Calmfors and Driffill Revisited: Analysis of European Institutional and Macroeconomic Heterogeneity

Thomas Pastore

Aizhan Shorman

ABOUT THE AUTHOR

Thomas Pastore École Normale Supérieure, Paris
Email Address: thomas.pastore@ens.fr

Aizhan Shorman Sciences Po et École Normale Supérieure, Paris
Email Address: aizhan.shorman@sciencespo.fr

ABSTRACT

The European labor market incorporates a great variety of institutional frameworks and divergent macroeconomic performances. The hump-shaped curve hypothesis of Calmfors and Driffill is interesting in its linkage of centralization of wage bargaining processes to real wages and unemployment. From the ICTWSS and OECD databases, we identify three labor market profiles according to their degrees of centralization (decentralized, centralized and intermediate). We aggregate the main institutional components of the dispersion of countries into a centralization indicator on which we regress real wages and unemployment rate. The hump-shaped relationship that results from our analyses is robust and pertinent to country trajectories over the years, especially to German decentralization. The poor macroeconomic performance of some European countries after the 2008 financial shock appears to be linked to the countries' consistent intermediate levels of centralization that result in a manifestation of the negative effects of both centralized and decentralized models.

KEY WORDS

Calmfors, Driffill, courbe en cloche, centralisation, performance macroéconomique, Allemagne, décentralisation, marché du travail

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1 Introduction

The European labor market is characterized by a great divergence both at the economic and institutional levels. After Reunification, Germany initiated a massive move toward decentralization, which was propelled even further by the Hartz reforms (2003-2005). Germany's policies allowed the country to reinvent itself: from being "the sick man of Europe" to the economic engine of the EU. In contrast, an extraordinarily high unemployment rate and strongly regulated centralized and indexed to inflation wages characterize the Spanish labor market. All European countries have experienced the Great Recession differently, suggesting that the impact of the shock is conditional on the institutional parameters of the labor markets, and thus, produces different economic results. The global financial crisis seems to have served not only as an economic divergent but also as a reinforcing factor of institutional change toward more market flexibility.

Often in their fruitless attempts to curb unemployment, rigid economic policies receive the blame for lack of salary adjustment and accelerated inflation. The supporters of flexible labor markets argue that the most decentralized wage bargaining policies, which allow negotiations to take place at the company-level, lead to the best results since companies can rapidly adjust to *ad hoc* financial shocks. However, from a more impartial point of view, it is important to note that Scandinavian countries, despite their high levels of union density and centralized wage bargaining, maintain a low level of unemployment (4% in the first half of 2008). How, then, does centralization affect economic performance?

Calmfors and Driffill respond with their hump-shaped hypothesis: centralization and macroe-conomic performance form a hump-shaped curve. The hypothesis states that countries most centralized and decentralized experience analogous economic performance, the intermediary countries suffer from an elevated unemployment rate, due to the accumulated disadvantages from both the centralized and decentralized models between which the intermediary countries fail to choose either. Our working hypothesis is that the 2008 crisis has had a polarizing ef-fect on the countries placed along the hump-shaped curve of Calmfors and Driffill. Over the years, countries that were initially on the left-side of the curve, decentralized, and therefore, descended further to the left. Countries initially on the right either descended more to the right or remained at the same location on the curve with the passage of time.

Using panel data over a period of 20 years we tested our hypothesis in the context of the Great Recession, and conducted a principal component analysis (PCA), identifying the major institutional characteristics of the dispersion among the countries. We then developed a fixed effects model and regressed the real wage and the unemployment rate on the first principal component of the PCA. Thus, we were able to analyze the relevance and applicability of the Calmfors-Driffill hypothesis to the economic performance of countries before and after the 2008 crisis. The before and after-crisis comparison in this theoretical framework allowed us to understand the European labor market at a more profound level.

Our analysis was carried out in two stages: 1) a statistical description of the labor market categorized into three distinct groupings of countries based on their levels of centralization (centralized, decentralized and intermediate); 2) a dynamic comparison of countries' trajectories from 1993 to 2014 highlighting a strong correlation between levels of centralization and the unemployment rate.

Our results show that from the 1990s, decentralization and de-unionization have become common phenomena in Europe, with the exception of Italy. We argue that the data does not reject the Calmfors-Driffill hypothesis, and in fact, the 2008 crisis renders the hypothesis evermore pertinent. Our hump-shaped curve accurately describes most of the trajectories of European countries, and it delineates especially well Germany's move, over the years, toward a more Anglo-Saxon model. Overall, the hump-shaped curve represents well the relationship of unemployment and centralization over time.

The paper is structured by the following sections: a discussion of the current literature on labor markets, decentralization, and macroeconomics, our contribution to the existent body of literature; a statistical description of the data and our methodology; the results we have obtained from our principal component analysis and the fixed effects models; an analysis of the implications and general trends in our findings as well as outstanding cases such as Germany and Italy.

2   Literature review

There is an extensive body of literature on centralization and labor markets; however, not much of it applies the Calmfors-Driffill hypothesis to existent data including the time period before and after the financial crisis of 2008. For instance, Oswald uses a microeconomic perspective for his

models of labor market institutions' effects on the unemployment rate. He compares the results of the *monopoly-union* model, where unions negotiate their salaries leading to an increase in unemployment, with that of *efficient bargain*, where unions negotiate their salaries but take into consideration salaries and employment-to-population ratios, and therefore, do not increase the unemployment rate.[1] Oswald's two models, relying on two different assumptions, lead to two opposite results, on which Pencavel further elaborates with a macroeconomic approach.

Pencavel, in his works, illustrates the theoretical ambivalence of whether or not unions take into consideration the employment-to-population ratio when participating in wage negotiations through a distinction of three profiles of the labor market. Firstly, Pencavel identifies, what we call in our paper, intermediary economies where the nonunion sector is small with a mix of industry-wide bargaining and company-level bargaining; secondly, there are highly decentralized countries with a large nonunion sector; thirdly, highly centralized countries where all wages are influenced by national agreements between coalitions of unions and coalitions of employers; the profiles correspond respectively to countries of continental Europe, Anglo-Saxon countries, and Nordic countries.[2]

In our paper, we highlight the strong correlations between these three profiles of the labor market and their unemployment rates as has been theorized by Calmfors and Driffill. Solow, however, has disputed the positive correlation between the rate of unionization and that of unemployment in his *insiders-outsiders* model, which demonstrates the need for a large number of non-unionized workers for *insiders* to benefit from the power derived from their exclusivity.[3]

In line with the preceding works, the ingenious article of Calmfors and Driffill (1988) synthesizes and promotes the ideas of both the proponents of decentralization and the defenders of centralization. The authors postulate the existence of a concave non-monotonic relationship between centralization (abscissa) and real wages (ordinate), with a high real wage resulting in a mediocre macroeconomic performance. Calmfors and Driffill inspired an abundance of literature on the validity of the hump-shaped relation and the relationship between institutional *inputs* and macroeconomic *outputs*. Although some economists propose alternative models and criticize the empirical simplicity, the Calmfors and Driffill model provides a valuable framework for coherent

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[1]Andrew J. Oswald. "The Economic Theory of Trade Unions: An Introductory Survey". In: *The Scandinavian Journal of Economics* 87.2 (1985), pp. 160–193.

[2]John Pencavel. "Wages and Employment under Trade Unionism: Microeconomic Models and Macroeconomic Applications". In: *The Scandinavian Journal of Economics* 87.2 (1985), pp. 197–225.

[3]Robert M. Solow. "Insiders and Outsiders in Wage Determination". In: *The Scandinavian Journal of Economics* 87.2 (1985), pp. 411–428.

theoretical analysis.[4] The endogeneity in the plurality of channels by which centralization, still an ambiguous concept, affects real wages and macroeconomic performance necessitates a more detailed analysis of the hump-shaped relationship proposed in 1988 by Calmfors and Driffill.[5]

Our project applies the theory to data adding a real-life dimension to the authors' hypothesized relationship. The initial model of Calmfors and Driffill is limited by its assumptions: a constant supply of fixed capital, unionization of all employees and nonexistence of intermediate goods, which viable only in closed economies. The authors also suppose that as aggregate demand increases, the goods become less substitutable. The theoretical model summarizes a relationship between macroeconomic performance and centralization in a hump-shaped concave curve, favoring two extremes and disfavoring the intermediate position, characterized by negative aspects of both a decentralized labor economy (i.e. lack of employment protection) and of a centralized economy (i.e. lack of flexibility during financial shocks). The hump-shaped relation could be a result of two opposing dynamics: the market effect and the price effect (i.e. augmentation of nominal salaries on the one hand and an inflationary effect on the other); the relative strength of the two effects could determine their influence on real wages.[6]

A subsequent empirical study of Calmfors (1993) reveals that the negative effect of unionization on employment depends on cooperation and government intervention. If there is horizontal cooperation, then the negative effect is reversed, but if the government extends collective bargaining agreements to initial non-signatory actors, then it is amplified. The literature following Calmfors' article shifts its focus from institutional factors to levels of coordination among actors and levels of centralization in wage bargaining processes (i.e. the level, such as firm, industry, or country, at which wage bargaining takes place). Incorporation of institutions in macroeconomic analysis once again was divided between the centralized and decentralized camps. For instance, Nickell and Layard (1999) argue that the effect of unionization on un-

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[4]R.E. Rowthorn. "Centralization, Employment and Wage Dispersion". In: *The Economic Journal* 102 (1992): the author confirms the hypothesis of Calmfors and Driffill for the 1980s but rejects it for the 1970s; J. Flanagan. "Macroeconomic Perfomance and Collective Bargaining: An International Perspective". In: *Journal of Economic Literature* 37 (1999), pp. 1150–1175: the author points out the empirical vulnerability of the hypothesis basing his critique on an OECD study in 1990 that did not find any valid support or justification for the hypothesis of Calmfors and Driffill; David Soskice. "Reinterpreting Corporatism and Explaining Unemployment: Coordinated and Non-coordinated Market Economies". In: *Labour Relations and Economic Performance*. 1990, pp. 170–211: the author considers the hump-shaped relation biased due to the inclusion of data from Japan and Switzerland, countries which obscure a linear relationship; Stefano Scarpetta. "Assessing the Role of Labour Market Policies and Institutional Settings on Unemployment: A cross-country study". In: *OECD Economic Studies* 26 (1996): the author finds the relationship between unemployment and centralization to be non-monotonic.

[5]Robert Boyer. *Contemporary capitalism: the embeddedness of institutions*. Cambridge University Press, 1997.

[6]John Driffill. "The Centralization of Wage Bargaining Revisited: What Have We Learnt?" In: *Journal of Common Market Studies* 44.4 (2006), pp. 731–756.

employment is conditional on the existence of solid cooperation at a centralized level, which negates the negative impact of unions on employment.[7] Meanwhile, Dustman et al. (2014) credit the institutions of the labor market, massive decentralization, and de-unionization for the German resurgence.[8] The three aforementioned forces having curtailed increases in union wages over the period 1990-2014 explain the German miracle in the Great Recession. Therefore, as Blanchard and Wolfers (2000) argue, it is less the shock itself or the institutional rigidness but the interaction of these two variables that is endowed with the most heuristic power, conditional on the impact of the shock and its *ex post* persistence.[9] Hence, it is important to highlight the principal institutional channels, which determine levels of centralization and explain the heterogeneity among European countries in their macroeconomic performances.

3 Institutional heterogeneity and macroeconomic performance

3.1 Data

The data in our descriptive statistics and regressions mostly comes from the ICTWSS database, which details the characteristics of the labor market for 51 countries and covers the time period from 1960 to 2015.[10] The *Industrial Relations in Europe* 2014 report has used the ICTWSS database as well since it assembles 249 variables descriptive of the labor markets resulting in 2806 observations. We have further extended the database manually with specific economic variables (real productivity per person, evolution of the real minimum wage between each year, the average inflation in PPP, the unemployment rate and the unit labor cost) mostly from the OECD and Eurostat databases.[11]

The principal setback of the database is that it quantifies centralization, coordination, and level of wage bargaining with nebulous indicators that vary little over time. These statistics,

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[7]Stephen Nickell and Richard Layard. "Labor market institutions and economic performance". In: *Handbook of Labor Economics*. Ed. by O. Ashenfelter D. Card. Vol. 3. 1999. Chap. 46, pp. 3029–3084.

[8]Christian Dustmann et al. "From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy". In: *Journal of Economic Perspectives* 28.1 (2014), pp. 167–188.

[9]Olivier Blanchard and Justin Wolfers. "The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence". In: *The Economic Journal* 110 (2000), pp. 1–33.

[10]J. Visser. *ICTWSS Database*. Version 5.1. Amsterdam Institute for Advanced Labour Studies (AIAS), University of Amsterdam, 2016.

[11]The variables added: real productivity per person and per hour; evolution of the real minimum wage between t and $t-1$, t standing for one year; the average annual with current and constant prices (national currency, PPP, and US dollar exchange rate); rate of inflation as a percentage of variation of *Consumer Price Index*; labor compensation per hour worked including incluant les charges; the nominal and real unit labor cost; the unemployment rate; the Gini coefficient. All of the data added is yearly.

however, allow to draw out the major patterns, which have shown themselves as consistent with current literature.[12]

In order to overcome the lack of variance in indices of centralization and coordination over time, we chose to focus mainly on continuous variables as opposed to the discrete ones, which often remained stable throughout decades. For example, continuous variables include union density rate and the bargaining coverage rate expressed in percentages of the total working-age population. Union density rate is defined as net union membership as a proportion of the wage earning population; the bargaining coverage rate refers to the proportion of the number of employee covered by collective agreements from the total population of all wage earners. We have also included the extension of the coverage rate in our analysis (i.e. application of the collective agreement coverage to non-signatories implemented by government agencies).

The majority of our graphics provide an illustration of the general institutional and economic trends and correlations on the labor market for a number of countries from 1993 to 2014, depending on the data available. The time interval (1993-2014) begins a few years following the publication of the Calmfors-Driffill hypothesis and ends post 2008, allowing for an analysis of the financial crisis in a long-term perspective taking into account the formation of the European Union.

To facilitate the reading, see below the table summarizing definitions of the principal variables used in our paper.[13]

Variable	Definition	Unit of measurement
ud	union density rate	a proportion of wage and salary earners in employment
adjcov	adjusted bargaining (or union) coverage rate	a proportion of all wage and salary earners in employment
ext	mandatory extension of collective agreements to non-organized employers	from 0 (none) to 3 (virtually automatic)
U	unemployment rate	percentage of the working-age population

[12]See: Lars Calmfors. "Centralisation of Wage Bargaining and Macroeconomic Performance : A Survey". In: *Documents de travail du Département des Affaires économiques de l'OCDE* 131 (1993): Calmfors distinguishes three profiles corresponding to the countries we chose in our research; Barbara Bechter and Bernd Brandl. "Developments in European industrial relations". In: *Industrial relations in Europe*. Ed. by Social Affairs Commission's Employment and Inclusion DG. 8th. Rapport au Parlement européen, 2015. ISBN: 9789279409462; Roberto Pedersini. "The Evolution of the Crisis - Developments in Wage Bargaining Systems". In: *Industrial relations in Europe*. Ed. by Social Affairs Commission's Employment and Inclusion DG. 8th. Rapport au Parlement européen, 2015. ISBN: 978-92-79-40946-2.

[13]For *ext* (mandatory extension of collective agreements to non-organized employers):

- 0: there are neither legal provisions for mandatory extension, nor is there a functional equivalent

- 1: extension is rather exceptional, used in some industries only, because of absence of sector agreements, very high thresholds (super-majorities of 60% or more, public policy criteria, etc.), and/or resistance of employers

- 2: extension is used in many industries, but there are thresholds and Ministers can (and sometimes do)

- 3: extension is virtually automatic and more or less general (including enlargement).

3.2 Three profiles of the labor market

The encompassing time-frame of the database allows us to create three different country profiles in correspondence with the indices of centralization and coordination in the wage bargaining processes: the de-centralized Anglo-Saxon countries (Canada, the US, New Zealand, the UK), the very centralized Nordic countries (Denmark, Finland, Norway, and Sweden), and the "Big Four" (Germany, France, Spain, and Italy), the four countries with the highest GDP in the EU. The three-profile categorization is nothing artificial: firstly, there is geographic coherence - the first group has strong historical cultural and linguistic ties, the second group consists of Scandinavian countries, and the third group consists of four neighboring EU member countries; secondly, there is extensive literature supporting the three-group categorization;[14] lastly, the categories correspond to three distinct levels of centralization, which are all congruent within each grouping. If Germany gravitates toward the Anglo-Saxon countries in terms of centralization, the country's divergence from the other three members of the Big Four is a phenomenon in itself that merits an *a posteriori* justification. Since our database consists of multiple decades, we are able to observe the temporal evolution of Germany.[15] Figure 1 clearly demonstrates the categorical divisions identified.

The graphic illustrates three profiles: firstly, the decentralized Anglo-Saxon countries with a low union density rate and a low coverage rate; following are the Nordic countries, the most centralized, with a high union density rate and coverage rate; lastly, it is the Big Four, historically less unionized than the Nordic countries, but paradoxically characterized by an elevated coverage rate, suggesting that the wage bargaining agreements do not constitute the result of union negotiations but rather embody decisions made by governments at the national level. State-level universal coverage is highly implausible in decentralized Anglo-Saxon countries.[16]

[14]Pencavel, "Wages and Employment under Trade Unionism: Microeconomic Models and Macroeconomic Applications": see the introduction. Also, see: José Ramón García and Valeri Sorolla. "The Calmfors-Driffill Hypothesis with Labour Market Frictions and Regulated Goods Markets". In: *Barcelona Graduate School of Economics Working Paper* 889 (2016): the authors not only distinguish three groups of countries (ANGLO, EUCON, and NORDIC), which are very similar to our three profiles, but also validate the Calmfors and Driffill hypothesis using an index of centralization and unemployment rate.

[15]Antje Kurdelbusch. "Multinationals and the Rise of Variable Pay in Germany". In: *European Journal of Industrial Relations* 8.3 (2002), pp. 325–449: the author believes that the flexibility of the labor market pulls Germany toward the Anglo-Saxon model; Niels-Erik Wergin-Cheek. "Collective bargaining has been decentralized in the UK and Germany over the past three decades. But in Germany, unions have retained much more power". 2012. URL: http://blogs.lse.ac.uk/europpblog/2012/04/12/germany-uk-unions/: the author compares the decentralization *trend* of Germany to that of the UK; while interesting, we do not agree with a claim made by the author that Germany's union density rate has remained strong and stable as our database shows the contrary(cf *infra*) and as has been shown by Dustmann in: Dustmann et al., "From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy".

[16]Anne Dufresne and Nicole Maggi-Germain. "Zwischen Staatsinterventionismus und Tarifautonomie: Die Allge-
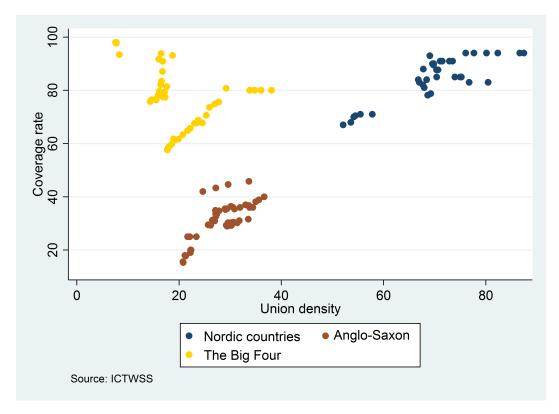
FIGURE 1: THREE PROFILES OF THE LABOR MARKET

3.3 Methods

Firstly, we performed a principal component analysis (PCA) to identify the most important determinants of the dispersion of the countries. Active variables include adjusted bargaining coverage rate ($adjcov$), mandatory extension of collective agreements to non-organized employers (ext), and union density rate (ud). PCA condenses the information in correlated variables and highlights the most distinct parts of the data rendering it especially useful in our project since our data is highly correlated as is shown in Figure 5. Having identified the two principal components, we later use them in our two distinct fixed effects models.

We took a sample with as many observations of different countries as was possible within the limits of internal and external validity of the chosen model. The observations ranged from 1960-2014 and comprised of the following 15 countries: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Slovenia, Spain, Sweden, the UK, and the US. Although there are certain specificities within the countries, the fixed effects model allows us to not only retain countries such as Japan in the

meinverbindlicherklärung von Tarifverträgen in Frankreich". In: *Stabilisierung des Flächentarifvertrages. Reform der Allgemeinverbindlicherklärung*. Revue WSI-Mitteilungen Heft, 2012, pp. 534–540.

sample, as the fixed effects model controls for the idiosyncrasies, but also to proceed with our calculations free of the critique of Soskice.[17] The PCA is run on the whole sample of countries mentioned from 1960 to 2014, while the regressions are run on data from 1993 to 2014, as the data on unemployment rate and real wages is not available in our database for all 15 countries in the preceding years.[18]

We observe the effect of institutional variables on real wages in order to test the Calmfors-Driffill hypothesis of the hump-shaped relationship between centralization and real wage restraint. The first fixed effects model:

$$\forall i \in [\![1,...,34]\!], \ \forall t \in [\![1993,...2014]\!],$$

$$log(w_{it}) = \alpha_i + \sum_{k=1}^{n} \beta_k x_{itk} + \varepsilon_{it}$$

where α_i controls for individual latent idiosyncrasies, w is the real wage, ε_{it} is the error term and x_{itk} are the individual variables that change over time. The selected independent variables: the first principal component (*PC1*) from the PCA, $PC1^2$, percentage of variation between t and $t-1$ of real minimum wage and real labor productivity. We have added a dummy variable for each year to control for the fixed temporal effects.

Following, we looked if the effect of centralization on the unemployment rate, a variable selected as an indicator of macroeconomic performance, corresponds to the results of the preceding model and with the general analysis of Calmfors and Driffill. The second fixed effects model with the *within* estimator:

$$\forall i \in [\![1,...,34]\!], \ \forall t \in [\![1993,...2014]\!],$$

$$log(U_{it}) = \alpha_i + \sum_{k=1}^{n} \beta_k x_{itk} + \varepsilon_{it}$$

where α_i controls for individual latent idiosyncrasies, U is unemployment rate, ε_{it} is the error term and x_{itk} are the individual variables that change over time. The selected independent variables: *PC1*, $PC1^2$, real wages, real productivity and an index to control for the Great Re-

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[17]Soskice, "Reinterpreting Corporatism and Explaining Unemployment: Coordinated and Non-coordinated Market Economies" To recall, the author considers the hump-shaped curve to be biased due to specific characteristics of Japan and Switzerland (see page 5 of this paper).

[18]Also, PCA from 1960 to 2014 captures long-term effects and trajectories of the countries. The constraints of the data for the variables ext and ud render PCA a useful tool as the extended time period allows for a closer study of the relevant data gathered.

cession.[19] The unemployment rate and real wages are expressed as their logarithmic values. Labor productivity and real minimum wage are expressed as percentages of change from the preceding year.

3.4 Results

3.4.1 Principal Component Analysis

Figure 2 demonstrates the heterogeneity of the labor market for a sample of countries and reveals the main components responsible for the variance in the data. The PCA results in part support the Calmfors and Driffill hump-shape hypothesis that real wage restraint is highest in highly centralized and highly de-centralized countries, resulting in lowest unemployment rate and real wages. Each point on the graphic is a value of a country along the aforementioned four variables at a certain year.
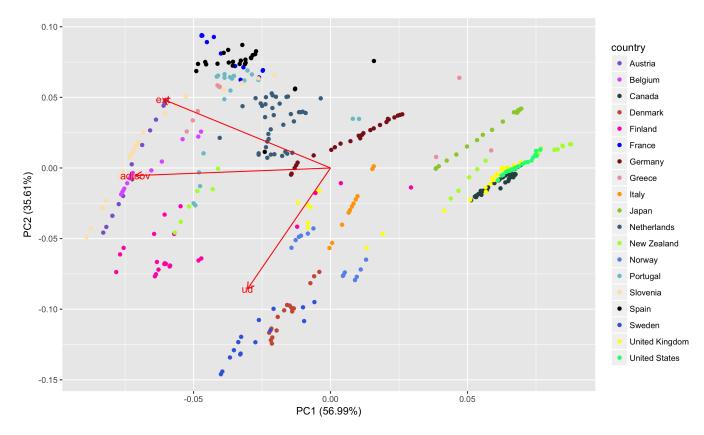

FIGURE 2: PRINCIPAL COMPONENT ANALYSIS

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[19]The selection of the variables is explained in more detail in the Appendix. We have also transformed the values of the real wages variable into values of the natural logarithm.

In Figure 2, the cluster on the right is especially easily identifiable. The group of green and yellow points is highly concentrated along the first and second component demonstrating that the lower the mandatory extension (ext) and adjusted coverage rate ($adjcov$) scoring of a country, (in other words, the more de-centralized it is), the lower the country's union density rate. The de-centralized countries as demonstrated by the graphic include: the UK, the US, Japan, and Canada. [20] The countries with higher adjusted coverage rates and mandatory extension rates, henceforth the more centralized ones, are situated on the left-side of the first component. More centralized countries witness more variable rates of unemployment and union density. For instance, the countries with high union density rate are situated in the lower left corner of the graph and include Austria, Belgium, Finland, Denmark and Sweden (countries with low rates of unemployment). However, on the top left corner, we see intermediate countries, neither centralized nor decentralized, such as Spain, France and Portugal, all of which have experienced high unemployment. In the center of the graph, we see countries with varied rates of mandatory extension and adjusted coverage rates, such as the Netherlands and Germany. The lack of data for Italy and its somewhat central positioning on the graphic warrants attention. Italy's central positioning is attributed to the country's high coverage rate connected to a solid union density rate and a low extension rate. In the center of the figure, the trajectory of Germany is also noteworthy, as in studying it, one sees almost a linear trend of the country over the years tending toward the decentralized cluster.

3.4.2 Results of the fixed effects models

We chose the first principal component ($PC1$), which is the main indicator of variation in the data, as one of our explicative variables in order to better understand the link between centralization and unemployment. The three active variables visible on the PCA decompose the obscure term of centralization into coverage rate, mandatory extension rate of collective agreements to non-signatories, and union density rate.[21]

In theory, the effect of the first principal component on employment is ambiguous due to the fact that a diminution of the coverage rate leads to two opposite effects in different working

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[20]Although Japan contains some industries that are highly centralized, its overall ranking on the ext and $adjcov$ scale provided in the ICTWSS dataset is equivalent to that of the UK, the US, and Canada.

[21]For a more detailed recount of the PCA, please see the Appendix.

populations: the wages and the employment rate of the non-covered workers increases, since they become relatively more numerous and provide cheaper labor than the workers who are covered by collective (wage) bargaining agreements, who experience their wages and their rate of employment decrease.[22] Since the average wage is lower for the non-covered workers than for the covered ones, the overall average wage decreases, but the total effect on employment is ambiguous as it depends on the relative strength of the two aforementioned antagonistic effects on different working populations.

Centralization and real wages

Table 1 presents the results of the fixed effects model with real wages as a dependent variable. We tested for heteroskedasticity and autocorrelation in the residuals; additionally, we controlled for the idiosyncratic characteristics of years and countries with certain cluster options in the fixed effects model; all of our results are robust.[23] We note that the relationship between $PC1$

TABLE 1: REGRESSION OF REAL WAGES ON $PC1$ OF THE PCA - FIXED EFFECTS

	Dependent variable: log(Real Wage)		
	(1)	(2)	(3)
VARIABLES			
PC1	0.0451**	0.0369***	0.0313***
	(0.0171)	(0.00856)	(0.00904)
PC1^2	-0.0247	-0.0211*	-0.0223**
	(0.0182)	(0.00978)	(0.00988)
Real minimum wage		0.0732***	0.0729***
		(0.0133)	(0.0132)
Real productivity			0.00330
			(0.00225)
Constant	10.42***	9.941***	9.937***
	(0.0494)	(0.0862)	(0.0855)
Observations	218	147	147
R-squared	0.718	0.779	0.782
Number of countries	18	11	11

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

and the real wages (calculated with a log transformation) is weakly positive, strongly concave,

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[22]Lars Calmfors (1993, p. 176)

[23]Manuel Arellano. "Computing Robust Standard Errors for Within-Group Estimators". In: *Oxford Bulletin of Economics and Statistics* 49 (1987), pp. 431–434.
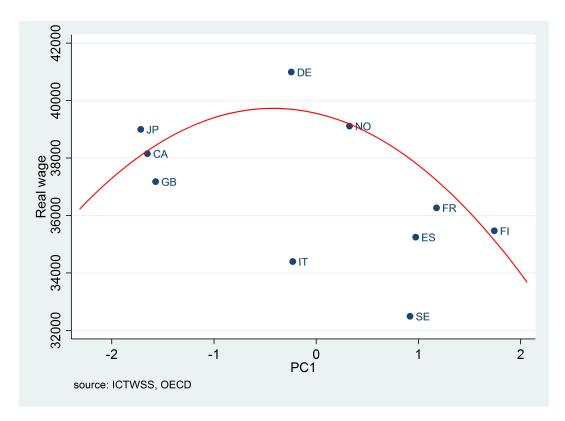
FIGURE 3: THE HUMP-SHAPED RELATIONSHIP BEFORE THE GREAT RECESSION (1993-2007)

and statistically significant. Control variables provide consistent results: real wage elasticity to real minimum wage and to real labor productivity is positive. The R^2 value is also high, indicating that the model explains over 70% of the data variation, however, the endogeneity in our model prevents a causal interpretation. Our first regression does not reject the Calmfors and Driffill hypothesis of a concave relationship between centralization, evaluated by $PC1$, and the log of real wages.

Figure 3 gives an overview of the hump-shaped curve for the period before the Great Recession from real wages from 1993 to 2007;[24] each point represents an average of a given country for the two variables. The curve is calculated from all of the observations in the sample; the countries selected serve uniquely to illustrate the polarization along the spectrum of centralization with decentralized countries on the left and centralized on the right. France gravitates toward the right by the strong mandatory extension of collective agreements to non-organized employers. Conversely, Norway gravitates toward the left due to its penchant toward de-unionization from 1993 to 2007. Italy and Germany strike as two interesting cases, especially when one compares this graphic with Figure 4: despite similar centralization rates, Italy experi-

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[24]The data used to create the curve itself is from 1993 to 2014, but the real wages are from 1993 to 2007.

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ences relatively low real wages, while Germany is characterized on average by much higher real wages. According to Calmfors and Driffill, Italy constitutes a notable exception in the period preceding the Great Recession.

Centralization and unemployment

Table 2 shows the results of the fixed effects model with the unemployment rate as the dependent variable. We have once again tested for the presence of heteroskedasticity and residual autocorrelation; the coefficients presented are all robust.

TABLE 2: REGRESSION OF THE UNEMPLOYMENT RATE ON $PC1$ OF THE PCA - FIXED EFFECTS

| VARIABLES | Dependent variable: log(Unemployment) | | | |
	(1)	(2)	(3)	(4)
PC1	-0.181*	-0.203***	-0.142***	-0.0845**
	(0.0920)	(0.0613)	(0.0485)	(0.0397)
PC1^2	-0.0851	-0.0871**	-0.0724*	-0.0736***
	(0.0547)	(0.0393)	(0.0370)	(0.0240)
log(Real wage)		-0.660	-0.926**	-1.701***
		(0.425)	(0.338)	(0.339)
Real productivity			-0.0266***	-0.0102
			(0.00840)	(0.00808)
Great Recession				0.228**
				(0.105)
Constant	2.069***	9.032*	11.84***	19.91***
	(0.0992)	(4.488)	(3.565)	(3.532)
Observations	189	189	189	189
R-squared	0.102	0.128	0.183	0.273
Number of countries	18	18	18	18
F-test	4.620	9.592	8.728	11.17

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The negative effect of the independent variables on the percentage of variation in the unemployment rate is statistically significant. $PC1^2$ is negative and statistically significant with a robust standard deviation in regards to heteroskedasticity and auto-correlation of residuals. The relationship is, therefore, concave and coincides well with the analysis of Calmfors (1993): at a certain point, in both centralized and decentralized economies, the unions are dis-incentivized to increase their nominal wages because the employers cannot shift their profit losses on to

the consumer prices, and therefore, their real wages remain lower, leading to overall higher employment rates, compared to wages in intermediate economies with industry-wide bargaining.[25] Elasticity of unemployment rate to real wages is negative, despite an evident endogeneity prohibiting a causal interpretation of the results. It is probable that the divergence between real wages and unemployment rate after 2008 is responsible for the negative coefficient of the real wage variable. The negative impact of real productivity per capita on the unemployment rate is not in itself surprising: when the variable for an economic shock is positive, the unemployment rate declines while labor productivity increases due to its procyclical nature (i.e. tendency to rise during economic booms and fall in recessions).[26]

Lastly, we control by a variable for the Great Recession, the value of which is 1 denoting the 2008-2014 period, and 0 otherwise; the index allows us to see the *ex post* effect of the regressors.[27] With the Great Recession variable added, the relationship remains concave and the coefficient is statistically significant, further reinforcing the validity of the Calmfors and Driffill hypothesis in the context of the Great Recession. The positive correlation between the first principal component of the PCA and the unemployment rate suggests that the first effect, mentioned earlier in the paper and described by Calmfors (1993), outweighs the second one for the period 1993-2014: the decrease in coverage rate leads to a fall in unemployment among workers not covered by industry-wide collective agreements, which largely offsets the rise in unemployment of covered workers, causing a total decrease in unemployment, and thereby, accrediting decentralization for the good macroeconomic performance.

Figure 4 demonstrates the hump-shaped curve of $PC1$ and the unemployment rate from 2008 to 2014. Each point is an average of the country for that period of time.

We observe a clear division of the Anglo-Saxon group and the Nordic group, both situated on either end of the curve, and thereby, depicting their radically opposing parameters in terms of centralization but experiencing similar unemployment levels. Italy on the other hand, at the top of the curve, combines an intermediate level of centralization and a mediocre macroeconomic performance.

Like in Figure 3, we observe a striking difference between Italy and Germany. It appears

[25]Calmfors, "Centralisation of Wage Bargaining and Macroeconomic Performance : A Survey".

[26]Mary C. Daly et al. *Shocks and Adjustments*. Working Paper 2013-32. Federal Reserve Bank of San Francisco, 2017.

[27]The Great Recession variable corresponds to data from 2008 to 2014 to capture the after-crisis effects, which were present well beyond 2009, the year that is credited as the end of the recession.
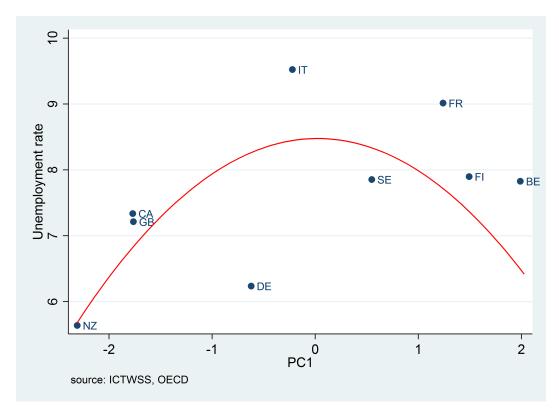
FIGURE 4: THE HUMP-SHAPED CURVE DURING THE GREAT RECESSION (2008-2014)

as if the two countries are almost polar opposites; Germany experienced an economic miracle while Italy suffered negative consequences of the financial crisis. Although the average values used in the figure normalize extraordinary results of idiosyncratic countries, we are still able to draw out the general tendency of Germany, due to its decentralization policies, to move towards the left of the curve over the two time-periods. It is, therefore, legitimate to assume that the macroeconomic performance gap between the two countries is due to their differing institutional strategies. While Italy remained static at the top of the hump over the years, and therefore, witnessed worsening macroeconomic results, Germany having begun decentralization after Reunification, was able to ameliorate its macroeconomic performance over the years.[28]

4 Decentralization and divergence of the European labor markets

Decentralization overall seems to have positive effects on the already-decentralized countries, a paradoxical result but one that corroborates the hump-shaped hypothesis where countries

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[28]Dustman et *al* believe that de-unionization in Germany aligned with decentralizing measures slowed down increases in real wages. For more, see: Dustmann et al., "From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy".

deviating from the middle, toward the left, experience improvement in their economies. In fact, Germany, contrary to its European neighbors, has been approaching the Anglo-Saxon model in its trajectory over time. Contrarily, less decentralized countries, such as France and Spain, seem to have been penalized for further extending their collective agreements to non-organized employers, and therefore, not implementing decentralization policies.

4.1 Massive de-unionization and decreasing coverage rate

Figure 5 demonstrates for a small sample of countries the two principal variables correlated with centralization: union density rate and coverage rate. We note a clear separation between
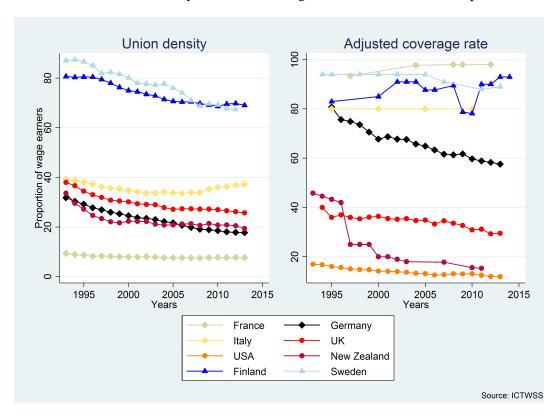

FIGURE 5: UNION DENSITY RATE AND COVERAGE RATE

the Nordic, very unionized countries, and all the others, which are less centralized. It is also noteworthy that only the Anglo-Saxon countries demonstrate a significantly lower coverage rate in comparison with other countries in the sample. The separation of the Anglo-Saxon countries highlights even more the mixed approach, a weak union density rate but an extensive coverage rate, of the Big Four.

The second important point is the temporal evolution of the two variables. While union

density remains relatively stable in Western Europe, and even tends to increase somewhat in Italy during the Great Recession, Germany has seen a consistent decrease in union density over time. In 1993, one in three German employees was unionized, but in 2013, one in five employees was unionized.[29] Similarly, the Anglo-Saxon and Nordic countries have experienced a drop in their union density rates, notably Sweden, where there was a 20 percentage points loss during the surveyed time period. The rapid decrease in union density seems to go hand in hand with the decentralization movement affecting most European countries. The adjusted coverage rate on Figure 5 decreases in most countries.

Looking at the graph, a few observations render themselves surprising. While it is by far the least unionized country in the sample, France has the highest coverage rate, due to its centralized state intervention extending the industry-wide bargaining agreements to non-unionized employees.[30] In the Nordic countries, the coverage rate also remains relatively constant, with the exception of the period from 2007 to 2011 since the crisis proved to be a brutal institutional shock to Finland. However, the financial crisis influenced the Nordic countries negatively only for a short period of time, and countries such as Finland recovered by increasing their market flexibility.[31]

It is, therefore, difficult to conclusively quantify the extent of decentralization in the Nordic countries: from one point of view, the decrease in unionization corroborates decentralization, however, from another point of view, the temporal stability of the coverage rate suggests that state intervention in industry-wide agreements along with stable extension rate of the agreements (variable ext) serve as substitutes for the weakened unions. In fact, the extension of agreements is widespread in Finland: every agreement concerning more than 50% of employees in the same industry is extended to all employees in the industry at a national level.[32]

Contrasting Finland, Sweden has never extended its collective bargaining agreements,

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[29]Dustmann et al., "From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy": the authors note that the de-unionization was one of the principal components of decentralization policies in Germany, notably slowing down increases in real wages.

[30]Dufresne and Maggi-Germain, "Zwischen Staatsinterventionismus und Tarifautonomie: Die Allgemeinverbindlicherklärung von Tarifverträgen in Frankreich"

[31]Lionel Fulton. "Worker representation in Europe". In: *Labour Research Department and ETUI* (2015). The brutal but temporary shock represented on the graphic corresponds to a period of wage bargaining decentralization. In 2007, *EK*, the most important Finnish employers' organization refused to sign a national agreement arguing that the crisis necessitated more flexibility; the agreements at industrial and sectorial levels replaced national agreements until October 2011, when *EK* accepted to sign a new national-level agreement. In October 2013, the Employment and Growth Pact slightly increased the wages and increased the coverage rate, but only for the sectors that were already signatories to collective bargaining agreements. Three movements took place in recent Finnish labor economics history: centralization (before 2007), decentralization (2007-2011), conditional re-centralization for sectors already signatories to collective bargaining agreements (2011-today).

[32]Line Eldring and Kristin Alsos. *European Minimum Wage: A Nordic Outlook*. Report on assignment. Fafo, 2012.

which explains its correlated decrease in union density rate and the coverage rate (Figure 5). The correlated decrease is not at all observed in Finland most likely due to its compensating effect of the industry-wide extension of collective bargaining agreements.

Germany constitutes an exception on the European labor market in its statistics and its similarity to the Anglo-Saxon model (unilateral decentralization of the wage bargaining processes). The drop of both the union density rate and the coverage rate in Germany sets the country apart on Figure 5. Through this idiosyncrasy in the European context, Germany shows a profound divergence despite the general decentralization trend: while certain countries, the more centralized ones, compensate their unions' weakening power with state interventions, the less centralized countries accelerate the decentralization movement by leaving negotiations to individual actors at the firm-level. Paradoxically, the countries that tend to allow firm-level wage bargaining are already decentralized, with the exception of Germany, which seems to be moving from a regime of industry-wide agreements and powerful unions such as *IG-Metall* to a much more decentralized system similar to that of the Anglo-Saxon countries. The Hartz reforms galvanized Germany's institutional transformation, which is strongly correlated to its macroeconomic performance and potentially even played a role in the German "miracle".[33] This simultaneous weakening of the union density rate and the coverage rate may serve as an explanation of Germany's sliding over the years toward the left-end of the Calmfors-Driffill curve.

4.2 Post-2008: Assessment of the Great Recession

The economic shock of 2008 was also an institutional shock generating asymmetrical adjustments in the European labor market. Economically and institutionally, the 2008 crisis impacted European countries differently (Figure 5); the cause of the divergence in macroeconomic performances can be attributed to an acceleration of decentralization in countries that began such policies in the 1990s.[34] By focusing on the Big Four, all within the eurozone, we observe very

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[33] Michael C. Burda and Jennifer Hunt. "What Explains the German Labor Market Miracle in the Great Recession". In: *Brookings Papers on Economic Activity, Economic Studies Program, The Brookings Institution* 42.1 (2011), pp. 273–335: the authors argue that the institutional context, in particular the Hartz laws and introduction of "working time accounts" hand in hand with *ex ante* pessimism, restrained employment in the manufacturing industry and prevented unemployment growth in Germany.

[34] For more information, see Reinhard Bispinck and Heiner Dribbusch. "Collective bargaining, decentralization and crisis management in the German metalworking industries since 1990". In: *Wirtschafts-und Sozialwissenschaftliches Institut, WSI Diskussionpaper* 177 (2011); additionally, Sotiria Theodoropoulou. *Drifting into Labour Market Insecurity? Labour Market Reforms in Europe after 2010*. Working Paper. ETUI, 2018 states that flexicurity is more on the side of flexibility than on that of security, and therefore, weakens job security and increases inequality between the insiders and outsiders. Also, in S. Häusermann. "The politics of old and new social policies". In: *The politics of the new welfare state*. Oxford University Press, 2012, pp. 111–132: the author argues that the 1990s initiated a

different profiles of countries with similar economic frameworks, which suggests that the explanatory factor of the various macroeconomic performances is the interaction of the economic shock with countries' institutions.[35] From an economic point of view, in 2006 all of the Big Four countries had relatively low unemployment rates, between 5% and 10%, but in 2013, the situation changed. For instance, 27% of Spain's working population was unemployed in contrast to the 6% of the German working population in 2013. From an institutional point of view, the coverage rate remained constant in France and Italy, but the crisis seems to have halted the decline of the coverage rate in Spain and accelerated it in Germany.

Although overall European countries have decentralized wage bargaining processes, there is a very large mix of methods and variables that show differing results. For instance, after the 2008 financial crisis, union density rate has increased in Italy and Spain. However, the union density rate in Germany continued to decrease suggesting different methods of decentralization among the countries. Italy and Spain, in the course of multiple reforms, decentralized their collective bargaining as they descended the level of wage negotiation from an industry one to a firm-level one.[36] However, the slight increase in union density rate in Southern Europe suggests that those countries' decentralization did not negatively impact the unions as it did in Germany. Italy seems to be the inverse model of Germany; its union density rate, after a slight decline from 1993 to 2004, stabilized and then increased once again after the 2008 crisis; furthermore, its coverage rate has been constant throughout the whole sampled time period. While Germany has been consistently decentralizing and moving toward the left end of the Calmfors and Driffill curve, Italy, over the years, has been moving toward the right end of the curve despite some decentralization-focused policies.

France seems to have decentralized less than its neighbors; even if one were to argue that France has decentralized in some aspects, the state remains engaged in collective bargaining as is exemplified by the increase in extension of collective bargaining agreements to non-signatories

movement toward "welfare protectionism" at the cost of "welfare readjustment". The terms "welfare protectionism" and "welfare readjustment" refer to two policy choices: the former favors the insiders through preservation of old welfare rights at the expense of unprotected and marginalized outsiders, while the latter favors the outsiders through the development of new policies at the expense of old policies of job and income support. The outsiders are members of the workforce who are particularly affected by atypical employment and unemployment. In the countries that were oriented toward "welfare readjustment", the decrease in inequalities within the workforce was attained by a suppression of the *insiders* protections rather than job or income support programs for the *outsiders*. This top-down flexibilization resulted in reduced inequalities and systematized job insecurity.

[35]Blanchard and Wolfers, "The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence".

[36]Alvar Kangur. *Competitiveness and Wage Bargaining Reform in Italy*. IMF Working Paper 18/61. 2018: decentralization of collective wage bargaining in Italy changed from industry-level to company-level, and therefore, contributed to a 3.5 percentage point decrease in unemployment and an improvement of the country's competitiveness.

after the crisis.

Germany has been an exception to the overall European labor market landscape with its drastic decentralization. The slight decrease in participation of companies in employers' associations (a decrease of 5 percentage points from 2002 to 2011) alongside with its consistent declining coverage and union density rates suggests a weakening of collective bargaining as individuals are faced against firms, which are mostly still in employers' organizations. This asymmetric wage bargaining, an institutional asymmetry, may be at the root of the cause for Germany's low level of unemployment as such an asymmetric system allows for more flexibility, when needed, in wage adjustment.

4.3 The different trajectories along the hump-shaped curve

4.3.1 Germany

The data for Germany supports the Calmfors-Driffill hypothesis. As we posed the question of what kinds of trajectories the countries followed along the Calmfors-Driffill curve, we proposed a hypothesis that Germany, over the course of time, has slid to the left of the hump-shaped curve from its initial position near the center as an intermediate country. The data has supported our hypothesis as we saw the Germany's position move from the right of the curve to its most recent position on the left end of the curve. Germany experienced a massive drop in its union density, coverage, and extension rates.

Figure 6 validates our hypothesis. The graphic depicts a concave parabolic non-monotonic relationship between the coverage rate (abscissa) and unemployment rate (ordinate). Each point represents the situation of the country at time t. Two important results are illustrated: firstly, the Calmfors-Driffill hypothesis is validated in the time period 1995-2013 in Germany, and secondly, the country shifts to the left with the passage of time, thus correlating with the country's improving macroeconomic performance.

It is unclear whether Germany's performance would have been similar if the country had chosen the other direction, that is, initiated a process of centralization and converged to a Scandinavian model as opposed to the Anglo-Saxon one. However, we decided to create a counterfactual model to compare actual history and fictional history, the evolution of unemployment in Germany if decentralization had not taken place and Germany continued on a business as
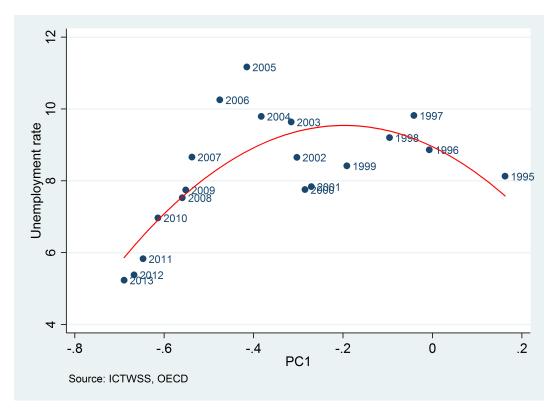
FIGURE 6: GERMANY'S TRAJECTORY ALONG THE HUMP-SHAPED CURVE

usual model.[37]‘

Figure 7 illustrates this fictitious history, the counterfactual model, by placing side by side the observed evolution of the German unemployment rate and the estimated unemployment rate that would have taken place if the coverage rate had remained the same in Germany since 1995.[38]

Taking into account the limits of our counterfactual model, it seems that Germany would have had a less volatile unemployment rate before the Hartz reforms (and one even slightly lower over the period 2004-2006) if the coverage rate had remained the same as in 1995. However, the impact of the economic shock of 2008 would have been much more profound and painful in Germany had the country not reduced its coverage rate since 1995. Germany would have experienced a wave of unemployment and would not have known the "miracle" of decreas-

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[37]Dustmann et al., "From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy": the authors similarly build a counterfactual evolution of the real wages in Germany if de-unionization had not occurred. According to their results, the real wages would have changed much more rapidly between 1995 and 2008 if the union density rate had remained the same as in 1995, indicating that the unemployment rate would have been much higher.

[38]The coverage rate is the variable with the greatest weight relative to the other ones (ud and ext) in the first principal component of the PCA. Our choice of coverage rate for this analysis is elaborated in more detail in the Appendix.
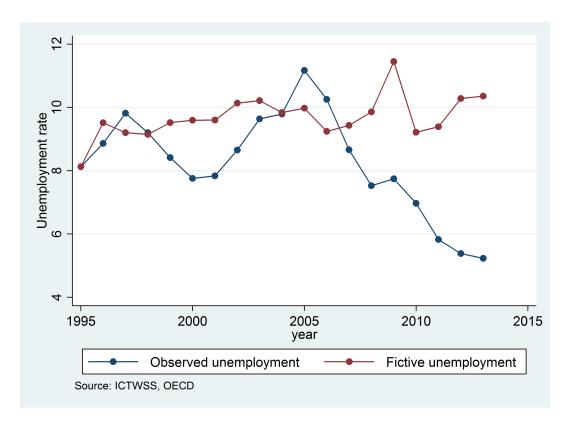
FIGURE 7: OBSERVED AND COUNTERFACTUAL GERMAN UNEMPLOYMENT

ing unemployment rate during the Great Recession that took place in reality. The unemployment rate would have been around 10%, much closer to that observed in its neighboring countries. Decentralization, thus, seems to have played a major role in Germany's macroeconomic performance over the period 1995-2013 supporting the conclusions of Dustmann and al. (2014), who have attributed Germany's economic resurgence to to institutional factors.[39]

4.3.2 Italy, an inverse of Germany?

The largest divergence in the eurozone seems to be that of Italy and Germany. As the latter slides to the left of the Calmfors-Driffill curve over time, the former does not. While one would expect Italy to slide to the right of the curve due to its increasing union density rate and consistently high coverage rate, the country's coverage rate actually remains at 80% from 2000 to today. Although we cannot say that Italy is a perfect inverse of Germany, the data suggests that from an institutional point of view, Italy, from all moderately centralized countries, is the closest to

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[39]Dustmann et al., "From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy".
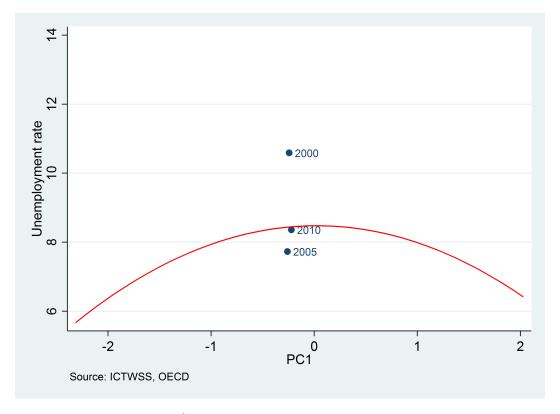
the Nordic model. [40]

FIGURE 8: ITALY'S POSITION ON THE CALMFORS-DRIFFILL CURVE

Figure 8 demonstrates the relationship between unemployment rate and the first principal component for Italy as does Figure 6 for Germany.[41] Italy maintains an intermediate position in terms of centralization, with the slight rise in the unionization rate at the end of the period probably offsetting the decrease in other indicators of centralization.[42] Unemployment rate remains quite high throughout the sampled period, which places Italy at the top of the hump-shaped curve and confirms the Calmfors and Driffill hypothesis. Italy's mediocre macroeconomic performance may be explained by a less ambitious decentralization in comparison to that of Germany's, or by a lack of centralization in collective bargaining, which is present in the Nordic countries.

[40]The data of the ICTWSS database includes the coverage rate for Italy only in the years 2000, 2005, and 2010; however, other databases, notably that of the OECD, shows a consistent coverage rate of 80% between 2000 and 2015.

[41]The curve represented is calculated with all of the countries unlike the one calculated specifically for Germany (Figure 6), where only the data from Germany was used.

[42]Francesco D'Amuri and Cristina Giorgiantonio. *The Institutional and Economic Limits to Bargaining Decentralization in Italy*. Policy Paper 98. IZA, 2015.

5 Conclusion

Institutions constitute an important component of country profiles and macroeconomic performances in Europe. Focusing on the links between unemployment rate, economic factors and institutions, we identified three labor market profiles according to their degrees of centralization in collective wage bargaining: decentralized, centralized and intermediate. The first corresponds to the Anglo-Saxon countries, characterized by a very low rate of all indicators (union density rate, coverage rate, and mandatory extension of collective bargaining agreements). The second refers to the Nordic countries, distinguished by very high indicators across all evaluations of centralization. Finally, the third profile is more heterogeneous as it consists of the four major countries of the European Union, which have a relatively high coverage rate and sometimes a rather low union density rate, as is the case of France.

The evolution of these indicators over time shows a general tendency towards decentralization, among different countries, including even those already decentralized from the start. The process of decentralization occurs at various levels and at differing time periods. While the union density rate and the coverage rate in Germany fell sharply over the whole period sampled (1993-2013), the Nordic de-unionization was not coupled with a drop in coverage rate. Italy, on the other hand, after decades of a consistent union participation rate appears to be at the beginning of a phase of union resurgence. The divergent trends of Germany and Italy thus embody the most prominent institutional and macroeconomic differences within the European Union.

Thirty years after the publication of Calmfors and Driffill article, the data does not allow us to reject the hypothesis of a hump-shaped relationship between unemployment and centralization. In fact, the data supports the notion of a non-monotonic concave relationship between centralization and macroeconomic performance. The hump-shaped curve that we present is a modified version of the Calmfors-Driffill hypothesis that suggests an inverted U-shaped correlation between the proportion of employees covered by collective wage bargaining agreements (coverage rate) and the unemployment rate. This correlation proves itself robust.[43] According to the results of our principal component analysis, the two main components of countries' dispersion are (1) coverage rate and (2) mandatory extension of collective bargaining agreements to non-signatories. Having constructed a fixed effects model, we regressed real wages and unem-

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[43]For robustness checks, please refer to the Appendix.

ployment rate on the first component of the PCA. The regression allowed us to analyze countries'
trajectories along the hump-shaped curve over time.

We showed that Germany has deviated from its initial group among intermediate coun-
tries, (Italy, Spain and France), towards the decentralized one, (the UK, the US, New Zealand).
German decentralization is a long-time horizon project that was began after the country's reuni-
fication and was accelerated by the Hartz reforms.

The European labor market is dotted with a variety of profiles that result in differing macroe-
conomic performances. Considering the idiosyncrasies of every country, it is impossible to pre-
scribe any one centralized or decentralized policy, but our analysis shows that there are multiple
different versions of economies that can be tailored to the differing characteristics of European
countries and that could yield in the long-term favorable macroeconomic results.

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Appendix

A   Complementary information

A.1   Different levels of wage bargaining: industry-wide in continental Europe and firm-level in Anglo-Saxon countries

While decentralization seems to be a trend across most of the countries in the sample, the movement is heterogeneous and invites us to peruse the evolution of the changes.[44] The breakdown of the proportions of employees covered by wage bargaining agreements made with an independent employer or with one that is in an employers' organization (group, branch, sector) renders a closer analysis of the levels of negotiations possible. An independent employer negotiating with employees constitutes a firm-level agreement, and therefore, will not influence the whole sector or branch. Conversely, agreements made between employees and a group of employers reach far beyond the firm and may affect the whole industry. These two variables, multi-employer bargaining and single-employer bargaining, also essentially embody centralization.

Figure 9 compares countries' coverage rate of branch-level agreements involving multiple employers. We note that employees in continental European countries are mostly covered by branch agreements (Austria) or national agreements (France), while those in Anglo-Saxon countries (United Kingdom and New Zealand) are covered only by agreements negotiated at the company level. The trajectory of Germany suggests that the level at which wage bargaining takes place has steadily declined over the years: moving from a sectoral bargaining model, based on agreements made between workers' unions and employers' representatives (*Mitbestimmungsgesetz*, 1976), to a firm-level model. The observed changes in Germany go hand in hand with its decline of large industrial unions such as *IG-Metall* and its decentralization and flexibilization of the labor market.

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[44]Salvador Ortigueira. "The Rise and Fall of Centralized Wage Bargaining". In: *The Scandinavian Journal of Economics* (2013), pp. 825–855: the author argues that countries' tendency to decentralize their wage bargaining processes is due to disintegration of unions in Scandinavia and continental Europe. Laurence Baraldi and Bruno Lamotte. "La négociation des salaires en France: une perspective institutionaliste". In: *Revue française d'économie* 9.4 (1994), pp. 137–167: in their article, Baraldi and Lamotte question the optimal level at which wage negotiation should take place. The authors place France within the indeterminate level due to its simultaneous coexistence of decentralization, in the form of a movement toward company-level negotiation, and paradoxically an exceptionally high degree of state intervention through the mandatory extension of collective agreements to non-signatories.
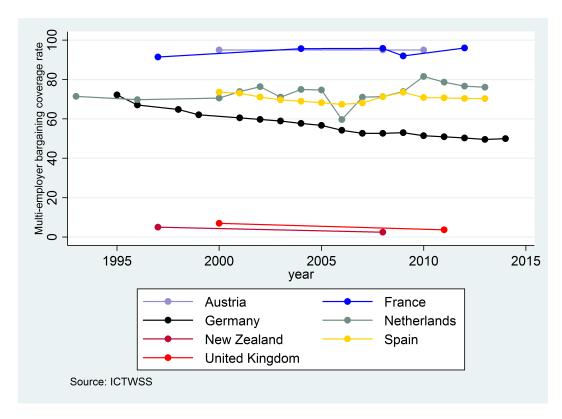
FIGURE 9: COVERAGE RATE OF INDUSTRY AGREEMENTS

A.2 Unemployment rate and mandatory extension of coverage

The inherent problem in certain countries, such as France, where high coverage rate is linked to an almost universal mandatory extension of collective agreements to non-signatories, requires us to take into account the effect of the mandatory extensions (extension rate) on the overall proportion of employees covered by collective wage bargaining agreements as a proportion of all wage and salary earners in employment (coverage rate). The extension of the agreements is motivated by the state's desire to ensure equal working conditions within the same sector, in order to constrict the dispersion of wages and to reduce gender bias. The extension also compensates for union weakness in countries like France where the union density rate is very low. However, extension may also conversely hinder the growth of unions by systematically extending negotiated agreements to all non-unionized workers. Despite moving toward uniform universal coverage, extension introduces wage rigidity that restricts the flexibility and adaptability of economies during critical times such as financial shocks.[45] Furthermore, expansion inhibits market competition by creating entry barriers for small businesses, and therefore, in-

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[45]Ernesto Villanueva. *Employment and wage effects of extending collective bargaining agreements*. doi: 10.15185/iza-wol.136. IZA World of Labor, 2015

creasing unit labor costs, undermining the country's trading position.[46]

Paradoxically, Table 2 presents a statistically significant result for the negative relationship between coverage extension and unemployment. Eastern European countries, caught in the "middle-income trap", do not widely extend their collective agreements, but suffer from high unemployment.[47] On the contrary, Finland, despite almost systematically extending collective agreements, like France, maintains a relatively low unemployment rate.

As noted throughout our research, the endogeneity of the variables does not allow us to establish a causal effect, however, we are able to draw out a strong and significant correlation between extension of the collective bargaining agreements and unemployment.

B PCA

This section presents the steps of the principal components analysis and the main quantitative results of the analysis. Firstly, in order to obtain the graph of the PCA, we corrected for the differences in variance across the variables and we chose three dimensions as they represent over 90% of the data. Then, we checked the quality of representation of the chosen variables on the principal components with cos^2 values. The adjusted coverage rate and the rate of extension of coverage are the two variables that the PCA represents the best.

Lastly, looking at the loadings values in Table 3, we are able to further interpret the results along the two components. The countries scoring highly along the first component are characterized by low adjusted coverage rate, extension rate, and union density rates. The values in the table for the first component represent well the cluster of decentralized countries noted on the right hand-side of the graph. In the second column, we see that countries with a high

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[46]Villanueva, *Employment and wage effects of extending collective bargaining agreements*; the degree of extension coverage influences positively the tax wedge elasticity of unemployment. For further information, see: Fabrice Murtin, Alain de Serres, and Alexander Hijzen. "Unemployment and the coverage extension of collective wage agreements". In: *European Economic Review* 71 (2014), pp. 52–66. ISSN: 0014-2921. Tax wedges have a highly significant and expansive effect on unemployment in France and Spain suggesting that the combination of the financial shock of 2008 and their pro-extension institutional framework together create a major factor raising the two countries' unemployment rates. On the other hand, Germany, benefiting from a decline in the tax wedge and in general a lower degree of coverage extension, has experienced a decrease in unemployment elasticity at the tax wedge over the period observed, mitigating the impact of the shock. Germany has also rendered its labor markets more flexible by not mandating agreement extensions to non-signatories. See Ortigueira, "The Rise and Fall of Centralized Wage Bargaining"

[47]Martin Myant. *Why are wages still lower in eastern and central Europe ?* Working Paper. ETUI, 2018: according to Myant, by constricting their wages to make themselves attractive to multinational corporations, Eastern European countries actually leave themselves out of more fruitful long-term investments, such as research and innovation projects, which could raise their economies to a much higher development level.

component score on the vertical axis tend to have low adjusted coverage rates and union density rates but high extension rates.

Variables	PC1	PC2	PC3
ext	-0.6199947648	0.4935406969	0.6099377609
ud	-0.3071329326	-0.868009108	0.3901660547
adjcov	-0.7219943583	-0.05456893809	-0.6897437043

<div align="center">TABLE 3: LOADINGS</div>

C Fixed effects models

C.1 Justification for selection of the dependent variable

The Calmfors and Driffill hypothesis utilizes real wage as an indicator of macroeconomic performance for two main reasons. Firstly, the neoclassical framework of analysis establishes a positively correlated relationship between the level of unemployment and wages, the flexible character of the latter allowing for the existence of an equilibrium in the labor market when no state intervenes in employment practices; a real wage kept artificially high relative to its equilibrium level, therefore, results in a rise of unemployment and a weakening of the country's macroeconomic performance as consumption decreases, further slowing down production and increasing public spending on unemployment benefits. A high real wage, in the presence of constant real productivity, increases the unit labor cost, and thus, negatively affects the current account of the country.

In consistence with the choice of Calmfors and Driffill, we too utilize real wages as an indicator of macroeconomic performance in our first fixed effects model. However, the divergence in all of our economic variables, especially after the 2008 crisis, obscures explanations of the performance gaps at the European level by traditional economic factors. Therefore, we returned to the article of Calmfors and Driffill, but the second time, we chose to utilize the level of unemployment rather than real wages to measure macroeconomic performance of countries. The relationship between unemployment and real wages not being empirically as evident as theoretically, we developed a second model to see if the hump-shaped relationship is valid from the point of view of unemployment as it is from that of real wages. Figure 10 illustrates the general relationship between unemployment rate and centralization over the period 1993-2015, in

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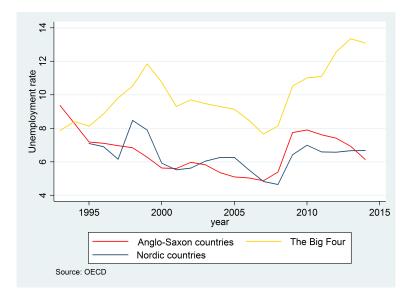support of the Calmfors and Driffill hypothesis.

FIGURE 10: UNEMPLOYMENT RATE AND CENTRALIZATION

On the graphic, the average rate of unemployment of the highly decentralized Anglo-Saxon countries and that of the highly centralized Nordic countries follow similar trends and are altogether lower during the whole sampled period than the unemployment rate of the four main European countries, which all have intermediate rates of centralization.[48] The average rate of unemployment for the Big Four is admittedly slightly distorted after 2008 by the explosion of unemployment in Spain, but on average it seems to be offset by the "German miracle". The graph, therefore, supports the hypothesis of a hump-shaped relationship between the degree of centralization and the macroeconomic performance of countries, modeled by the unemployment rate.

C.2   Robustness testing

C.2.1   Fixed effects versus random effects

In the existing literature, the fixed effects model is used more often than the random effects model, the assumption of independence of the individual specificities of the regressors often imposing too strong constraint to use the random effects model. It is obvious that the individual idiosyncrasies of the countries are, in our model, correlated with the variables on which we

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[48]As a reminder, the Nordic countries: Sweden, Finland, Denmark, Norway. Anglo-Saxon countries: the United Kingdom, the United States, Canada and New Zealand. The "Big Four": Germany, France, Spain, Italy.

regress the unemployment rate. Institutional factors in particular depend on the political and historical constructions of each country. Likewise, economic factors are dependent, in the particular, on the *inputs* of each country. Therefore, our choice of a fixed effects model was reasonable and to an extent intuitive.

The traditional test for robustness is that of Hausman. However, the test is based on certain assumptions that due to heteroskedasticity and auto-correlation (cf*infra*), we had some problems satisfying. However, to resolve, in part, the problems, we used the cluster option in our sample. Therefore, neither of the two estimators of Hausman compared had minimal (asymptotic) variance. In addition, for some model specifications, the difference in variance of the two estimators, which is supposed to approximate the variance of the difference, is not definitely positive. Hence, the result of the Hausman test is indeterminate.

We therefore proceeded with the Sargan-Hansen test for the second fixed-effect model (with the unemployment rate). The robustness of our standard deviations to heteroskedasticity led to a Hansen J-test statistic that allowed us to reject the orthogonality assumption of the unobservable specific regressors at 5%. We, therefore, rejected the model with random effects and opted for a model with fixed effects.

The Sargan-Hansen test conducted on the first model (real wages) does not differentiate between the fixed and random effects because of the absence of variance in the latent characteristics not taken into account by the random effects model. This means that the random effects model is not relevant and equivalent to a simple OLS. We, therefore, rejected the random effects model and, due to a sufficiently large Fisher test statistic and panel data characteristics, also rejected the OLS regression. Hence, ultimately, we used the fixed effects model to treat both of our regressions. Fixed effects control for individual specifications, (i.e. the latent characteristics of each country). We also tested for the presence of fixed year effects by performing a Wald test. With the elevated *F-test* statistic values, we rejected the null hypothesis that the coefficients associated with the year-effects are all null. A model controlling for the year-effects became, therefore, necessary to obtain non-biased coefficients. We only control the presence of year fixed effects in the model with the real wages in dependent variable.

In the second model, the coefficients associated with the dummies per year are almost all non-significant. In order not to reduce the significance of the coefficients, already suffering from problems of heteroskedasticity and auto-correlation, we chose not to include year-effect control

in the second model.

C.2.2 Validity of assumptions of our fixed effects models

Our sample is composed of panel data of fifteen countries over a period of 20 years. The variables selected in the model are continuous; we did not utilize the variables in the dataset titled centralization, coordination and the level of negotiation due to their ambiguity and lack of variance. From the selected variables, they all change from year to year for all countries, with one exception: Italy's coverage rate (the country's idiosyncrasy supports our choice of a fixed effects model).

Non-negligible endogeneity

The problem of endogeneity is not unexpected. In fact, it would have been strange to find variables perfectly independent of one another. Coverage rate, union density rate and extension rate of collective bargaining agreements are non-exogenous to real wages and unemployment insofar as the latter may also affect the former. Solving the problem of endogeneity requires creating a model that would endogenize the unemployment coverage rate and treat the unemployment rate together with the other variables.[49] Therefore, our resolution would be complex as it would require endogenization of all the variables used: the impact of unemployment on the wage, extension of coverage, measurement of productivity, and so on.

As endogeneity is the main weakness of our models, we have done as much as we could to take it into account in our analyses and accentuated that causal interpretation could not be made. Therefore, the results of regressions show mainly significant correlations, which suggest a probable link between the institutional variables of labor markets and the macroeconomic performance of countries.

Presence of Heteroskedasticity

We perform Wald tests to check for heteroskedasticity in each model, and confirm the presence of heteroskedasticity in both models. The results presented in Tables 1 and 2 take into account the presence of heteroskedasticity and are thus robust. We use the White-Huber method to obtain robust standard deviations for heteroskedasticity, assuming that the structure of the latter is

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[49]The suggestion of Driffill in Driffill, "The Centralization of Wage Bargaining Revisited: What Have We Learnt?"

such that the variance is constant within each cluster but varies between clusters. The clusters correspond to countries. In sum, we assume that homoskedasticity is verified within each group but is not verified, as shown by the Wald test, between the groups.

Presence of serial correlation

The autocorrelation of residuals is a common problem in macro-level data spanning over long periods of time. The problem posed becomes the fact that coefficients may be presented smaller than their real values, and the R^2 may artificially elevated. It is, therefore, important in our case, to control for autocorrelation of residuals.

One would expect the performance of the Durbin-Watson test, controlling for autocorrelation, $\varepsilon_t = \rho\varepsilon_{t-1} + \epsilon_t$. However, the Durbin-Watson test is based on very demanding assumptions that we cannot validate, in particular the strict exogeneity of the regressors *supra*. Hence, we chose a different test based on weaker assumptions, the Wooldridge test, and we confirm serial-correlation.[50] The Wooldridge test provides reliable results even for unbalanced panel data with heteroskedasticity. All of our coefficients are, therefore, HAC (*Heteroskedasticity and Autocorrelation Consistent*).

Unbalanced Panel Data

One of the major problems of the ICTWSS database is its significant lack of data for some years and countries. For example, if the evolution of the coverage rate is complete for the whole sampled time period for Germany, then it may not at all be the case for Italy, for which the coverage rate is available only for the years 2000, 2005 and 2010. As the tables show (cf. *infra*), coefficients may be biased by the unbalanced characteristic of the dataset as the regressions and correlations quantify effects observed only for a small group of countries but present the effect as indicative of all the countries included in the regression.

However, the lack of consistency in data availability does not fundamentally limit our analyses. A serious potential problem of unbalanced panel data is correlation of the lacking data with the error terms, an idiosyncratic shock that can generate an attrition effect. However, for macro data like ours, the lack of data is not related to shocks but to a recording or incomplete measurement of the data. However, in the preceding tests, we carefully chose valid tests for

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[50]Jeffrey M. Wooldridge. *Econometric Analysis of Cross Section and Panel Data*. MIT Press, 2002.

unbalanced panels and deliberately selected countries for our tests and regressions in order to avoid the problem of over or under representation of certain effects in ours results.

C.3 Counterfactual to the unemployment rate

The construction of a counterfactual was simple, but its result should not be interpreted as the only potential alternative history of Germany if it had not decentralized. Instead, the counterfactual shows another possible trajectory of German unemployment if no adjustment had been made from an institutional point of view. This trajectory is represented graphically and empirically by the coefficients in table 2. We created a fixed-effects model and then looked at any changes possible if there was no decrease in the coverage rate in Germany. This hypothetical regression, gave us a probable evolution of unemployment if the coverage rate remained at 80.75% (the rate in 1995). The counterfactual model has the unemployment rate for the dependent variable and the coverage rate, union density rate, and mandatory extension of agreements, the real wage, and the real productivity for explanatory variables; lastly, there was also a dummy variable for the period 2008-2014, the Great Recession. Coverage rate is treated independently of the other variables that are correlated with centralization due to its position as the best predictor of country dispersion (according to our results from the PCA).

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