, through better information availability or through improvements in enforcement), this may well lead to a smoother adjustment of real wages to adverse productivity shocks and a smaller increase in unemployment. Conversely, if labour market institutions are associated with an increase in the average duration of unemployment spells, adverse shocks that reduce employment may have little effect on wages and thus further fuel the persistence of higher unemployment.

A final important point before outlining our working hypotheses is to draw attention to the crucial role of heterogeneity in driving the idea of Shocking Institutions. Indeed, this hypothesis *requires* cross-country heterogeneity: "While adverse shocks can potentially explain much of the rise in unemployment, there is insufficient heterogeneity in these shocks to explain cross-country differences" (Blanchard and Wolfers, 2000, p. C1).

How can we think about the heterogeneity of shocks? A first aspect is to distinguish between common and specific shocks, typically at the country level. Unexpected increases in the price of inputs such as oil and gas, which are essential inputs for a whole range of production activities, are almost by definition shocks that are common across countries. The intensity of these shocks can vary according to sectoral composition (countries producing more energy-intensive products will suffer more) and the availability of domestic production or substitutes. Globalisation shocks, or in particular the Chinese import shock, can also have heterogeneous labour market effects within countries (Autor et al 2021). First, the impact of shocks may be felt more strongly in some sectors than in others: workers in manufacturing may be more affected than those in (e.g. health) services. This in turn would affect different groups of workers in different ways. If female workers are predominantly employed in non-manufacturing activities, this could lead to shocks having gender-specific unemployment effects. Second, workers who are less experienced and/or less skilled may also feel the shock more acutely. Consider young workers, who by definition have less labour market experience, may be less skilled (certainly in terms of firm-specific human capital) and may have more precarious contractual arrangements (being relatively "less insiders").<sup>6</sup>

How to think about the heterogeneity of labour market institutions? This concern is reinforced when one considers that the notion of institutions can be easily expanded. Economists typically define institutions as the rules of the game that govern human economic interactions. These rules can be formal (as described above) or informal. By noting that institutions can be informal, one can encompass a range of other explanations for the US-European unemployment gap that focus not only on the political economy of insiders versus outsiders, but also on explanations that focus on ideology, beliefs and culture (Saint-Paul 2002). Such extensions can account for heterogeneity both between and within countries. Culture and beliefs continue to play an important role in the age and gender division of intra-household work, informality and labour market participation.

In the light of these considerations, and based on our reading of the theory and the relevant literature, the three working hypotheses that we put forward to guide our econometric work are as follows:

- H1 The Shocking Institutions Hypothesis holds, i.e. the interaction between shocks and institutions is important in explaining differences in unemployment rates.
- H2 The Shocking Institutions Hypothesis holds for the introduction of the single European currency, the euro.
- H3 The Shocking Institutions Hypothesis holds for different types of workers

<sup>&</sup>lt;sup>6</sup> Note that Blanchard does not seem to believe in the severity of youth unemployment: "Italy and Greece indeed have much more youth unemployment than the regression line would predict, Germany much less (because of its apprenticeship programmes); on average, the experience of the EU15 does not appear that unusual" (2006, p. 12, italics added), although the data suggests that there is a difference in levels between Europe and the US, with higher youth unemployment rates in the former.

(namely by gender and age).

It should be clear that these hypotheses are somewhat nested and that they are better understood together. We are interested in whether the Shocking Institutions Hypothesis still holds, and for what kind of institutions and shocks. Note that the motivation for the first hypothesis stems essentially from the theoretical framework we presented earlier.

Our Hypothesis 2 concerns the introduction of the euro. First of all, it is important to note that while academic and policy attention to the relationship between the euro and labour markets declined substantially after the Global Financial Crisis, it was a very important concern before then (see, among others, Pissarides 2008). Since the introduction of the single currency in 1999, there has been a staggered enlargement of the euro area, with different countries joining at different times, which provides an interesting source of variation. As described above, many researchers believe that the euro has made an important contribution to the development of labour markets in Europe. With regard to the role of ideology, one can imagine that more left-wing governments would react differently to the employment and labour force consequences of shocks if these were more severe and/or more directly affected the voters who support them (i.e. workers).

With respect to Hypothesis 3, we note that the theoretical model assumes that workers are homogeneous. Moreover, many authors are very explicit that their understanding of the evidence is that worker heterogeneity is not an important consideration when trying to understand the differences in unemployment rates across countries. In our view, youth unemployment as a dimension of worker heterogeneity has been much discussed in the literature, while gender differences in unemployment have not yet received sufficient attention in this context, namely (converging) differences in the behaviour of male and female unemployment rates in Europe relative to the US.

In this paper, we take up these issues and attempt to explore cross-worker

heterogeneity in more detail. The next section explains our econometric methodology, providing details of the data series, and then turns to the econometric testing and evaluation of these hypotheses.

### 3. Data and methodology

Unemployment rates, the dependent variable in our econometric analysis, come from the International Labour Organisation (ILO). Unlike other sources, such as the World Bank or the European Commission's AMECO database, the ILO database allows us to differentiate unemployment rates by gender and age group at the cost of the disaggregated time series starting in 1980 instead of 1960 for a small set of countries. To construct youth unemployment, we combine data from the Labour Force Statistics (LFS, 2023) with the Youth Labour Market Indicators (YouthSTATS, 2023), which are both published by the ILO. In addition, these international data sources include a number of countries outside Europe and the US. The total unemployment rate is calculated for the working age population. The youth unemployment rate from the ILO focuses specifically on the 15-24 age group. Using information on the share of the labour force by age group, we can calculate the adult unemployment rate, i.e. for those aged 25 and over.

Our first set of explanatory variables are labour market institutions. We use the CBR data on labour market regulation from Adams et al's (2019) because of their extensive time and country coverage.<sup>7</sup> Their measures include labour market laws and regulations. These meticulously documented *de jure* measures are coded from individual pieces of legislation for each year from 1970 to 2015 in 117 countries.<sup>8</sup> The dataset contains 40 different variables measuring different dimensions of labour market regulation which are aggregated into: (A) regulations on different forms of employment (*hiring*), (B) regulations on *working time*, (C)

<sup>&</sup>lt;sup>7</sup> The OECD labour market reform index is widely used (e.g. Alesina et al, 2010) as a summary measure of the degree of protection provided by employment legislation. It covers both permanent (regular) workers and temporary (fixed-term) employees. The IMF provides a narrative database of "major" labour and product market reforms (Duval et al, 2018).

<sup>&</sup>lt;sup>8</sup> See Campos et al (2018) for a detailed discussion.

laws on dismissal (*firing*), (D) worker representation (*unionisation*), and (E) industrial action (*strikes*). Our econometric analyses include each of these five variables separately. Higher scores correspond to stricter regulation, which is typically associated with greater worker protection.

We treat euro area membership as an institutional change due to its permanent nature. The euro area membership dummy takes the value of one from the year of accession (see Campos et al 2020). Finally, using data from Armingeon et al (2022), we include a dummy variable that takes the value of one if the cabinet composition is dominated by social democratic or other left-wing parties. We treat this left-wing government dummy like an institution because we are interested in how the ideology of a government shapes the response to a shock (see, for instance, the discussion of the government responses to the Great Recession in Boeri and Jimeno 2016) and therefore want to interact it with our shock variables.

Our second set of explanatory variables are shocks.<sup>9</sup> As discussed above, there are different types of shocks that could affect unemployment. The first set of shocks is inspired by Blanchard and Wolfers (2000) and consists of total factor productivity growth, the (nominal) long-term interest rate and the inflation rate (using national consumer price indices). These variables are taken directly from the AMECO database.

Our second set of shocks relates to foreign influences that are not explicitly modelled in Blanchard and Wolfers (2000). Our first measure of foreign shocks is the terms of trade, as measured by the ratio of the price deflators for exports and imports of goods and services, as provided by the AMECO database. The next two measures of foreign shocks relate to the *de facto* degree of economic and financial globalisation, and are taken from the KOF

<sup>&</sup>lt;sup>9</sup> Here we use the term "shock" as it appears in the earlier literature on the European unemployment problem. Contemporary studies typically classify our final set of shock variables as true shocks because they are presented as dichotomous variables indicating significant changes. However, the distinction between continuous and dichotomous measures of shocks is not essential; statistical methods often exploit the variation present in the data regardless of the measurement approach.

globalisation database (Gygli et al 2019, Dreher 2006). The KOF index of de facto economic globalisation measures the integration of a country into the world economy on the basis of flows of goods and services. The KOF index of de facto financial globalisation, on the other hand, looks at financial flows and international debt positions.<sup>10</sup> Our fourth measure of international shocks, inspired by the literature on the China's export expansion following its accession to the World Trade Organisation l (e.g. Autor et al 2013, 2021), is imports from China as a share of total imports using data from the IMF DOTS (2023).

The third set of shock variables aims to capture shocks from a different angle. We take ex-post measures of crisis situations as used by others and include a dummy for currency crises, sovereign debt crises, and the onset of systemic banking crises from Laeven and Valencia (2018). In this way, we ensure that we do not miss anything that is not already captured by our more general shock variables.<sup>11,12</sup>

Table 1 shows the descriptive statistics. Our baseline regression sample contains 728 country-year observations covering up to 33 countries and 33 years (see Appendix A, Table A1). Rows 1-3 show that the average male unemployment rate is below the overall unemployment rate, while the average female unemployment rate is above it. The average unemployment rate for young people is over 17%, almost 11 percentage points higher than the unemployment rate for those aged 25 and over (rows 4 and 5).

<sup>&</sup>lt;sup>10</sup> Note that although these two variables are statistically highly correlated, we choose to keep them separate and include both simultaneously because the literature clearly distinguishes between these two concepts (see, for example, Bertola, 2017) and because the empirical results show that they have different effects on the unemployment rate. In a sense, it is surprising to observe their individual significance despite this potential multicollinearity problem.

<sup>&</sup>lt;sup>11</sup> Although there are criticisms of Laeven and Valencia's (2018) efforts to measure crises, it remains the most widely used measure in the literature. The main criticisms are that the measures do not always capture the duration of the crisis and that they are limited to economic aspects, when in many cases political aspects may be more important.

<sup>&</sup>lt;sup>12</sup> Given the limited number of currency and sovereign debt crises in our sample of countries, we combine these with banking crises into one dummy. Specifically, the three currency crises we observe occurred in Greece and Spain in 1983 and in Iceland in 2008. The two sovereign debt crises occurred in Greece in 2012 and in Cyprus in 2013.

### Table 1: Summary statistics.

		Sun	umary s	tatistic	5	Correlation coefficients								
Unemployment measures	Obs	Mean	S.D.	Min	Max	_	(1)	(2)	(3)	(4)	(5)			
<ol> <li>Overall unemployment rate (in %)</li> </ol>	728	8.26	4.40	1.48	27.69	Γ	1.00							
(2) Female unemployment rate (in %)	728	9.01	5.20	1.52	31.65		0.94	1.00						
(3) Male unemployment rate (in %)	728	7.79	4.30	1.44	25.60		0.96	0.82	1.00					
(4) Unemployment rate, 15-24 (in %)	728	17.69	10.04	3.11	58.66		0.90	0.88	0.84	1.00				
(5) Unemployment rate, 25+ (in %)	728	6.89	3.79	1.14	25.51		0.98	0.90	0.96	0.84	1.00			
Institutional variables	Obs	Mean	S.D.	Min	Max		(1)	(2)	(3)	(4)	(5)	(6)	(7)	
(1) euro area membership	728	0.27	0.44	0	1	Γ	1.00							1
(2) Left-wing-dominant government	728	0.23	0.42	0	1		0.00	1.00						1
(3) LRI - Hiring (a)	728	0.55	0.25	0.06	0.98		0.51	0.10	1.00					1
(4) LRI - Working time (b)	728	0.54	0.19	0.00	0.87		0.17	0.13	0.48	1.00				1
(5) LRI - Firing (c)	728	0.52	0.19	0.00	0.85		0.21	0.23	0.63	0.43	1.00			1
(6) LRI - Unionisation (d)	728	0.55	0.20	0.04	0.82		0.17	0.13	0.39	0.49	0.50	1.00		1
(7) LRI - Strike (e)	728	0.48	0.21	0.11	0.91		0.28	0.00	0.38	0.21	0.60	0.33	1.00	1
Shock variables	Obs	Mean	S.D.	Min	Max		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<ol> <li>Total factor productivity decline</li> </ol>	728	-0.86	2.24	-7.50	12.88	Γ	1.00							
(2) Long-term interest rate	728	6.65	3.77	0.72	27.74		0.01	1.00						
(3) Inflation (using national CPIs)	728	3.50	3.39	-4.48	24.51		0.06	0.73	1.00					
(4) Terms of trade of goods and services	728	98.61	11.80	59.98	156.03		0.00	-0.32	-0.33	1.00				
(5) KOF Eco.Glob.Index, de facto	728	61.80	17.16	24.71	91.53		0.04	-0.47	-0.32	-0.06	1.00			
(6) KOF Fin.Glob.Index, de facto	728	70.64	18.71	21.97	99.78		0.11	-0.57	-0.44	-0.05	0.91	1.00		
(7) Imports from China (% of total imports)	728	3.84	3.96	0.12	22.20		0.16	-0.49	-0.31	0.27	0.06	0.17	1.00	
(8) Currency, sovereign debt, or banking crisis	728	0.038	0.19	0	1		0.20	0.02	0.11	-0.03	0.06	0.07	0.08	1.00

Notes: Summary statistics and pair-wise correlation coefficients for the sample used in Table 2.

With pairwise correlation coefficients mostly well below 0.6, there is considerable variation in the institutional variables. In particular, we note that a good quarter of the observations are euro area countries. Almost a quarter of the country-years are governed by left-wing governments. The third and final set of variables are the shock variables. Note that these shocks can be either positive or negative and that we implicitly assume that their effects on unemployment are symmetric. Most of the shock variables show considerable variation. For example, the share of imports from China varies between 0.12% and 22%. Currency, sovereign debt or banking crises occur in only 3.8% of the country-years and are largely driven by systemic banking crises in the 1980s, the Great Financial Crisis and the euro area crisis.

In the following regression analyses, all continuous explanatory variables are standardised by subtracting the respective mean and dividing by the standard deviation. This helps in the interpretation of the results, as on average all these variables have a value of zero and a change of one unit implies a change of one standard deviation in the respective variable. The dummy variables are left as they are, again to facilitate the interpretation of the results.

Let us turn to our estimation strategy. We test our hypotheses in a linear regression framework with different sets of dependent variables and interaction effects. We interpret our estimates as conditional correlations rather than causal relationships. Our baseline linear regression model is:

$$Unemployment_{it} = \alpha Institutions_{it-1} + \beta Shocks_{it-1} + \gamma Institutions_{it-1} * Shocks_{it-1} + \delta_i + \theta_t + \varepsilon_{it}$$
(3)

where *i* refers to the country, and *t* to the year. The vector  $\alpha$  gives the conditional correlations of the one-year lag of labour market institutions with unemployment. The vectors  $\beta$  and  $\gamma$  do the same for shocks and the interaction between institutions and shocks, respectively. A positive and significant  $\gamma$  would provide support for the Shocking Institutions Hypothesis (H1). Standard errors are clustered at the country level.

We chose a model that is linear in parameters to obtain estimates of the interactions between institutions and shocks, the core element of the Shocking Institutions Hypothesis. Previous econometric implementations of the Shocking Institutions Hypothesis (Blanchard and Wolfers 2000 and Bertola 2017, among others) prefer nonlinear least squares estimation. Its main advantage is its parsimony, rigour and elegance, but its main disadvantage is that it limits the model, as there are no explicit interactions in the model and we cannot distinguish the direct effects of shocks and institutions from their indirect effects (i.e. their effects on unemployment via interactions). A challenge of our approach is the number of regressors. For the selection of interaction terms, which would otherwise quickly become unwieldy, we have implemented a basic general-to-specific approach that drops those interaction variables that are not significant at the 10% level, while allowing them to re-enter at each step of the process if they turn out to be significant at the 5% level.

Since our main concern is to learn about the relative importance of different sets of

variables rather than individual variables separately, we run F-tests of joint significance on the following sets of variables: the euro area and left-wing government dummies and their interactions with shocks, labour market institutions, shocks, the interactions between these labour market institutions and these shocks, and country and time-fixed effects. To learn more about the quantitative importance of these sets of variables, we compare the change in R<sup>2</sup> across specifications and decompose the R<sup>2</sup> within a specification using Shapley-Owen values (see Israeli 2007, Fortin et al, 2011, Biasi and Ma 2023). The procedure consists of three steps. First, we implement the Shapley-Own decomposition by estimating the OLS regression of the unemployment rate including all sets of variables and the different sets of fixed effects. Second, we calculate how much the R<sup>2</sup> decreases when we exclude either a set of fixed effects or a set of variables *k*. Finally, we calculate the average decrease in the R<sup>2</sup> for each dimension *k* across all these regressions, which is analogous to the Shapley value used in game theory. This statistic, which Biasi et al (2023) call the partial-R<sup>2</sup> of dimension *k*,  $R_k^2$  represents the proportion of the total variance in the unemployment rate associated with *k*.<sup>13</sup>

To test our third hypothesis about the explanatory power of the Shocking Institutions Hypothesis for unemployment of different groups of workers, we stack the unemployment rates by worker type g and estimate the following equation:

 $Unemployment_{git} = \alpha Institutions_{it} + \beta Shocks_{it} + \gamma Institutions_{it} * Shocks_{it} + \delta_i + \theta_t$  $+ \mu Institutions_{it} * G_g + \lambda Shocks_{it} * G_g$  $+ \tau Institutions_{it} * Shocks_{it} * G_g + \delta_i * G_g + \theta_t * G_g + \varepsilon_{git}$ (4)

where G is an indicator for the type of worker. The standard errors are again clustered at the

<sup>&</sup>lt;sup>13</sup> Hüttner and Sunder (2012) propose the Shapley value and its generalisation, the Owen value, to uniquely decompose the R<sup>2</sup> of a model. To address situations where regressor variables are grouped together, such as with dummy variables or conceptually related variables, the authors introduce the Owen value as a generalisation of the Shapley value. The Owen value allows the interpretation of both individual variable values and group values, ensuring that equally performing groups receive the same value. The sum of the values attributed to variables within a group is therefore equal to the value attributed to the group if the R<sup>2</sup> were attributed directly to the group using the Shapley value decomposition. For this reason, we refer to this as the Shapley-Owen value decomposition. To decompose the R<sup>2</sup>, we use the *rego* command in Stata provided by these authors.

country level. We will also examine whether the group identifier (gender or age cohort) as well as the interactions included in Equation (4) contribute to explaining the variation in unemployment rates.

### 4. Empirical results

### 4.1 Baseline results

In this subsection, we test and discuss our three main hypotheses using the data and econometric specifications presented in the previous section.

Table 2 shows our baseline estimate using the specification in Equation (3) above on annual data from 1982 onwards in the last column. Before turning to this, the first column, labelled "CTFE", regresses the unemployment rate on country- and time-fixed effects only (CTFE). The  $R^2$  and the adjusted  $R^2$  are relatively high, suggesting that around 66% of the total variation in unemployment can be explained by these two factors alone. The  $R^2$  from a regression in which we "turn off" (i.e. exclude) the time-fixed effects is around 58%, and when we turn off the country-fixed effects the resulting  $R^2$  collapses to around 8%. According to the Shapley-Owen values shown in Figure 4, about 57.4% of the variation in the unemployment rate (or 87.5% of the  $R^2$ ) can be attributed to the country-fixed effects and 8.2% (or 12.5% of the  $R^2$ ) to the time-fixed effects. The Shapley-Owen values thus serve to decompose the relative importance of different sets of variables or fixed effects.

	(1)	(2)	(3)	(4)					(5)			
VARIABLES	CTFE 1	Institutions	Shocks	Both			Bo	th + signif	icant intera	ctions		
(1) euro area membership		0.861		0.304	0.264							
		(0.907)		(0.377)	(0.371)							
(2) Left-wing-dominant government		0.143		0.0925	0.236							
		(0.305)		(0.210)	(0.759)							
(3) LRI - Hiring (a)		-0.672		-1.022	-0.860**							
		(-0.721)		(-1.642)	(-2.119)							
(4) LRI - Working time (b)		1.071		1.451	1.488*							
		(0.760)		(1.307)	(1.969)							
(5) LRI - Firing (c)	-	4.274***		-3.155***	-3.315***							
		(-4.354)		(-5.127)	(-4.540)							
(6) LRI - Unionisation (d)		0.124		-0.218	0.797							
		(0.108)		(-0.183)	(0.876)							
(7) LRI - Strike (e)		1.388		0.840	0.0328							
		(0.620)		(0.432)	(0.0232)	Euro	Left	LRI-a	LRI-b	LRI-c	LRI-d	LRI-e
						(5.1)	(5.2)	(5.3)	(5.4)	(5.5)	(5.6)	(5.7)
Total factor productivity decrease			0.213	0.339*	0.323*						-0.274**	
<b>.</b>			(0.864)	(1.783)	(1.766)						(-2.101)	
Long-term interest rate			2.4/6***	2.279***	1.6/1**	2.006***					-0.910***	
			(5.341)	(5.727)	(2.444)	(3.991)		0.000**	0.402*		(-3.541)	
Infilation (Using national CPIs)			-1.//4****	-1.030****	-1.040****	-1.582**		(2,000)	-0.485*		(2.207)	-0.554****
Towns of the deside of an edge of the sectors			(-4.558)	(-5.780)	(-4.449)	(-2.512)	0 60 4 **	(2.090)	(-1.870)		(2.387)	(-3.025)
Terms of trade of goods and services			(0.0425)	-0.0769	-0.367		(2.541)				(2 992)	
KOE Fac Clab Indan, do facto			0.206	(-0.551)	(-1.381)		(-2.541)		0.052***	1 706***	(2.002)	
KOF ECO.Glob.Ilidex, de lacto			(0.0055)	(0.453)	(0.956)				(3.506)	(4.574)		
KOF Fin Glob Index, de facto			0 727	0.497	1 814*			0.672*	(3.300)	(-4.574)		
KOF Fill Glob. Index, de facto			(0.534)	(0.390)	(2.032)			(2.026)				
Imports from China (% of total imports)			0 349	0.138	0.598**		1 462***	(2.020)				
			(0.819)	(0.416)	(2.671)		(3.477)					
Currency, sovereign debt, or banking crisis			1.282*	1.109	0.369		()					
,g ,g			(1.800)	(1.661)	(0.725)							
				· · · ·								
R-squared	0.656	0.708	0.734	0.773				0	.841			
Adjusted R-squared	0.623	0.676	0.704	0.745				0	.818			
F-test LRI-Institutions		0.000		0.000				0	.000			
F-test Shocks			0.000	0.000				0	.000			
F-test Interactions LRI-Shocks								0	.000			
F-test Euro area members		0.371		0.708				0	.002			
F-test Left-wing governments		0.763		0.835				0	.008			

Table 2: Regression results for total unemployment.

Notes: Standard errors are clustered at the country level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. p-values are shown for F-test statistics. Country- and period-fixed effects are always included and highly significant. Each regression is based on 728 observations covering 33 countries over 33 years.

In Column 2, we add the set of *institutions* of interest. Unlike in most previous studies, they are all time-varying and include both the introduction of the euro, changes in government ideology and employment protection legislation, ranging from hiring, temporary work and dismissal regulations to unionisation and strike activity. Overall, the addition of these institutional variables in Column 2 increases the adjusted R<sup>2</sup> from 0.66 to 0.71. According to the Shapley-Owen decomposition, these institutions together explain 7% of the variation in the unemployment rate (see Figure 4), with the role of the euro area and ideology being relatively limited and statistically insignificant according to the F-test results.



Figure 4: Decomposition of the R2 of the results in Table 2 using Shapley-Owen values.

Notes: The horizontal axis indicates to which table and column the decomposition of the  $R^2$  in the different groups refers.

Including "shocks only" (alongside the fixed effects) in Column 3 increases the R<sup>2</sup> further, from 0.66 to 0.73. Similarly, the decomposition based on Shapley-Owen values suggests that shocks account for 12.8% of the variation in unemployment, which is considerably more than (the time-varying part of) institutions. Adding both shocks and institutions simultaneously in Column 4 increases the adjusted R<sup>2</sup> to 0.77, with the Shapley-Own values providing a joint explanatory power of institutions and shocks of 17.2% without and 18.1% with the euro area and left-wing dummies.

Finally, adding the significant interactions between shocks and institutions (Column 5) yields an R<sup>2</sup> of 0.84. The decomposition suggests that the interactions alone explain between 9.1% and 15.7% of the variation in unemployment rates, depending on whether the euro area and left-wing interactions are included, compared with 13.8% for the non-interacting labour market institutions (excluding the euro area and left-wing dummies) and the shock variables. Finally, note that the F-tests of joint significance at the bottom of each column suggest that all included sets of variables and the fixed effects are now significant at least at the 1% level.

Adding shocks, institutions and their joint effects, we find that the importance of

country-fixed effects, as calculated by the Shapley-Owen value decomposition, explains a decreasing share of the variation in the unemployment rate, from 57.4% to 46.8%. To avoid an overload of interaction coefficients, our preferred specification, as shown in Column 5 of Table 2, includes only statistically significant interaction terms, as selected by a standard general-to-specific procedure. Although the dropped interaction terms were individually insignificant, together they may be able to explain some of the variation in the unemployment rate. For this reason, Appendix A, Table A.2 reports the results of a regression that includes all possible interaction terms between our institutional variables and our shock variables. The last bar in Figure 4 shows that this does indeed raise the R<sup>2</sup> further to 0.85 and increases the overall importance of the interaction terms from 9.1% to 15.9% (excluding the euro area and left-wing terms). At the same time, it reduces the share explained by the country-fixed effects from 46.9% to 39%. Although decreasing in these specifications, these results strongly suggest that cross-country heterogeneity, which is not captured by the time variation in our institutional and shock variables or their interactions, is the most important factor in explaining the variation in unemployment rates across countries and over time. These cross-country differences could include elements such as culture and norms related to employment and job search.

Let us now turn to the interpretation of some of the individual variables. In Column 2 of Table 2, we can see that when we include all our institutional variables, the only coefficient that turns out to be statistically significant at conventional levels is the one on the regulation of dismissals. As explained above, the euro and ideology variables are our only institutional dimensions that are dummies, while all the others are standardised to have an average of 0 and a standard deviation of 1. Higher values indicate a higher level of protection for workers in each of the five areas. These results suggest that, conditional on country- and time-fixed effects, a one standard deviation increase in the legal protection of workers against dismissal is associated with a decrease of more than four percentage points in the average

unemployment rate.

The introduction of our time-varying shock variables in Column 3 of Table 2 shows that a one standard deviation increase in the nominal long-term interest rate (equivalent to 3.7 percentage points - see Table 1) increases the unemployment rate by almost 2.5 percentage points. The effect of a standard deviation increase in the inflation rate (equivalent to 3.3 percentage points) is to reduce the unemployment rate by almost 1.8 percentage points. Finally, the rare occurrence of a currency, sovereign debt, or banking crisis is associated with an increase in the aggregate unemployment rate of around 1.3 percentage points.

Column 4 shows our baseline specification with both shocks and institutions, but still without their interactions. On the institutional side, we again find that higher protection against dismissal is associated with a reduction in the unemployment rate. Also with respect to shocks, there is little change between Column 4 and Column 3, except that the coefficient on the productivity variable becomes statistically significant at the 10% level and the crisis dummy loses its significance.

Column 5 is our main baseline specification as it includes shocks, institutions and their interactions. The first thing to note concerns labour market institutions: in addition to dismissal protection, the negative direct effect of hiring-related regulations now also becomes statistically significant. Looking at the set of shocks, we again obtain similar effects for the long-term interest rate and the inflation rate. What is new here, conditional on the full set of interactions between shocks and institutions, is the emergence of the China shock. A standard deviation increase in imports from China raises the unemployment rate by about 0.6 percentage points when institutions are set to their average value of zero. The effect of a crisis is further reduced and remains insignificant.

We now discuss the individual interactions that we consider to be noteworthy. There are a total of 56 possible interactions (seven institutions times eight shocks) and in the table we present only those that are statistically significant using the general-to-specific approach.

The table shows a total of 14 interactions, seven with a positive sign and seven with a negative sign. Those with positive coefficients are for the interactions between the euro and the interest rate shocks, left-wing government and the Chinese import shock, hiring regulation and inflation and financial globalisation, working time and economic globalisation, and unionisation and inflation and terms of trade. Conversely, the interactions that lead to a decrease in the unemployment rate (i.e. that have a negative sign) are the following: the interaction between the euro and inflation, left-wing governments and terms of trade, working time regulation and inflation, firing regulation and economic globalisation, regulation of union activity and a decrease in TFP and interest rate shocks, and between strike regulation and inflation.

Figure 5 plots the two-way marginal effects of the significant interactions in Column 5 of Table 2. The plots have the institutional variable on the x-axis and the change in the unemployment rate on the y-axis, so that the marginal effect shows the increase in unemployment for a one standard deviation increase in the shock variable for different levels of institutions. Appendix A, Figure A6 complements these plots by showing the marginal effect of a one standard deviation increase in the institutional variable for different values of the shock variables, together with the histograms of the latter.

What can we learn from these figures? Figure 5.1 shows that euro area members are significantly more sensitive to both inflation and interest rate shocks than non-members: switching to the euro increases (decreases) the effect of an interest rate shock (inflation shock) on the unemployment rate by almost 2 percentage points.

Figure 5.2 shows that the impact of both a terms of trade shock and an increase in imports from China on the unemployment rate is more pronounced when the government is dominated by left-wing parties. A one standard deviation negative terms of trade shock increases the unemployment rate by almost 1 percentage point in the case of a left-wing dominated government (x=1). A one standard deviation shock to imports from China

increases the unemployment rate by around 2 percentage points. In both cases, these effects would be reduced to around half a percentage point in the absence of a left-wing dominated government (x=0).

Figure 5.3 shows the effect of the interaction between financial globalisation and hiring regulations on unemployment. The graph shows that a one standard deviation increase in financial globalisation is associated with a significant increase in unemployment for countries with above-average hiring regulations. For the countries with the most restrictive hiring conditions, this implies an increase in the unemployment rate of 3 percentage points. The left-hand side of Appendix A, Figure A6.6 shows that a change in hiring regulations has no significant effect for the highly globalised countries, while hiring regulations significantly reduce the unemployment rate for all other countries. Figures 5.1 and 5.3 also show that higher inflation is associated with a significant reduction in unemployment, irrespective of hiring regulations and euro area membership. Only at very low levels of working time and/or strike regulation does the impact of an inflation shock become insignificant (see Figures 5.4 and 5.7).

Figure 5.4 shows that economic globalisation significantly reduces unemployment rates when the level of working time protection is low: a one standard deviation increase in globalisation reduces unemployment by almost 4 percentage points in countries with the lowest level of this labour market institution. Figure 5.5 shows economically and statistically significant interactions with the opposite signs depending on the level of dismissal regulation. A standard deviation increase in economic globalisation reduces the unemployment rate by almost up to 5 percentage points in countries with the strictest firing regulations, while the opposite is true for the least globalised countries and those with the weakest regulations along this labour market dimension. Figure 5.6 shows, among other things, the interaction between a negative shock to TFP (i.e. a fall in TFP) and trade union regulation, indicating that such a TFP shock generally leads to higher unemployment unless this dimension of labour market

institutions is highly regulated.



(5.1) Interest rate, inflation and euro area

Figure 5: Marginal effects of shock variables conditional on the institutional environment.

(5.2) Terms of trade, imports from China and left-wing governments



### (5.3) Inflation, financial globalisation and hiring regulation



(5.5) Economic globalisation and firing regulation



### (5.4) Inflation, economic globalisation and working time regulation



(5.6) TFP decrease, interest rate, inflation, terms of trade and unionisation





#### (5.7) Inflation and strike regulation

Notes: Marginal effects corresponding to the interactions in Column 5 of Table 2, i.e. those that remain following a step-wise general-to-specific approach. The marginal effects of a shock to the variable in the title on the unemployment rate (left-hand scale) are shown, together with the corresponding 95% confidence intervals. These marginal effects are conditional on the institutional variable on the x-axis, while all other variables are held at their means. Figure A6 in Appendix A includes all margins plots for both shocks and institutions on the x-axis and shows the histograms for the variables on the x-axis.

Our baseline results support some of the findings in the previous literature, but are also somewhat at odds with others. For example, Nickell et al (2005) present econometric results suggesting that institutions matter more than shocks and also matter more than their interactions with shocks. Indeed, in their model the direct effect of labour market institutions accounts for 55% of the increase in European unemployment from 1960 to the early 1990s, while their indirect contribution, together with shocks, is found to be much smaller (see footnote 3). Figure 4 shows the results of our decomposition analysis using Shapley-Owen values. The conclusion of this analysis is quite different: focusing on our preferred specification in Column 4, we find that country-fixed effects explain a huge amount of about 46.8% of the variation in the unemployment rate, while time-fixed effects account for less than 8%. The remaining almost 30% is roughly split between institutions and shocks on the one hand and their interactions on the other, supporting the Shocking Institutions Hypothesis. In fact, the relative contribution of interactions is slightly larger than that of labour market institutions or shocks, which contrasts somewhat with the findings from Nickell et al (2005).

In order to test how sensitive our results are to the contemporaneous or further lagged

inclusion of variables in the baseline model, we apply what can be considered a form of local projection analysis, where we start by estimating a contemporaneous relationship between our explanatory variables and the unemployment rate and then increase the lag structure up to five years. In order to truly compare the results across these different specifications of the lag structure, we include all possible interactions between our institutions and the shock variables and restrict the sample to those observations that are available in each of these underlying specifications. This also allows us to examine how the relative importance of each set of variables changes over time.

Figure 6 shows the results of this analysis. The highest explanatory power is obtained with a one-year lag.<sup>14</sup> While the role of country-fixed effects remains relatively stable over time, the importance of time-fixed effects increases as the lag structure is extended. The relative importance of our institutional variables also tends to increase slightly with the length of the lag structure. The opposite is true for the shock variables; their importance decreases with longer lags. The relative importance of the interaction between labour market institutions and shocks initially increases, peaks at three years and then slowly declines. Putting this in the context of our Shocking Institutions Hypothesis, the direct impact of shocks dies out relatively quickly, depending on the set of institutions this process is delayed, and in the longer run labour market institutions themselves become more and more important.

 $<sup>^{14}</sup>$  Due to the smaller sample, the second bar (x=1) of Figure 6, which reflects one-year lags for all explanatory variables, does not correspond exactly to Column 5 of Table 2.



Figure 6: Decomposition analysis with Shapley-Owen values when varying the lag structure.

Notes: The horizontal axis indicates the years by which the explanatory variables are lagged. To ensure full comparability across the lags used, the sample is kept constant and all regressions include all potential interaction effects. Each cell contains first the share of the respective variable in explaining the overall R2 and then the share of that variable in explaining the variation in the unemployment rate. Thus, within each column, the first sums up to 100% - the second sums up to the respective R2. The second column with one lag is comparable to the specification in Column 5 of Table 5, but uses a slightly smaller sample.

### 4.2 Robustness and extensions

In this subsection, we subject our baseline results to a series of robustness tests to assess their potential sensitivity to various changes. First, we report how our results change when we follow some of the literature (e.g. Blanchard and Wolfers 2000) and use 5-year averages instead of annual data. Second, we re-evaluate our baseline results when we exclude some southern European countries that have a longer history of higher unemployment rates and that have been at the centre of the euro area crisis, namely Greece, Italy, Portugal and Spain. Third, we examine how our baseline results change when we remove the euro area and left-wing dummies from our specification. Finally, we look at possible asymmetric results between positive and negative shocks, i.e. we relax the assumption that the effects of negative and positive shocks are symmetric and investigate whether and how they vary. Let us comment on each of these issues in turn.

Table 3 shows our pooled OLS regression results for total unemployment using 5-year averages instead of the annual data we prefer (Table 2). As can be seen, our baseline results are quite robust to this change. With regard to labour market institutions, the dismissal regulations remain statistically significant. The results for our shock variables are also broadly comparable: long-term interest rates, inflation and our crisis dummy remain statistically significant. However, there are some changes in the significant interaction terms selected by the general-to-specific procedure. Nevertheless, the overall importance of the Shocking Institutions Hypothesis remains.

	(1)	(2)	(3)	(4)					(5)			
VARIABLES	CTFE	Institutions	Shocks	Both			Bo	oth + signi	ficant intera	ctions		
(1) euro area membership		0.736		0.137	0.764							
(-)		(1.131)		(0.269)	(1.597)							
(2) Left-wing-dominant government		0.220		0.0238	0.706***							
(-/		(0.672)		(0.0716)	(3.125)							
(3) LRI - Hiring (a)		-0.371		-1.211	-0.703							
		(-0.246)		(-1.220)	(-1.001)							
(4) LRI - Working time (b)		1.233		1.692	0.687							
.,		(0.585)		(1.042)	(0.599)							
(5) LRI - Firing (c)		5.597***		-3.199***	-4.808***							
		(-3.797)		(-3.951)	(-5.859)							
(6) LRI - Unionisation (d)		0.162		-0.871	2.075							
		(0.104)		(-0.465)	(1.579)							
(7) LRI - Strike (e)		4.489		2.457	2.238							
		(1.552)		(1.055)	(1.143)	Euro	Left	LRI-a	LRI-b	LRI-c	LRI-d	LRI-e
						(5.1)	(5.2)	(5.3)	(5.4)	(5.5)	(5.6)	(5.7)
Total factor productivity decrease			-0.0971	0.166	-0.365					-0.678***		
			(-0.298)	(0.610)	(-1.301)					(-2.965)		
Long-term interest rate			2.909***	2.712***	1.857***	2.361***		-1.415*			-0.644*	
			(3.783)	(3.983)	(3.380)	(3.875)		(-2.029)			(-2.012)	
Inflation (using national CPIs)			-2.248***	-2.202***	-0.699			0.985**				
			(-5.834)	(-4.111)	(-1.318)			(2.158)				
Terms of trade of goods and services			0.191	0.0572	-0.522						0.839**	
			(0.538)	(0.208)	(-1.580)						(2.137)	
KOF Eco.Glob.Index, de facto			-0.290	0.431	-2.712***					-1.860***	3.940***	
			(-0.123)	(0.206)	(-3.112)					(-3.423)	(2.806)	
KOF Fin.Glob.Index, de facto			1.315	0.698	1.714*		-0.576*		1.211***		-3.181***	
			(0.816)	(0.368)	(1.815)		(-1.793)		(3.125)		(-2.849)	
Imports from China (% of total imports)			0.564	0.210	1.226**		0.904**					0.606**
			(1.060)	(0.460)	(2.406)		(2.216)					(2.065)
Currency, sovereign debt, or banking crisis			0.678***	0.565**	0.511**						0.315**	-0.185**
			(3.037)	(2.688)	(2.412)						(2.712)	(-2.164)
R-squared	0.701	0.774	0.805	0.847				(	0.925			
Adjusted R-squared	0.604	0.682	0.722	0.767				(	0.866			
F-test LRI-Institutions		0.000		0.001				(	0.000			
F-test Shocks			0.000	0.000				(	0.001			
F-test Interactions LRI-Shocks								(	0.000			
F-test Euro area members		0.266		0.790				(	0.002			
F-test Left-wing governments		0.506		0.943				(	0.021			

Table 3: Regression results for total unemployment using 5-year averages instead of yearly data as in Table 2 above.

Notes: Robust standard errors are clustered at the country level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. p-values are shown for F-test statistics. Country- and time-fixed effects are included. Each regression contains 151 observations covering 33 countries and 7 5-year periods.

As shown in Figure 7, the results of our Shapley decomposition are still very much in line with those we had before: they still show that the country-fixed effects carry the bulk of the explanatory power both with respect to the time-fixed effects and to the other three components of the Shocking Institutions Hypothesis. There are some notable changes in the relative importance of the latter components. While in the annual data, we found that interactions explained a larger share than shocks and institutions, in the five-year framework we find that shocks are instead the most important factor (relative to interactions and institutions) (Figure 7). However, (time-varying) labour market institutions remain the least important factor in terms of overall explanatory power.

Figure 7: Shapley Own decomposition of the  $R^2$  for the regressions in the robustness check tables.



■ Country-FE ■ Time-FE ■ LRI-Institutions ■ Shocks ■ Interactions LRI-Shocks ■ Euro area members ■ Left-wing government

Notes: The first stacked bar chart repeats the decomposition of the R<sup>2</sup> of the baseline model presented in Column 5 of Table 2. The remaining five show the decomposition of the R<sup>2</sup> in the models presented as robustness checks. "All interactions" includes all potential interactions between the different institutional and shock variables (see Table A.2). In "5-year averages", the data are collapsed from an annual frequency to a 5-year frequency using averages of the respective variables (see Table 3). For "No GIPS", Greece, Italy, Portugal and Spain are excluded from the sample. In "No Euro/Left", the variables euro area membership and left-wing dominated governments are completely removed from the specification. In the "Shock asymmetry" model, we split all shock variables except the crisis dummy into positive and negative shocks.

With regard to the next three robustness checks, Figure 7 shows that this leads to

some, but often small changes in the overall decomposition of the variation in the unemployment rate explained by our model. Without the Southern European crisis countries, the relative importance of labour market institutions, our shock variables and their interaction terms increases. In particular, the country-fixed effects and the euro area dummy variable lose their impact. When the euro area dummy and the left-wing dummy are removed (but Greece, Italy, Portugal and Spain are re-entered), the shock variables and the country- and time-fixed effects become relatively more important. These changes in sample and specification have little effect on the coefficient estimates. Virtually all the coefficients we highlight in our baseline model remain statistically significant and there are minimal changes in their magnitudes.

Finally, we look at shock asymmetry, the possibility that unemployment reacts differently to positive than to negative shocks which we implement by splitting all the shock variables into two parts, thus doubling the number of shock and interaction variables. The results are somewhat different in the sense that the explained share of the variance increases (the height of the bar is greater than in the previous two) and the composition is also different, so that we must conclude that shocks seem to have asymmetric effects depending on whether they are positive or negative (i.e. above or below their standardised averages, which is zero) and that this provides strong support for the Shocking Institutions Hypothesis: the decomposition allocates almost 20% to the interactions between institutions and shocks.

### 4.3 Heterogeneity

Table 4 tests our third hypothesis that the Shocking Institutions Hypothesis holds in the presence of worker heterogeneity, namely gender differences (and age differences in Table 5). We do this using the specification in equation (4) above on annual "stacked" data starting in 1982, the first year with gender-specific unemployment rates. The first Column of Table 4 reproduces our preferred estimation equation as discussed above (i.e. Column 5 in Table 2).

Column 2 of Table 4 shows the resulting equivalent specification using the stacked data, repeating the general-to-specific approach. As mentioned above, we do not have individual worker data, so to allow for heterogeneity by gender and age we calculate unemployment rates by type of worker and "stack" the data. Thus, when we use the gender-stacked unemployment rate, we go from 728 observations in Column 1 to 1456 observations (i.e. 728 x 2 = 1456) in Column 2. Unsurprisingly, the R<sup>2</sup> drops by almost 0.1 to 0.75 from Column 1 to Column 2, reflecting that there is more variation in the dependent variable, but no change (yet) in the model to account for it.

VARIABLES	(1) Table 2	(2) baseline	(3) +female	Females	(4) Males	Difference	(a Males	5) Difference
female			1.216** (2.297)					
euro area membership	0.264	0.0686	0.0686	-0.146	0.283	-0.430	0.395	-0.654
Left_wing_dominant government	(0.371)	(0.0970)	(0.0969)	(-0.178)	(0.405)	(-1.016)	(0.558)	(-1.581) -0.00794
Len-wing-dominant government	(0.759)	(0.843)	(0.843)	(0.911)	(0.673)	(0.00612)	(0.699)	(-0.0427)
LRI - Hiring (a)	-0.860**	-0.842**	-0.842**	-0.692*	-0.991**	0.299	-0.967**	0.251
LRL - Working time (b)	(-2.119) 1.488*	(-2.206) 1 545**	(-2.206) 1 545**	(-1.701) 1 713**	(-2.380) 1 376*	(1.294)	(-2.400) 1.426*	(1.088) 0.238
	(1.969)	(2.114)	(2.113)	(2.189)	(1.725)	(0.744)	(1.735)	(0.465)
LRI - Firing (c)	-3.315***	-3.354***	-3.354***	-3.671***	-3.036***	-0.636	-2.929***	-0.849*
LRI - Unionisation (d)	0,797	0.950	0.950	1.484*	0.416	1.067*	0.508	0.884*
	(0.876)	(1.116)	(1.116)	(1.733)	(0.418)	(1.836)	(0.536)	(1.990)
LRI - Strike (e)	0.0328	-0.0472	-0.0472 (-0.0343)	0.0937	-0.188	0.282	-0.486 (-0.349)	0.878*
Total factor productivity decline	0.323*	0.334*	0.334*	0.229	0.440*	-0.211	0.409*	-0.150
T and tame interest anto	(1.766)	(1.956)	(1.955)	(1.558)	(1.894)	(-1.323)	(1.703)	(-0.790)
Long-term interest rate	(2.444)	(2.445)	(2.444)	(2.070)	(2.541)	-0.520* (-1.898)	(2.421)	-0.455***
Inflation (using national CPIs)	-1.040***	-1.050***	-1.050***	-1.150***	-0.950***	-0.201	-0.920***	-0.260
Terms of trade of woods and services	(-4.449) -0.387	(-4.595) =0.403	(-4.593) -0.403	(-4.458) =0.406	(-3.794) -0.399	(-1.083) -0.00721	(-3.483) -0.374	(-1.463)
Terms of trade of goods and services	(-1.581)	(-1.689)	(-1.688)	(-1.481)	(-1.683)	(-0.0526)	(-1.662)	(-0.459)
KOF Eco.Glob.Index, de facto	-0.967	-1.098	-1.098	-1.166	-1.031	-0.135	-1.291	0.386
KOF Fin Glob Index de facto	(-0.956) 1.814*	(-1.108) 1.826**	(-1.107) 1.826**	(-1.093) 1.770*	(-0.924) 1.883**	(-0.183) -0.113	(-1.218) 2.004**	(0.609) -0.355
	(2.032)	(2.048)	(2.047)	(1.754)	(2.064)	(-0.211)	(2.249)	(-0.600)
Imports from China (% of total imports)	0.598**	0.606***	0.606***	$0.790^{***}$	0.423	0.366*	0.561**	0.0899
Currency, sovereign debt, or banking crisis	0.369	0.335	0.335	0.0800	0.590	-0.510	0.559	-0.447
	(0.725)	(0.700)	(0.700)	(0.190)	(0.978)	(-1.605)	(0.873)	(-1.136)
EAmember x NomIntRate	2.006***	1.991*** (4 104)	1.991*** (4.102)	2.223***	1.759***	0.464	1.991*** (3.977)	
EAmember x Inflation	-1.582**	-1.597**	-1.597**	-1.352**	-1.841**	0.489*	-1.597**	
	(-2.312)	(-2.452)	(-2.452)	(-2.093)	(-2.520)	(1.704)	(-2.377)	
gov_left x 101	-0.684*** (-2.541)	-0.684*** (-2.616)	-0.684*** (-2.615)	-0.604***	-0.763***	(0,544)	-0.684**	
gov_left x shImpChina	1.462***	1.392***	1.392***	1.196**	1.588***	-0.392	1.392***	
chriri A x Inflation	(3.477) 0.388**	(3.401) 0.399**	(3.399) 0.399**	(2.091) 0.422**	(3.120) 0.377*	(-0.582) 0.0451	(3.295) 0.399**	
	(2.090)	(2.244)	(2.243)	(2.247)	(1.766)	(0.282)	(2.174)	
cbrlri_A x KOFFiGIdf	0.672*	0.696**	0.696**	0.817**	0.574	0.244	0.696**	
chrlri B x Inflation	(2.026) -0.483*	(2.197) -0.486*	(2.196) -0.486*	(2.548) -0.552**	(1.595) -0.420	(1.313)	(2.129) -0.486*	
	(-1.876)	(-1.991)	(-1.990)	(-2.472)	(-1.349)	(-0.679)	(-1.929)	
cbrlri_B x KOFEcGIdf	0.953***	1.064***	1.064***	1.376***	$0.752^{***}$	0.624	1.064***	
cbrlri_C x KOFEcGIdf	-1.796***	-1.925***	-1.925***	-2.383***	-1.467***	-0.916***	-1.621***	-0.609***
	(-4.574)	(-5.133)	(-5.131)	(-5.810)	(-3.502)	(-3.172)	(-4.277)	(-3.569)
cbrln_D x TFPgap	-0.274** (-2.101)	-0.253* (-2.022)	-0.253* (-2.022)	-0.161 (-1.264)	-0.346** (-2.455)	0.185**	-0.346** (-2.445)	0.186**
cbrlri_D x NomIntRate	-0.910***	-0.903***	-0.903***	-0.906***	-0.901***	-0.00552	-0.903***	(=1000)
abriri D y Inflation	(-3.541)	(-3.635)	(-3.633)	(-3.399)	(-3.344)	(-0.0373)	(-3.522)	
contr_D x mination	(2.387)	(2.359)	(2.359)	(2.189)	(2.173)	-0.173 (-0.860)	(2.286)	
cbrlri_D x ToT	0.591***	0.572***	0.572***	0.454*	0.690***	-0.236	0.572***	
chrlri E x Inflation	(2.882) -0 554***	(2.840) -0 514***	(2.839) -0 514***	(1.901) -0.382**	(3.368) -0.647***	(-1.533) 0.265**	(2.752) -0.634***	0 240***
	(-3.025)	(-2.938)	(-2.937)	(-2.143)	(-3.224)	(2.379)	(-3.303)	(2.765)
P squarad	0.941	0.752	0.740	0.802	0.805	0.854		0.852
Adjusted R-squared	0.818	0.736	0.753	0.866	0.776	0.834		0.832
Number of Observations	728	1456	1456	728	728	1456		1456
F-test LRI-Institutions	0.000	0.000	0.000	0.000	0.000	0.000		0.000
F-test Shocks	0.000	0.000	0.000	0.000	0.003	0.000		0.005
F-test Interactions EXT-SHOCKS	0.002	0.001	0.001	0.002	0.004	0.006		0.002
F-test Left-wing governments	0.008	0.005	0.005	0.021	0.034	0.042		0.007
F-test Gender						0.000		0.000

### Table 4: Regression results from stacked data allowing for gender differences.

Notes: Robust standard errors are clustered at the country level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. p-values are shown for F-test statistics. Country- and time-fixed effects are included and always highly significant. The observations of each regression cover 33 countries and 33 years.

There are at least two direct ways to check whether worker heterogeneity along gender lines matters in our context. One is to add a gender dummy (Column 3) and the other is to run a nested model and estimate separate coefficients for each variable and each interaction for men and women, including year and country dummies (Column 4). Column 3 shows that the unemployment rate is 1.2 percentage points higher for women than for men, controlling for the full set of variables in our baseline specification. Note that all these coefficients appear to be quite stable, as none of them changes noticeably after the introduction of the gender dummy. Including the indicator for women increases the R<sup>2</sup> by 0.016. The Shapley-Owen decomposition of Column 3 suggests that the importance of gender is limited to 2.2% of the total R<sup>2</sup>, which is a much smaller share than that attributed to any other (set of) variables or any of the fixed effects. One might be tempted to conclude that gender does not matter, but that would be premature.

Column 4 of Table 4 implements the second approach and allows for gender-specific relationships between each variable or interaction and the dependent variable, the gender-specific unemployment rate. The first thing to note is that the R<sup>2</sup> now exceeds the value reported in Column 1. As the R<sup>2</sup> results for the two gender-specific regressions show, this is largely due to the fact that our model is better able to explain the female unemployment rate than the male unemployment rate. Figure 9 compares the decomposition of each set of variables between the baseline and the different stacked models. In particular, it shows that country-fixed effects are more important in explaining differences in female than male unemployment, as are labour market institutions, shocks, and their interactions. This implies that the Shocking Institutions Hypothesis has a higher explanatory power for female than for male workers.

We now consider the role of individual shocks and institutions in explaining female and male unemployment. We first discuss those variables and interactions for which there are significant differences in the magnitude of the estimated coefficients between the sexes. These are captured by looking at the difference in the coefficients for men and women as shown in Table 4. For ease of interpretation, we apply the general-to-specific approach to the coefficients that capture the differences in the interaction effects between women and men in Column 4. These results are shown in the second sub-column of Column 5 of Table 4 and these differences between the two sexes are highlighted in Figure 8.

Both dismissal regulation and trade union regulation affect women much more than men. Dismissal regulation reduces unemployment more for women than for men, while the trade union regulation increases unemployment more for women than for men (as discussed below, the former difference is even more pronounced when interacted with the economic globalisation indicator). For men, however, the unionisation variable is not statistically significant. Regarding shocks, the occurrence of a long-term interest rate shock increases unemployment more for men than for women. We also find gender differences for the interaction between economic globalisation and institutions governing dismissals, the interaction between a TFP shock and union rules, and the interaction between an inflation shock and strike regulation. For now, we conclude that the variables correlated with female and male unemployment rates are of somewhat different importance (Figure 8).



Figure 8: Coefficient plot showing the differences in coefficient estimates across gender.

Notes: The differences in gender-specific coefficients and their 95% confidence intervals are shown. Results are equivalent to those in the last sub-column of Column 5 in Table 4. Coefficients related to sovereign debt crises are not shown.

In Table 5 we test the hypothesis that the Shocking Institution Hypothesis holds for different age groups. An important motivation for this line of investigation is the attention that has been paid to "youth unemployment" in Europe (e.g. Blanchard and Wolfers 2000). Our aim here is to compare the determinants of youth unemployment with those of the "older" population. This is done using the specification in equation (4) above on annual "stacked" data starting in 1982, the first year for which we have enough data to compute separate unemployment rates for those under and over 25 years of age. The first column in Table 5 reproduces our preferred estimation equation from above (i.e. Column 5 in Table 2).

Column 2 of Table 5 applies the same general-to-specific procedure for the interaction terms as Column 1, but now uses the stacked data for young and older workers, similar to Column 2 of Table 4. Interestingly, and very different from the gender differences, the R<sup>2</sup> halves and the selected interaction terms and coefficients we obtain after stacking the data for age are somewhat different from the "unstacked" ones. In Column 3 we add the dummy for

the unemployment rate of those under 25. Most importantly, the R<sup>2</sup> rises sharply but remains below the model fit in Column 1, and the Shapley-Owen value decomposition suggests that belonging to an age group explains more than 40% of the difference in unemployment rates (not shown).

Column 2 of Table 5 suggests that institutions related to dismissal protection remain negative and significant, but the size of their coefficient increases, while the negative coefficient on institutions related to the hiring of workers loses statistical significance. Regarding the set of shocks, we obtain more pronounced relationships between unemployment and the inflation rate, the terms of trade and financial globalisation, while the coefficient on the TFP shock becomes statistically insignificant in the stacked data. It should also be noted that most of the interaction coefficients experience a significant increase in magnitude. The only changes in statistically significant interactions are the one between hours worked and inflation and the one between trade union regulation and inflation, both of which drop out of the specification when we run the general-to-specific model selection on the stacked "age" data, while the interaction between euro area membership and Chinese imports enters the model positively and significantly.

As in our discussion of gender differentials above, there are at least two direct ways of checking whether worker heterogeneity along age lines matters in our context. One is to add an age dummy (Column 3) and the other is to run a nested model and report separate coefficients for younger and older workers (Column 4). Column 3 shows that the unemployment rate is on average almost 11 percentage points higher for younger than for older workers, controlling for the full set of variables in our baseline specification. In Column 4 of Table 5 shows the age-specific relationships between each variable, interaction or dummy variable and the unemployment rate. In the last column, Column 5, we apply the general-to-specific approach to the age group differences in the interaction terms.

VARIABLES	(1) Table 2	(2) baseline	(3) +(15-24)	15-24	(4) 25+	Difference	(25+	5) Difference
below25			10.80***					
auro area membershin	0.264	1.057	(8.902)	1 286	0.827	0.459	0 706	0.701
euro area memoersmp	(0.371)	(1.091)	(1.090)	(0.875)	(1.358)	(0.450)	(1.238)	(0.654)
Left-wing-dominant government	0.236	0.123	0.123	0.0452	0.200	-0.155	0.146	-0.0460
LRI - Hiring (a)	-0.860**	-0.738	-0.738	-0.517	-0.958**	0.441	-0.934**	0.392
LRI - Working time (b)	(-2.119) 1.488*	(-1.296) 2.391**	(-1.296) 2.391**	(-0.617) 4.171***	(-2.541) 0.611	(0.804) 3.560***	(-2.374) 0.519	(0.689) 3.743***
LRI - Firing (c)	(1.969) -3.315***	(2.436) -5.254***	(2.435) -5.254***	(2.795) -7.552***	(0.943) -2.956***	(3.307) -4.596***	(0.872) -2.847***	(3.336) -4.815***
LRI - Unionisation (d)	(-4.540) 0.797	(-4.841) 1.181	(-4.839) 1.181	(-4.619) 2.056	(-4.331) 0.306	(-4.150) 1.750	(-4.036) 0.320	(-4.645) 1.722
LRI - Strike (e)	(0.876) 0.0328	(0.870) 0.336	(0.870) 0.336	(0.971) 0.327	(0.400) 0.345	(1.174) -0.0177	(0.427) 0.207	(1.101) 0.259
Total factor productivity decline	(0.0232) 0.323*	(0.175)	(0.175)	(0.124)	(0.248)	(-0.0127)	(0.149) 0.263*	(0.192)
Long term interact rate	(1.766)	(1.441)	(1.440)	(1.247)	(1.662)	(0.911)	(1.730)	(0.828)
Long-term interest rate	(2.444)	(1.660)	(1.660)	(1.186)	(2.970)	(0.433)	(3.147)	(0.373)
Inflation (using national CPIs)	-1.040*** (-4 449)	-1.313***	-1.313*** (-3.864)	-1.593*** (-3.033)	-1.032*** (-4.397)	-0.561 (-1.372)	-1.033***	-0.560 (-1.394)
Terms of trade of goods and services	-0.387	-0.675**	-0.675**	-1.076**	-0.275	-0.802**	-0.274	-0.802*
KOF Eco.Glob.Index, de facto	(-1.581) -0.967	(-2.080) -1.800	(-2.080) -1.800	(-2.186) -2.491	(-1.146) -1.108	(-2.088) -1.382	(-1.098) -1.003	(-2.026) -1.592
KOF En Clab Index de facte	(-0.956)	(-1.122)	(-1.122)	(-0.959)	(-1.252)	(-0.688)	(-1.142)	(-0.720)
KOF Fin.Glob.Index, de facto	(2.032)	2.673* (1.983)	2.673* (1.982)	(1.532)	(2.725)	(0.782)	(2.674)	(0.629)
Imports from China (% of total imports)	0.598**	-0.157	-0.157	-0.391	0.0779	-0.469	0.112	-0.537
Currency, sovereign debt, or banking crisis	0.369	0.775	0.775	1.428	0.122	1.306**	0.0462	(-0.746) 1.458**
EAmember x NomIntRate	(0.725) 2.006***	(1.240) 3.521***	(1.240) 3.521***	(1.649) 4.938***	(0.244) 2.104***	(2.289) 2.834***	(0.0871) 2.155***	(2.510) 2.733***
EAmember x Inflation	(3.991) -1.582**	(5.170) -2.042***	(5.168) -2.042**	(5.113) -2.789**	(4.264) -1.295**	(4.704) -1.494**	(3.881) -1.207**	(4.389) -1.670**
EAmember x shImpChina	(-2.312)	(-2.739) 1.793***	(-2.738) 1.793***	(-2.540) 2.689**	(-2.577) 0.898**	(-2.047) 1.791**	(-2.417) 0.868**	(-2.322) 1.851**
gov left x ToT	-0 684**	(2.745) -1.287***	(2.744) -1 287***	(2.592) -2.352***	(2.139) -0.222	(2.183) -2.130***	(2.155) -0.216	(2.154) -2.143***
	(-2.541)	(-3.736)	(-3.735)	(-4.172)	(-1.037)	(-4.555)	(-1.010)	(-4.619)
gov_left x shImpChina	1.462*** (3.477)	2.553*** (3.940)	2.553*** (3.939)	3.598*** (3.477)	1.508*** (4.230)	2.089** (2.710)	1.478*** (4.013)	2.149*** (2.861)
cbrlri_A x Inflation	0.388**	0.835***	0.835***	1.316***	0.353**	0.963***	0.469***	0.732***
cbrlri_A x KOFFiGldf	0.672*	0.813*	0.813*	1.132	0.495*	0.637	0.813*	(2.727)
cbrlri_B x Inflation	-0,483*	(1.794)	(1.794)	(1.073)	(1.742)	(1.442)	(1.734)	
cbrlri_B x KOFEcGIdf	(-1.876) 0.953***	1.413***	1.413***	2.184***	0.642**	1.542**	0.573*	1.681***
cbrlri C x KOFEcGIdf	(3.506) -1.796***	(2.947) -2.559***	(2.946) -2.559***	(2.780) -3.792***	(2.467) -1.325***	(2.487) -2.468***	(1.918) -1.492***	(2.854) -2.132***
	(-4.574)	(-4.524)	(-4.522)	(-4.348)	(-3.876)	(-3.984)	(-3.923)	(-3.576)
cbrin_D x TFPgap	-0.274** (-2.101)	-0.337* (-1.850)	-0.337* (-1.849)	-0.446 (-1.647)	-0.229* (-1.951)	-0.217 (-1.222)	-0.337* (-1.788)	
cbrlri_D x NomIntRate	-0.910*** (-3.541)	-0.614** (-2.274)	-0.614** (-2.273)	-0.783* (-1.890)	-0.444** (-2.564)	-0.339 (-1.124)	-0.614** (-2.197)	
cbrlri_D x Inflation	0.739**	( =:=; ; ;)	( =.=,0)	(1.070)	(2.001)	(	(	
cbrlri_D x ToT	0.591***	0.839***	0.839***	1.361***	0.317	1.044***	0.257	1.164***
cbrlri E x Inflation	(2.882) -0.554***	(2.921) -0.855***	(2.920) -0.855***	(3.030) -1.110**	(1.521) -0.600***	(2.825) -0.511	(1.166) -0.587***	(3.089) -0.535*
_	(-3.025)	(-2.973)	(-2.972)	(-2.450)	(-3.644)	(-1.537)	(-3.335)	(-1.764)
R-squared	0.841	0.436	0.772	0.849	0.831	0.898		0.898
Adjusted R-squared	0.818	0.398	0.757	0.827	0.807	0.884		0.884
F-test LRI-Institutions	0.000	0.000	0.000	0.000	0.000	0.000		0.000
F-test Shocks	0.000	0.017	0.018	0.075	0.001	0.000		0.001
F-test Interactions LRI-Shocks	0.000	0.000	0.000	0.000	0.000	0.000		0.000
F-test Euro area members	0.002	0.000	0.000	0.000	0.002	0.000		0.001
F-test Left-wing governments	0.008	0.002	0.002	0.001	0.002	0.000		0.001

Table 5: Regression results allowing for age differences.

Notes: Robust standard errors are clustered at the country level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. p-values are shown for F-test statistics. Country- and time-fixed effects are included. The observations of each regression cover 33 countries and 33 years.

Figure 9: Coefficient plot showing the differences in coefficient estimates across the two age groups.



Notes: The differences in age-specific coefficients and their 95% confidence intervals are shown. Results are equivalent to those in the last sub-column of Column 5 in Table 5. Coefficients related to sovereign debt crises are not shown.

Turning to the significant differences in the coefficients for each age group, Figure 8 shows the differences in the age-specific coefficient from Column 5 of Table 5. Institutions that regulate dismissals or layoffs are clearly important across the age distribution, and yet the differences between younger and older workers are significant: a standard deviation increase in dismissal protection reduces the unemployment rate of younger workers by about 7.5 percentage points, almost 5 percentage points more than for older workers. This is evidence of the insider-outsider problem. For the 15-24 age group, working time regulations are detrimental; a one standard deviation increase increases youth unemployment by about 4 percentage points on average. The average effect for the 25+ age group is insignificant. Regarding our shock variables, we find that a terms of trade shock reduces the unemployment rate for younger workers significantly more than for older workers. We also find that younger workers suffer the most from crisis shocks. The coefficients on each of the age interactions

show that the unemployment relationship is more pronounced for younger workers than for older workers, and this difference is mostly statistically significant.

We also find that the model with age-specific interactions increases the explanatory power of the model. The Shapley-Owen decomposition also suggests that age-specific time-fixed effects are important and, in particular, that institutions and their interactions with shocks are more important in explaining unemployment for the 15-24 age group than for the 25+ but larger part of the population (Figure 9).



Figure 9: Decomposition analysis of our key equations with Shapley-Owen values.

Notes: The horizontal axis indicates to which table and column the decomposition of the  $R^2$  in the different groups refers. In case of Female/Male and Below/Above 25 the bottom part of each group refers to respectively Female or Below 25 and the upper part to respectively Male or Above 25. These second stacked bars within each model thus decompose the overall group effects into gender and age categories respectively.

In short, the main message we take from the gender and age results is that the Shocking Institutions Hypothesis holds, but it is much more complex and nuanced than previously thought. We find that only a small fraction (less than half) of the number of potential interactions we examine have some empirical support from our data. Moreover, we find that some interactions between institutions and shocks increase the unemployment rate, while others decrease it. Put differently, interactions between a given labour market institution and different types of shocks can have opposite effects on unemployment, and these effects depend on the level of institutions as well as on the type of worker.

#### 5. Concluding remarks

The aim of this paper is to revive the debate in economics on the so-called European unemployment problem, i.e. the persistence of higher unemployment rates in Europe relative to the US since the early 1980s, and to re-examine the determinants of differences in unemployment rates across OECD countries. The paper contributes in various ways. Among the proposed explanations for the persistence of the unemployment gap between Europe and the US, but also for the large heterogeneity within Europe (Nickell et al, 2005), we are particularly interested in the Shocking Institutions Hypothesis (Blanchard and Wolfers 2000), which suggests the interaction between institutions and shocks as the main explanation for the rise and persistence of higher unemployment rates in some countries. We revisit its underlying theoretical framework, which we test in an econometric model. In contrast to the previous literature, our approach takes into account time-varying labour market institutions, a large number of new and previously studied shocks (e.g. China, globalisation, Global Financial Crisis) and explicitly estimates the interactions between these two sets of variables. We also provide estimates of the quantitative importance of different sets of variables: shocks, institutions, their interactions and different sets of fixed effects.

Our main findings show that the enduring validity of the Shocking Institutions Hypothesis, which examines the interaction between shocks and labour market institutions, is more complicated and nuanced than previously recognised. It remains a valuable starting point for understanding differences in unemployment rates across OECD countries. In re-examining the stylised facts, we have also taken into account heterogeneity across countries and across different groups of workers (such as youth and gender), which has received insufficient attention in the macroeconomic literature on unemployment.

Our results confirm the importance of the Shocking Institutions Hypothesis: the combined effect of institutions, shocks and their interactions accounts for about 30% of the variation in unemployment rates across countries. However, not all interactions between shocks and institutions lead to higher unemployment, as the original Shocking Institutions Hypothesis suggests. An illustrative example is the joint effect of globalisation and hiring institutions: at low levels of regulation, a globalisation shock has no effect on unemployment, while at higher levels we observe a significant and large increase. Finally, we find that the interactions between shocks and institutions have heterogeneous effects on workers, with certain shocks disproportionately affecting men (or younger workers), while certain institutions are associated with higher employment levels for women (or older workers). Moreover, we find that the Shocking Institutions Hypothesis has higher explanatory power for female unemployment than for male unemployment.

Finally, we think it is important to highlight some general directions for future research. One is the need for greater efforts to measure changes in labour market institutions over time across countries. In this paper we focus on *de jure* measures, as de facto measures of labour market institutions are still lacking. Second, there seems to be a need for further theoretical work that can build simpler, clearer and ultimately stronger bridges between theory and the empirical testing of the Shocking Institutions Hypothesis. In particular, consideration could be given to investigating other important heterogeneities, such as differences in education and skill levels and spatial variation within countries.

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### **Appendix A: Additional results**

### Appendix figures

Figure A1: Unemployment rates from different sources for the EU, the euro area and the US.



Sources: ILO, World Bank, AMECO.











Source: AMECO.

Figure A4: Structural breaks in the coefficients of variation of unemployment rates within the EU.



Notes: The coefficient of variation is based on a definition of the EU that varies over time. Source: AMECO.

Figure A5: Female versus male unemployment rates amongst young people in the EU, euro area, and the US.



Source: World Bank.

Figure A6: Marginal effects of variables involving significant interaction effects (Column 5, Table 2).



### (A6.1) Euro membership and long-term interest rate





(A6.3) Left-wing government and terms of trade





### (A6.4) Left-wing government and import from China





### (A6.6) Regulation of hiring and financial globalisation



(A6.7) Regulation of working time and inflation







(A6.9) Regulation of firing and economic globalisation









### (A6.11) Regulation of unionisation and the long-term interest rate

















Notes: The marginal effects of a shock to the variable in the title on the unemployment rate (left-hand scale) are shown, together with the corresponding 95% confidence intervals. These marginal effects are conditional on the variable on the x-axis, while all other variables are held at their means. The histogram for the variable on the x-axis is also shown (right-hand axis).

### Appendix table

Table A1: Countries and years in the estimation sample.

Country	Nr. of years	Start sample	End Sample	Year 1	Nr. of countries
Austria	33	1982	2014	1982	8
Belgium	17	1998	2014	1983	13
Bulgaria	12	2003	2014	1984	13
Canada	25	1987	2011	1985	13
Croatia	8	2007	2014	1986	15
Cyprus	16	1999	2014	1987	17
Czech Republic	13	2002	2014	1988	16
Denmark	32	1983	2014	1989	17
Estonia	13	1999	2011	1990	13
Finland	26	1982	2014	1991	13
France	32	1983	2014	1992	13
Germany	32	1983	2014	1993	15
Greece	30	1982	2014	1994	15
Hungary	15	2000	2014	1995	18
Iceland	11	2004	2014	1996	18
Ireland	32	1983	2014	1997	18
Italy	33	1982	2014	1998	20
Japan	33	1982	2014	1999	22
Latvia	13	2002	2014	2000	24
Lithuania	13	2002	2014	2001	24
Luxembourg	16	1998	2014	2002	28
Netherlands	30	1983	2014	2003	30
Norway	21	1986	2011	2004	31
Poland	15	2000	2014	2005	31
Portugal	29	1986	2014	2006	31
Romania	8	2007	2014	2007	33
Slovak Republic	14	2001	2014	2008	33
Slovenia	12	2003	2014	2009	33
Spain	33	1982	2014	2010	33
Sweden	27	1982	2014	2011	33
Switzerland	19	1993	2011	2012	29
United Kingdom	32	1983	2014	2013	29
United States	33	1982	2014	2014	29
Total	728				728

Notes: This table lists all countries and years that are used in Table 2.

-		(1)										
_	VARIABLES		Both + all interactions									
(1)	euro area membership	0.250										
		(0.278)										
(2)	Left-wing-dominant government	0.272										
		(0.876)										
(3)	LRI - Hiring (a)	-0.794*										
		(-1.700)										
(4)	LRI - Working time (b)	0.928										
		(0.941)										
(5)	LRI - Firing (c)	-3.122***										
		(-3.516)										
(6)	LRI - Unionisation (d)	0.908										
		(0.794)										
(7)	LRI - Strike (e)	0.465										
		(0.338)	Euro	Left	LRI-a	LRI-b	LRI-c	LRI-d	LRI-e			
			(1.1)	(1.2)	(1.3)	(1.4)	(1.5)	(1.6)	(1.7)			
	Total factor productivity decrease	0.184	0.0166	0.148	0.00105	-0.0719	0.0128	-0.210	-0.127			
		(0.981)	(0.0529)	(0.616)	(0.00516)	(-0.457)	(0.0687)	(-1.532)	(-1.099)			
	Long-term interest rate	1.820***	2.328**	-0.306	0.0625	0.153	0.759	-1.027*	-0.258			
		(3.383)	(2.357)	(-0.612)	(0.139)	(0.276)	(1.038)	(-1.731)	(-0.381)			
	Inflation (using national CPIs)	-1.040***	-1.565*	-0.0357	0.234	-0.532	-0.304	0.922**	-0.466			
		(-3.655)	(-1.762)	(-0.0793)	(0.873)	(-1.692)	(-0.792)	(2.510)	(-1.146)			
	Terms of trade of goods and services	-0.575	-0.168	-0.632*	-0.258	0.301	-0.325	0.578	0.392			
		(-1.536)	(-0.277)	(-1.964)	(-0.658)	(0.908)	(-0.924)	(1.460)	(1.145)			
	KOF Eco.Glob.Index, de facto	-3.134**	1.434	-0.595	-0.666	0.817	-2.561	0.863	1.052			
		(-2.280)	(0.951)	(-0.734)	(-0.673)	(0.672)	(-1.589)	(0.649)	(0.767)			
	KOF Fin.Glob.Index, de facto	3.682***	-2.178	-0.135	1.360	0.471	0.973	-0.698	-0.849			
		(3.407)	(-1.429)	(-0.152)	(1.496)	(0.715)	(0.646)	(-0.742)	(-0.774)			
	Imports from China (% of total imports)	-0.405	1.274	2.042**	0.0888	-0.330	-0.217	0.206	0.0181			
		(-0.555)	(1.340)	(2.542)	(0.148)	(-0.453)	(-0.241)	(0.580)	(0.0281)			
	Currency, sovereign debt, or banking crisis	0.768	-1.272	0.104	-0.0195	-0.405	0.596	-0.319	0.257			
		(0.995)	(-0.838)	(0.140)	(-0.0190)	(-0.881)	(0.488)	(-0.683)	(0.470)			
	R-squared				0.852	2						
	Adjusted R-squared				0.819	9						
	F-test LRI-Institutions				0.00	l						
	F-test Shocks				0.00	1						
	F-test Interactions LRI-Shocks				0.000	)						
	F-test Euro area members				0.036	5						
	F-test Left-wing governments				0.18	5						

### Table A.2: Regression results for total unemployment using all possible interactions.

Notes: Standard errors are clustered at the country level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. p-values are shown for F-test statistics. Country- and period-fixed effects are always included and highly significant. Each regression is based on 728 observations covering 33 countries over 33 years.

### **Appendix B: A brief review of the literature**

There is a large menu of explanations for the gap in unemployment rates between Europe and the US since 1980 (see Saint-Paul 2002 for a survey). The first theoretical explanations for the rise in European unemployment emphasised the role of shocks, in particular the oil shocks of 1973 and 1979 and the associated productivity shock. As US rates fell much faster than European rates after these shocks, theoretical explanations began to focus on deeper differentiating features of European labour markets, with the role of employment protection, unemployment insurance, and collective bargaining being prominent aspects. In such frameworks, shocks explain the sudden rise in unemployment rates in Europe especially after 1980 and in subsequent crises and labour market institutions explain their higher level and their slower speed of adjustment back to pre-crisis employment levels after macroeconomic shocks.

The literature on the differential impact of shocks on different types of workers is mostly microeconomic in nature. Using a theoretical model and empirical evidence from Brazil, Chauvin (2018) shows that local labour demand shocks can lead to different outcomes depending on whether they favour male or female employment. For the Peruvian context, Mansour et al (2022) find that the negative effects of import competition were persistent for women but not for men. They conclude that shocks interacting with occupational and industrial segregation can lead to a widening of the gender gap in employment. Similarly, Góes et al (2023) show for Tunisia that external demand shocks were relatively larger in male-intensive sectors and led to a decline in the female to male employment ratio. High-quality evidence on the group of workers most affected by shocks also comes from various Covid-19 surveys. For example, Crossley et al (2021) find for the United Kingdom (UK) that those in precarious employment, under 30 years of age and from ethnic minority groups experienced the largest labour market shocks.

Among the institutional explanations for differences in unemployment rates across countries, ideology and specific labour market institutions such as employment protection figure prominently in the literature. When we use the term labour market institutions and later test for empirical relationships, we do not forget Nickell's (1997) arguments for a nuanced understanding of labour market institutions. Many labour market institutions should not be seen as rigidities. They often have no observable effect on unemployment and may be put in place for other purposes. In this context, Brancaccio et al (2020) describe the evolution of the literature from a consensus view on the negative impact of labour market institutions on unemployment (especially after shocks) to weaker and less general statements. Their meta-analysis of 53 papers using the OECD's popular Employment Protection Legislation (EPL) index, published between 1990 and 2019, suggests that a minority of papers, regardless of method, journal or number of citations, support the once dominant view that labour market institutions harm labour market performance. Using a different review approach, Perone (2022) provides a paper-by-paper comparison of the results in the literature. There is also a large microeconomic literature on reforms of labour market institutions, which we cannot cover here. Our review focuses on macroeconomic studies, especially those dealing with worker heterogeneity.

The first labour market institution where there are notable differences between Europe and the US is the power of trade unions and the role of collective bargaining in setting wages. The effect of these institutions on employment tends to be more pronounced during recessions. Bertola et al (2023) examine the empirical impact of union involvement in wage setting on participation rates by age and gender. Using data from 17 OECD countries over the period 1960-1996 in a general least squares framework, they find that greater union involvement in wage setting increases female unemployment significantly more than male unemployment.

Unemployment insurance is a second prominent labour market institution. According

to theory, the optimal level of unemployment benefits depends on the trade-off between the incentive to search for work and the fiscal externalities associated with unemployment insurance. Ljungqvist and Sargent (2007, 2008) study the effects of public benefits (unemployment insurance and employment protection) on unemployment for workers with different skill levels when the "state of the world" changes. Ljungqvist and Sargent (2007), propose a model in which workers' skill levels (another important dimension of worker heterogeneity), public benefits (unemployment insurance and employment protection) and turbulence in the sense of skill transition probabilities can interact to generate high unemployment rates and durations. Tatsiramos (2009) provides microeconomic evidence from the European Community Household Panel that suggests a more ambiguous effect of unemployment, he also finds positive matching effects: unemployment insurance increases employment stability, especially in countries with relatively generous benefit systems and for the long-term unemployed. A more recent literature considers the optimal design of benefits over the business cycle (see Jimeno and Boeri 2016).

The literature on a third type of labour market institution, the regulation of different forms of employment (permanent vs. temporary), has identified effects on employment, wages, labour turnover, and productivity (for surveys, see Boeri 2011 and <u>Bentolila, Dolado</u> and Jimeno 2012a). <u>Bentolila et al (2012b</u>) compare the employment adjustment in France and Spain during the Great Recession and conclude that the differential increase in the unemployment between the two countries was partly due to the fact that the difference in dismissal costs between permanent and temporary contracts was larger in Spain than in France, and that the rules on the use of the temporary contracts were less restrictive in Spain.

Nickell et al (2005) dispute the role of Shocking Institutions as proposed in Blanchard and Wolfers (2000). Using data from 20 OECD countries for 1966-1995 and generalised least squares with time-varying labour market institutions, country-specific trends and time- and country-fixed effects, they find that labour market institutions can explain the general pattern of unemployment across OECD countries while shocks (measured by time dummies) have no significant explanatory power. More recently, Boeri and Jimeno (2016) show that for the Great Recession and the euro area debt crisis, differences in the intensity and nature of shocks (real vs. financial) across countries are insufficient to explain the divergence in unemployment patterns across countries. They document an increasing divergence in unemployment rates within Europe and across age groups since the mid-2000s. They argue that these differences can be explained by an interaction between the magnitude and nature of the shocks and labour market institutions, namely bargaining structures and labour market segmentation between temporary and permanent contracts, which condition firms' adjustment to these shocks. They find that youth unemployment is a key driver of the divergence in European unemployment across countries, with an increasing share of the dispersion being explained by differences between countries rather than between regions within countries.

After reviewing more than 150 studies on the impact of four types of labour market institutions (minimum wages, employment protection, unions and collective bargaining, and mandated benefits) on different outcomes (employment and earnings effects, productivity, and social cohesion), Betcherman (2012) concludes that, in most cases, the impact of these institutions is smaller than the intense (policy) debates would suggest. While the results on the efficiency effects of labour market regulation and collective bargaining tend to be modest and ambiguous in their direction, the distributional effects are clearer. While covered workers tend to experience equalising effects, while groups such as youth, women, and the less skilled are outsiders to its benefits.

As mentioned above, Blanchard and Summers (1986) and Blanchard and Wolfers (2000) argue that differences in unemployment rates can be explained by the interaction between shocks and labour market institutions. Blanchard and Wolfers (2000) test this hypothesis empirically using non-linear regression models for a sample of 15 countries over the period 1960-1996. They construct five-year averages of all variables to focus on long-run effects. They include interactions between time-invariant institutional variables and shocks that include the level of TFP growth, the real interest rate, the change in inflation and shifts in labour demand. In another model, Blanchard and Wolfers replace their shock variables with time dummies to capture unobserved common shocks and again interact them with time-invariant institutions. This greatly increases the explanatory power of the model. Bertola et al (2001a) build on this model and find that while macroeconomic and demographic shocks and changing labour market institutions explain a modest part of the decline in US unemployment between 1960 and 1990, the interaction of these shocks and labour market institutions explains most of the change. Using a panel of 20 OECD countries over the period 1960-96, they show that this high employment is associated with low wage levels and high wage inequality. These findings suggest that more flexible labour market institutions, such as in the US, have allowed shocks to affect real and relative wages more than elsewhere and partly explain the decrease in US unemployment. A similar argument and result is also presented in Adsera and Boix (2000). Bertola et al (2023) analyse the impact of labour market institutions on the relative employment of young people, women, and older people in a sample of 17 OECD countries over the period 1960-1996. Most relevant to our study, they find that more powerful unions do not affect the gender wage gap, but increase female unemployment relative to male unemployment.

Jimeno and Rodriguez-Palenzuela (2002) study youth unemployment rates using a panel of 19 OECD countries for the period 1968-1996 with the difference between the gender-specific unemployment rate of those aged 14-25 and those aged 25-54 as the dependent variable. They find a significant and positive relationship between the unemployment gap and the relative size of the youth population. Their subsequent analysis follows the setup of Blanchard and Wolfers and includes shocks and time-invariant institutions, running regressions with annual data as well as five-year period averages. They find that higher replacement rates and longer duration of unemployment benefits reduce the youth unemployment gap, while minimum wages and higher incidence of unions and collective bargaining increase it. Strict regulation of temporary contracts does not seem to be associated with differences in youth unemployment. Finally, they conclude that the adjustment to macroeconomic shocks has affected young workers more than adult workers.

The persistence of unemployment (or so-called hysteresis as in Blanchard and Summers 1986) was coming to an end when these prominent papers were written. Similarly, the data in other important papers (e.g. Nickell et al 2005, Bassanini and Duval 2006) also end in the early 2000s. In the run-up to and early stages of the Economic and Monetary Union, unemployment rates started to fall and converge until the Great Recession and the European debt crisis, which caused them to rise and diverge. Bertola (2017) replicates the original model for 20 countries over the period 1960-2014 and finds that the original specification does not fit these data. In additional analyses, he finds that capital flows and international economic integration are crucial for understanding recent changes in unemployment rates in Europe and elsewhere.

In summary, this broad review of a large literature has shown that the empirical test of the Shocking Institutions Hypothesis needs to be updated in terms of data, time-varying institutional variables and measures of recent shocks, mainly due to globalisation. With regard to worker heterogeneity, we have highlighted some interesting results on differential outcomes, but we are not aware of a comprehensive analysis that takes into account gender and youth as well as different types of labour market institutions.

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