Flat or not flat? The role of wage bargaining institutions in the EU Phillips curves

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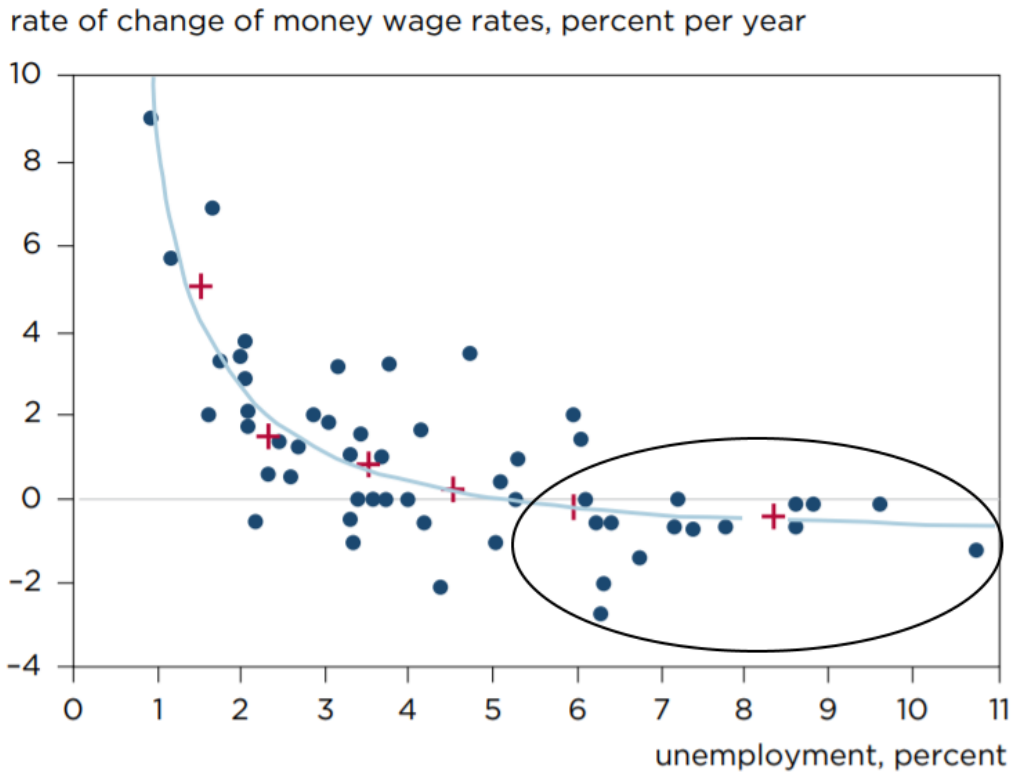
Research question — Main intuition

Figure 1. Inflation and Employment: threshold effects?

Notes: the employment gap is defined as $U^{\star} > U$. When inflation is already very low, even large negative employment gaps have little effect, but there is some evidence that positive gaps push inflation up. If the asymmetry is driven by downward wage and price rigidity, there is no reason to doubt that a significant positive employment gap will eventually push inflation up. Source: Collins and Gagnon (2019).

Research question — Main intuition



Source: Phillips (1958), retrieved from Wiley Online Library.

Figure 2. Wage Inflation and Unemployment: back to the basics

Note: if the curve is just hibernating, we revert to the original nonlinear Phillips curve where downward nominal rigidities play a crucial role in a low inflation environment.

Research question — Main motivation

Motivation

1. Understanding the determinants of the curve's flattening
2. Exploring the impact of (a peculiar form of) downward nominal rigidities: centralization of wage bargaining
3. Allowing for nonlinear effects and threshold effects
4. For the European economy at the regional level, downward bias with aggregate (national) data

Research question — Some literature

Literature

1. Several flattening factors: anchored inflation expectations (more credible CB), structural changes (demography, globalization, etc.)
   - Bernanke (2010); Blanchard (2016); Ball and Mazumder (2019), Daly et al. (2016); Forbes et al. (2020)
2. Complementary explanation: downward nominal wage rigidities (DNWR)
   - Wage and price rigidities bend the Phillips Curve when economic slowdown and low inflation (Gagnon et Collins, 2019)
   - Wages cuts are more likely in decentralized bargaining systems and no automatic extension of collective agreements (Villanueva, 2015; Gnocchi et al., 2015)
   - Flexible wage schemes during the Great Recession in some countries (e.g. Italy) made the wage Phillips curve steeper (Bulligan and Viviano, 2017)

Research question — Some literature

Literature

- Collective bargaining and wage dynamics:
  - D'Adamo and Rovelli (2015) present evidence that more prominent labor market institutions (including more wage coordination and higher union density) flatten the PC
  - Stansbury and Summers (2020) highlight the decline in the bargaining power of US workers relative to that of employers as an explanation for low wage growth in good labor market conditions, and thus the broken relationship between unemployment and inflation
  - Regardless of country and despite a declining bargaining power, unions still generate a wage premium, namely, difference in wages linked to the existence of trade unions and collective agreements compared with a situation without this institutional framework (Bryson, 2014)

Research question — Some literature

Literature

- Collective bargaining and wage dynamics:
  - Empirical evidence reveals the wage premium depends on the features of the collective bargaining system, including the coverage of collective agreements and the level of centralization at which bargaining takes place (Gürtzgen, 2009; Dahl et al., 2013)
  - Wages are more likely to be adjusted downwards during recessions in economies where bargaining takes place closer to the company level and/or collective agreements are not automatically extended to all workers in an industry (Aidt and Tzannatos, 2008; Gnocchi et al., 2015; Villanueva and Adamopoulou, 2022)
  - By contrast, DWNR is stronger in countries with a high union density and centralized wage setting: workers resist more to wage cuts in this context

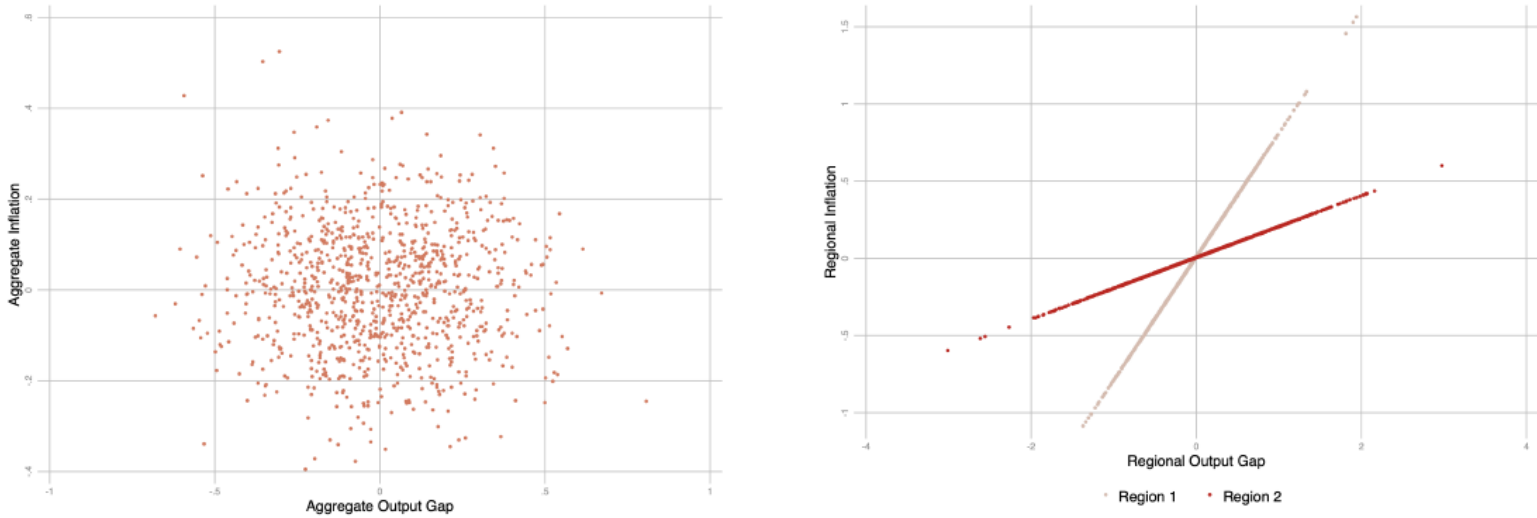
Research question — Some literature

Literature

1. Rely on European regional data (NUTS-2) merged with the OECD/AIAS ICTWSS database describing the centralization of wage bargaining in each country
2. Spatial and temporal heterogeneity between the collective bargaining systems of European countries to investigate the role of wage bargaining centralization on the slope of the wage PC
3. Such data help to mitigate the downward endogeneity bias of monetary policy, and offers a large variability in the dataset allowing a valid identification of the wage PC, as shown by Imbs et al. (2011), Levy (2019), McLeay and Tenreyro (2020), Hooper et al. (2020), and Schuffels et al. (2022)
4. Is it really important to use disaggregated (regional) data in a monetary union?

Research question — Some literature

Figure 2: Inflation and Output Gap in Simulations: Heterogeneous Slopes



(a) Aggregate Data **(b)** Regional Data

Figure 3. Downward bias of national data

Notes: The OG is linked to the UG through Okun's law. After a demand shock in Region 2, the CB raises the policy rate to reduce the OG in this last region. However, in Region 1 the CB will offset the region 1 shock to a larger degree than in the region 2. Negative correlation between OG in Region 1 and OG in the MU + Positive correlation between OG in Region 2 and OG in the MU. Both Regions contributes to the downward bias (weighted average of the two regions), since spillovers from Region 1 to Region 2 are stronger than vice-versa. Source: Schuffels et alii (2022).

Research question — Testable assumptions

Table 1. Different configurations for the wage-PC slope

	Slack labor market	Tight labor market
Decentralized wage bargaining	α_1	β_1
Centralized wage bargaining	α_2	β_2

Note: Our conjectures will be expressed by comparing the wage-PC slope in different configurations. The coefficients α_1, α_2, β_1 and β_2 represent the impact of the unemployment gap (that is, the difference between unemployment and mean unemployment) on the wage inflation in different combinations of labor market tightness and centralization of wage bargaining. Source: Authors' elaboration.

- From the literature on the flattening of the PC, the wage-PC slope is steeper in tight labor market (expansions) than in slack labor market (recessions): $|\beta| > |\alpha|$, contested by Doser et al. (2023).
- Then, we conjecture that the wage PC is flatter when wage bargaining is more centralized in slack labor markets as workers may resist to wage cuts. We expect that when wage bargaining is centralized, the wage-PC slope is higher in absolute value than in decentralized wage bargaining. Thus, we can express our main conjecture in the following way $|\alpha_1| > |\alpha_2|$. This flattening is caused by DWNR that can occur more frequently when wage bargaining is more centralized.
- Finally, we do not expect any influence of wage bargaining institution on the wage-PC slope in tight labor markets. We assume $|\beta_1| \simeq |\beta_2|$.

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Methodology — Empirical investigation

Economic variables

1. European regional data (NUTS-2 level), from 1995 to 2019, $N = 280$
2. Data on the usual determinants of the Wage Phillips curve

Variables definition

$WAGE$	Hourly wage (compensation divided by the number of hours worked)
$UGAP$	Unemployment Gap (Unemployment rate - Mean of unemployment rate)
GVA	Gross value added (all economic activities included, NACE Rev. 2)
$SHARE_{AGR-GVA}$	Share of Agriculture GVA in Total GVA
$SHARE_{CON-GVA}$	Share of Construction GVA in Total GVA
$SHARE_{IND-GVA}$	Share of Industry GVA in Total GVA
$SHARE_{LOW-EDUC}$	Share of 25-64 year olds which achieved a low-level of education
$SHARE_{MEDIUM-EDUC}$	Share of 25-64 year olds which achieved a medium-level of education

Methodology — Empirical investigation

Institutional variables

1. National data on collective bargaining features, from 1995 to 2019
2. Centralization of wage bargaining, taking into account:
   - the predominant level of bargaining
   - the incidence of and control over additional bargaining at enterprise level
   - the space that central or sectoral agreements allow for enterprise bargaining
   - degree to which agreements can be perforated through opening clauses

Variables definition

LEVEL	Measure on 0-4 scale of the predominant level of bargaining (firm, firm-sector, sector, cross-sectoral)
BARGCENT	Centralization of wage bargaining and flexibility of firm-level bargaining, if any (0.8-4.7)

Methodology — Empirical investigation

Table 2. Summary statistics of variables

Variables	Mean	SD	Min	Median	Max
Regional macroeconomic outcomes					
Growth of hourly wage (%)	3.0	5.4	-19.9	2.6	51.5
Unemployment rate (%)	8.8	5.7	1.2	7.2	37.0
Unemployment gap (p.p.)	0.0	3.2	-14.4	-0.1	14.9
Growth of annual GVA (%)	3.4	5.8	-22.9	3.4	88.9
Share of industry GVA in total GVA (%)	21.8	8.7	1.7	21.5	62.6
Share of construction GVA in total GVA (%)	6.4	2.1	0.9	6.3	16.1
Share of agriculture GVA in total GVA (%)	3.1	3.3	-0.9	2.1	21.8
Share of low-educated population (%)	27.4	15.3	2.4	23.5	87.7
Share of medium-educated population (%)	46.9	14.7	6.9	45.3	80.3
National wage bargaining institutions					
Centralization of wage bargaining (BARGCENT)	2.1	0.9	0.8	2.2	4.7
Predominant level of wage bargaining (LEVEL)	2.5	1.0	1	3	4
Coverage rate (%) (COV)	62.5	25.3	7.1	67.8	100

Methodology — Some Graphical Inspections

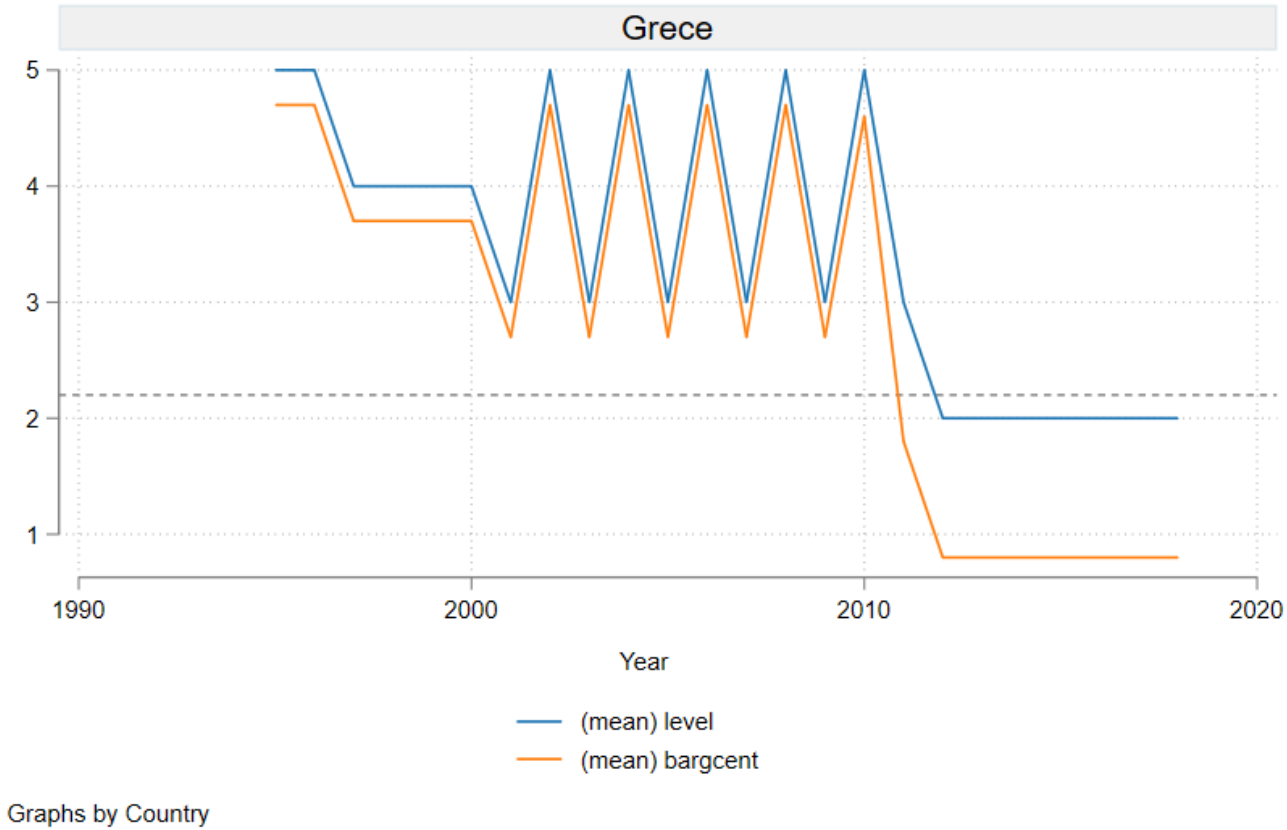

Figure 4. BARGCENT for Greece

Notes: the euro crisis took place between 2010 and 2012. Starting with the code for the dominant level of bargaining, bargcent takes three additional elements into account: the incidence of and control over additional bargaining at enterprise level; the 'space' that central or sectoral agreements assign, delegate or allow for such additional bargaining to take place; and the degree to which agreements can be perforated through the use of 'opening clauses'.

Methodology — Some Graphical Inspections

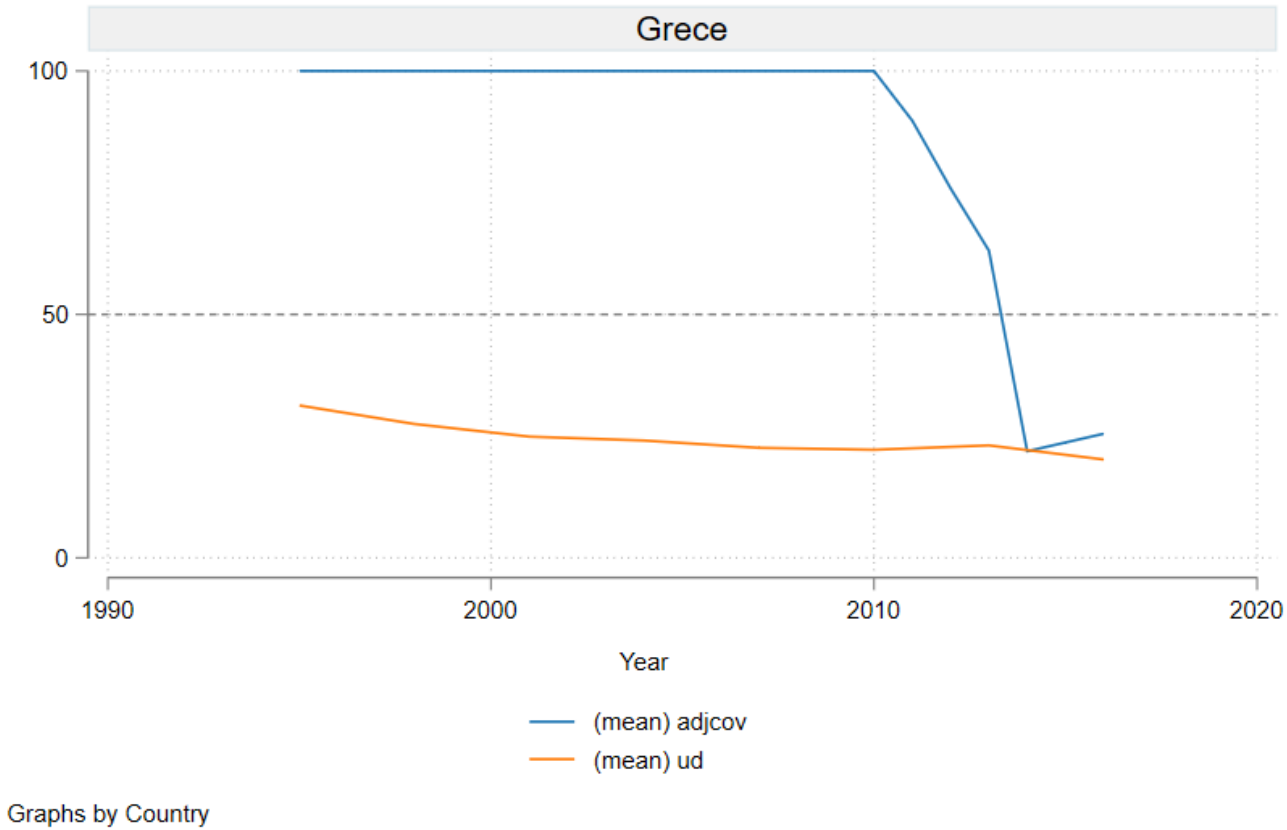

Figure 5. UD for Greece

Notes: the euro crisis took place between 2010 and 2012. Union density (ud), or union membership as a proportion of employees.

Methodology — Some Graphical Inspections

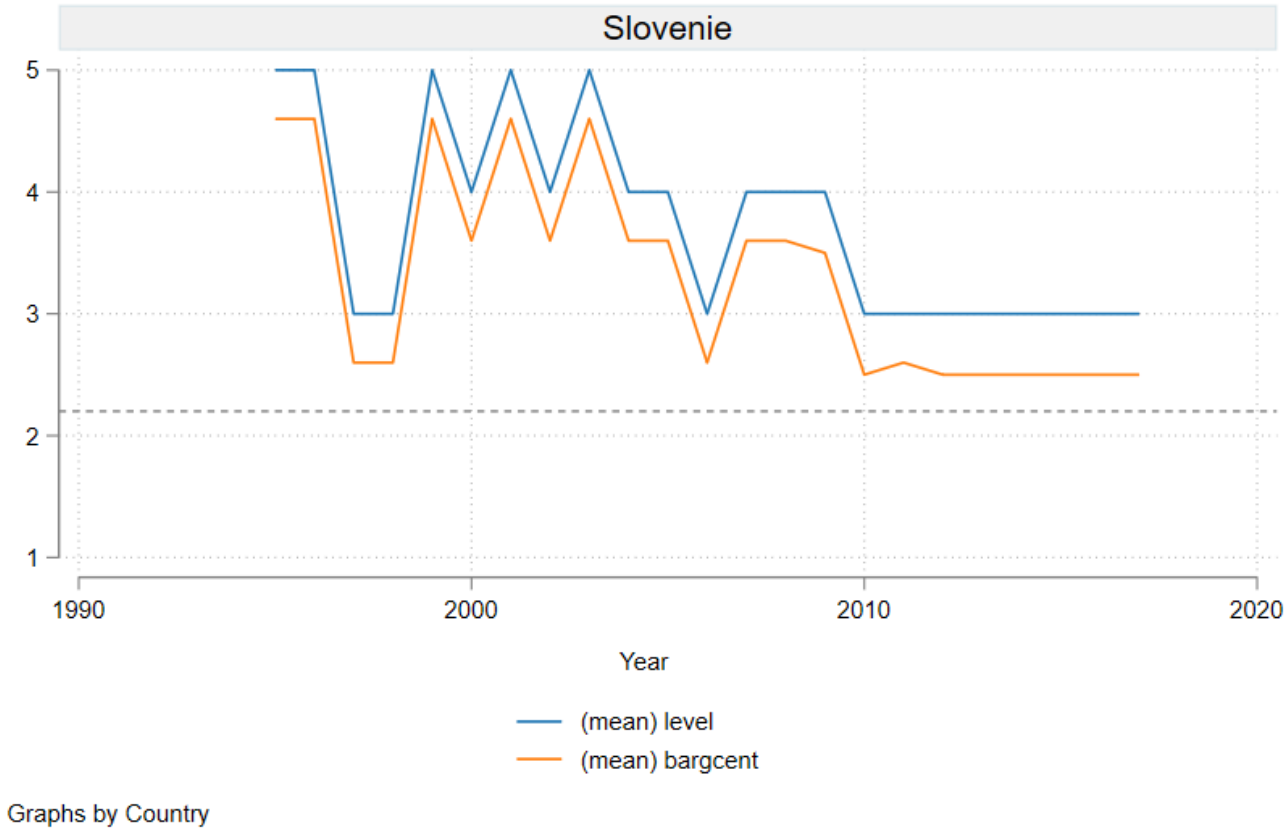

Figure 6. BARGCENT for Slovenia

Notes: the euro crisis took place between 2010 and 2012. Starting with the code for the dominant level of bargaining, bargcent takes three additional elements into account: the incidence of and control over additional bargaining at enterprise level; the 'space' that central or sectoral agreements assign, delegate or allow for such additional bargaining to take place; and the degree to which agreements can be perforated through the use of 'opening clauses'.

Methodology — Some Graphical Inspections

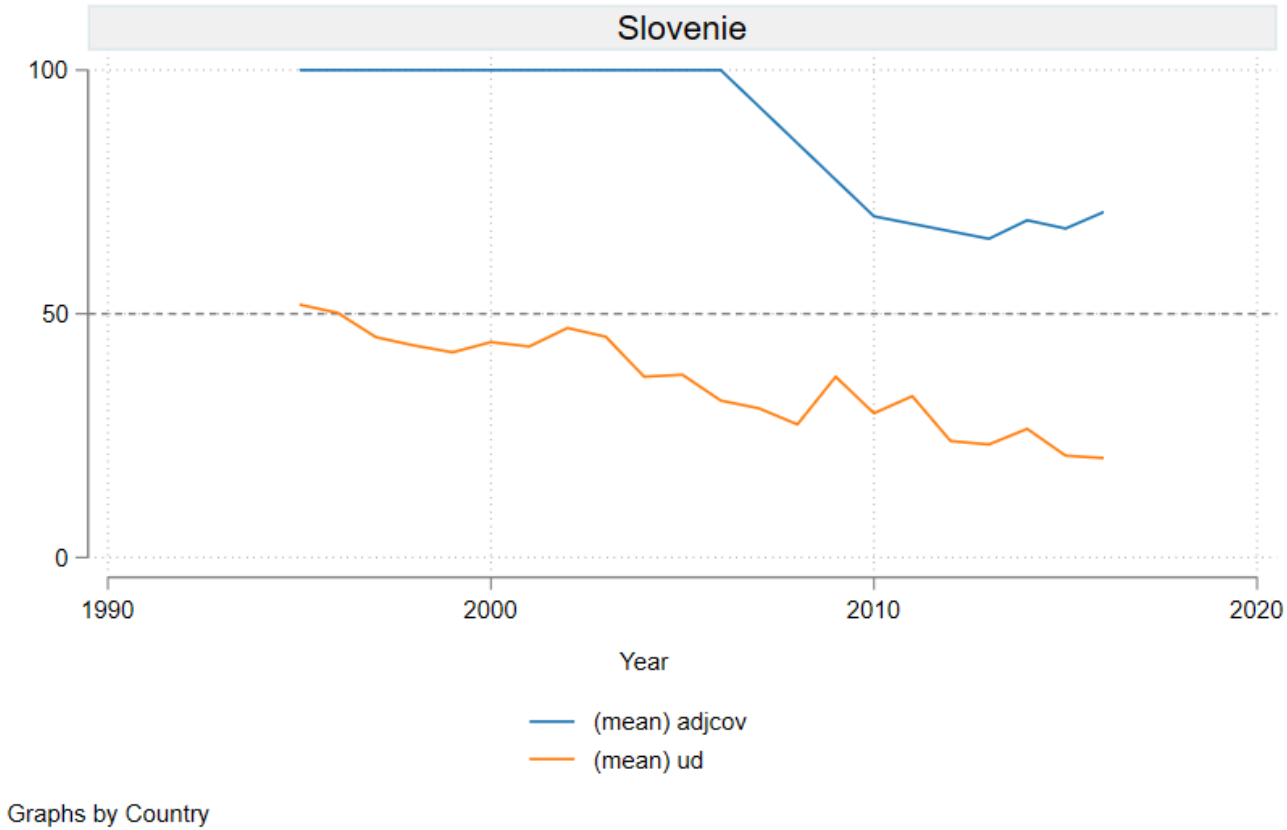

Figure 7. UD for Slovenia

Notes: the euro crisis took place between 2010 and 2012. Union density (ud), or union membership as a proportion of employees.

Methodology — Empirical investigation

Baseline specification

$$\Delta log(WAGE)_{i,c,t} = \alpha\, \Delta log(WAGE)_{i,c,t-1} + \beta\, UGAP_{i,c,t} + \theta\, BARGCENT_{c,t} + \lambda\, [UGAP_{i,c,t} \times BARGCENT_{c,t}] + \gamma\, X'_{i,c,t} + \mu_i + \nu_t + \epsilon_{i,c,t} \quad (1)$$

System-GMM (Blundell and Bond, 1998)

1. Dynamic specification of the wage Phillips Curve equation
2. Potential endogenous covariates among RHS variables

Methodology — Empirical investigation

Panel threshold model with endogenous regressors

$$\begin{aligned}\Delta log(WAGE)_{i,c,t} = {} & \chi \Delta log(WAGE)_{i,c,t-1} \\ & + \alpha_1 UGAP_{i,c,t} I(BARGCENT_{c,t} \leq \gamma) + \alpha_2 UGAP_{i,c,t} I(BARGCENT_{c,t} > \gamma) \\ & + \beta_1 X'_{i,c,t} + \mu_i + \varepsilon_{i,c,t} \end{aligned} \tag{2}$$

Kremer et al. (2013)

1. Extends the panel threshold model of Hansen (1999)
2. Potential endogenous covariates among RHS variables
3. Threshold effects: the coefficient of the curve changes after a certain level of bargaining centralization ($\alpha_1 \neq \alpha_2$)
4. We extend the analysis of the role of collective bargaining in the slope of the wage PC by investigating the existence of a threshold of the level of centralization at which the slope would become more flat ($|\alpha_1| > |\alpha_2|$)

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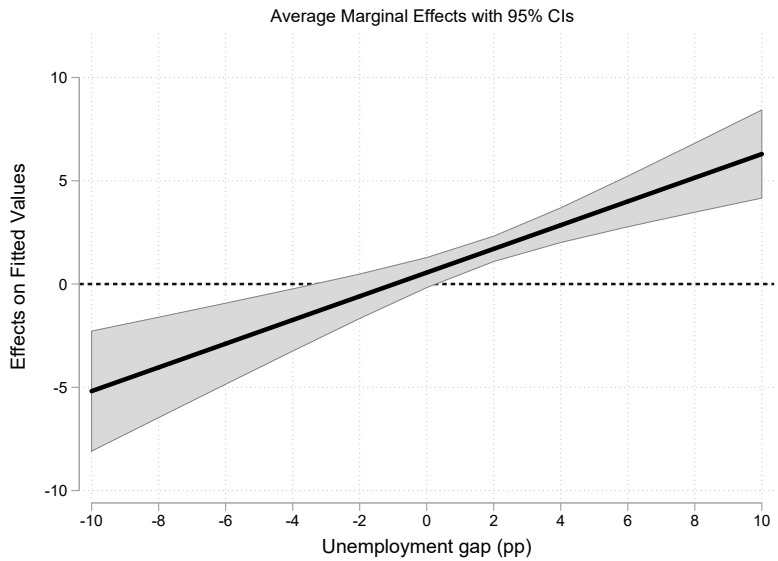
Results — Nonlinear regression

Table 3. Effects of bargaining centralization on the PC

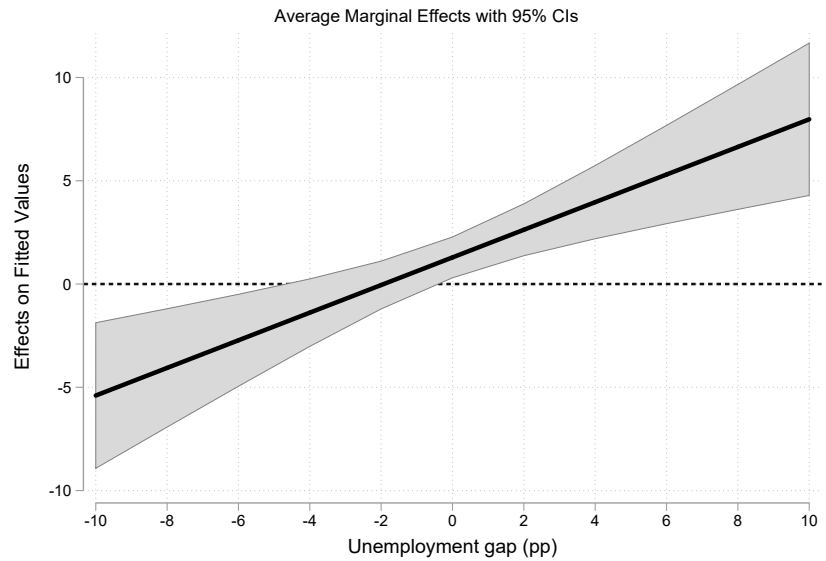
Dep. Variable: $\Delta log(WAGE)$	Coefficient	SE
UGAP	-0.289***	[0.077]
BARGCENT	0.410***	[0.130]
BARGCENT×UGAP	0.116***	[0.035]
Other control variables	YES	
Intercept	2.163*	[1.251]
Observations	3585	
Rsquared	0.596	
Year FE	YES	
Region FE	YES	
AR(2) (p-value)	0.262	
Hansen test (p-value)	0.198	

Notes: Robust standard errors are in brackets. Statistical significance levels are * p<0.10, ** p<0.05, *** p<0.01. We rely on λ to test conditional effects of the collective bargaining centralization on the contribution of the unemployment gap to the wage growth: a significant interaction means the effect of the unemployment gap is different for various values of the bargaining centralization. As the centralization of wage bargaining is observed at the national level, λ partially captures the regional heterogeneity of the interaction of unemployment gap and wage bargaining. However, we use the lowest available level of data aggregation for macroeconomic outcome (regional data) and for collective bargaining (national level). We complete the identification strategy with regional fixed effects to capture remaining unobserved regional heterogeneity (sectoral differences across regions analyzed by Imbs et al., 2011).

Results — Nonlinear regression



(a) Sectoral (Highly centralized) *versus* Company (Weakly centralized)



(b) Cross-sectoral (Highly centralized) *versus* Company (Weakly centralized)

Notes: If the confidence interval includes 0 on the y-axis, the implication is that no significant difference exists in the slope of the wage PC between the predominant bargaining level considered and the reference level (company level). If the confidence interval is above 0 on the y-axis, the slope of the wage PC is less steep; if it is below, it is steeper.

Results — Threshold regression

TABLE 3 Alternative identification strategies.

	Two-stage least squares Unemployment gap		MSA panel Unemployment rate
Method Slack/regime	**Federal funds rate**	**Wu and Xia shadow rate**	**—**
Romer and Romer shocks	**—**	**—**	**MSA, time**
based on Fixed effects	**(1)**	**(2)**	**(3)**
Panel A: Linear model			
Slope, $\hat{\kappa}$	−0.27 (0.18)	−0.30 (0.19)	-0.41^{***}(0.06)
Panel B: Threshold model			
Slopes			
Left, $\hat{\kappa}_L$	−0.65 (0.64)	−0.59 (0.54)	-0.45^{***}(0.07)
Right, $\hat{\kappa}_R$	−0.10 (0.32)	−0.06 (0.31)	-0.34^{***}(0.08)
Expected inflation			
UMSC, $\hat{\alpha}_2$	0.84^{***}(0.20)	0.84^{***}(0.19)	0.00 (0.11)
SPF, $\hat{\alpha}_1$	−0.27 (0.36)	−0.27 (0.35)	
Sum of lags, $\hat{\alpha}_0$	0.43^{**}(0.15)	0.43^{**}(0.15)	0.07^{**}(0.04)
Threshold, $\hat{\gamma}$	1.08	1.13	6.8
Test p-value (H_0: linear model)	0.55	0.51	0.94
N	168	168	1248

Note: Estimates obtained using two-stage least squares with grid search and aggregate data are shown in Columns (1) and (2). The estimation sample is 1969:Q1 through 2015:Q4 at a quarterly frequency. The dependent variable is CPI inflation. The slack and regime variable is the unemployment gap. The Romer and Romer (2004) shocks, extended by Wieland and Yang (2020), are used to instrument the gap. In Column (1), the shocks are based on the federal funds rate. In Column (2), the shocks are based on the Wu and Xia (2016)

Figure 9. Threshold effects at the regional level?

Notes: Doser et al. (2023) do not find threshold effects using regional data for the price PC in the US. However, they use the unemployment as the threshold variable, but they do not find that consumer expectations are significant in their regional regressions when region fixed effects are included. Metropolitan-level data include 24 MSAs during the period 1991:H1 through 2017:H2 at a semiannual frequency. Source: Doser et alii (2023).

Results — Threshold regression

Table 4. Dynamic threshold panel regression estimation

Dep. Variable: $\Delta log(WAGE)$	BARGCENT		BARGENT (after 2008)	
Estimated threshold	2.4		2.1	
95% Confidence Interval	[2.2; 2.4]		[1.2; 2.6]	
Impact of UGAP				
Below threshold (α_1)	-0.567***	[0.083]	-0.753***	[0.109]
Above threshold (α_2)	-0.255**	[0.113]	-0.315*	[0.182]
Other control variables	YES		YES	
Observations	3 660		2 948	
Observations above threshold	1435		1 184	

Notes: Robust standard errors are in brackets. Statistical significance levels are * p<0.10, ** p<0.05, *** p<0.01. These results provide support to our main conjecture $|\alpha_1| > |\alpha_2|$. Interestingly, after the beginning of the Great Recession in 2008, the wage PC is steeper for low values of BARGCENT (inferior to 2.1), as we can see in column 2. Bootstrap p-value for the threshold in column 1 indicates rejection of the null of no threshold at the 1 percent level.

Final thoughts

To conclude

- Provides an complementary explanation about the curve's flattening in the European case (labor market specificity) relatively to the US
- Empirical investigation to understand the role of these specific DWNR that identifies nonlinearities and the existence of a threshold in the centralization of bargaining
- After this threshold, the curve becomes flatter due to one form of DWNR (centralization of wage bargaining)
- Understanding of the interaction of monetary policy and labor market characteristics (different slopes according to the level bargaining centralization)
- Possible extensions: the role of Union Density on workers productivity and Time-varying Wage Expectations in context of high inflation