Growth, unemployment and wages in EU countries after the Great Recession: The Role of Regulation and Institutions

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Abstract

In this paper, I apply a hierarchical Bayesian non-parametric curve fitting model to analyse the economic and labour market developments in EU countries after the Great Recession. The model identifies four latent classes that represent distinct patterns of the labour market and economic development after the Great Recession. I present evidence that countries in the different classes systematically differ by labour market regulation and quality of institutions. This demonstrates the relevance of institutions and regulation for resilience of economies to shocks.

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1. Introduction

After 2008, the EU countries recorded an economic downturn that resulted in a deterioration of the labour market conditions. However, the depth of the downturn and its repercussions in the area of unemployment and wages differed substantially across countries. The heterogeneity of the initial downturn in economic activity was affected by a range of exogenous factors, such as external demand and sectoral composition, but the subsequent economic developments and the responses on the labour market were undoubtedly also affected by domestic conditions, especially economic policy and the quality of institutions.

In this paper, I investigate the patterns of macroeconomic experience of European countries during and after the Great Recession. To do this, I propose and apply a hierarchical Bayesian non-parametric curve fitting model to analyse the economic and labour market developments in EU countries during the period of interest. The estimated model identifies four latent classes that represent distinct patterns of the labour market and economic development.

I present evidence that countries in the different classes systematically differ by labour market regulation and quality of institutions. This demonstrates the relevance of institutions and regulation for resilience of economies to shocks.

The rest of the paper is organized as follows. Next Section 2 describes the related literature. Section 3 describes the econometric model and data used. Section 4 describes the latent classes (clusters) identified by the model. Section presents the evidence that countries in distinct classes systematically differ by regulation and institutions. The last section concludes.

2. Related Literature

There is an interesting research investigating how structural policies and quality of institutions are able to affect the resilience of countries to shocks.

Blanchard and Wolfers (2000), for example, investigate the resilience of the labour market to shocks and evaluate on a panel of European countries the role of institutions in shock propagation on unemployment dynamics. They find that shocks have a larger and more persistent effect in countries with poor labour market institutions. Following this study, the interplay between shocks and institutions for unemployment were investigated e.g. by Smith and Zoega (2004), Rumler and Scharler (2009) or Alexandre et al. (2010). Rumler and Scharler (2009) find that countries characterized by high union density tend to experience more volatile movements in output and unemployment. Alexandre et al. (2010) investigate the interplay between labour market flexibility and resilience to shocks on a panel of Portuguese industries. They find that more flexible industries are more prone to external (exchange rate) shocks.

Duval et al. (2007) find that structural policies affect both the strength and persistence of the effects of outside exogenous output shocks. They also find that effectiveness of macroeconomic stabilisation policies is influenced by structural policy settings. The corresponding findings on the labour market (i.e. that institutions affect the strength and persistence of exogenous shocks) have been confirmed by Furceri and Mourougane (2009). Also Ziemann (2013) finds that some structural indicators (such as employment protection legislation) affect macroeconomic stability.

Biroli et al. (2010) find that the degree of labour and goods market regulation affects the extent and the speed of adjustment of countries using the real exchange rate. Indicators of product and labour market regulations matter for the inertia of competitiveness indicators. Regulations appear to matter also for the extent to which common shocks may have country-specific effects on price competitiveness.

3. Econometric Model

3.1 Model formulation

In this part of the paper, I describe the model used to describe patterns of economic and labour market developments in E.U. countries after the year 2008. Mixture models are a convenient approach to model the heterogeneity across units (Frühwirth-Schnatter (2006)) and are used also in this paper. It is assumed that there are $\mathscr{K}$ latent classes of countries. Countries in a given class exhibit the qualitatively similar patterns, while these patterns are distinct across classes.

Let y_{it} be a vector of variables of interest for country i at time t. It is then assumed that conditional on being in the latent class κ, the distribution of the vector y_{it} is multivariate normal:

$$y_{it}(i \in \kappa) \sim N(\mu_{\kappa,t}, \Sigma_{\kappa,t}), \tag{1}$$

where $\mu_{\kappa,t}$ is the mean value for the latent class κ at time t, and $\Sigma_{\kappa,t}$ is the corresponding covariance matrix. The mean and the covariance matrix are modelled as non-parametric Bayesian curves. In particular, I assume that:

$$\mu_{\kappa,t} = \mathscr{B}(t)\beta_{\kappa}, \tag{2}$$

where $\mathscr{B}(t)$ is the vector of basis functions (such as B-splines or orthogonal polynomials) that are dense in the usual $\mathscr{L}^2(R)$ space and β_{κ} are coefficients to be estimated. The covariance matrix is modelled analogously.

The apriori probabilities of latent classes $\kappa = 1, \ldots \mathscr{K}$ are denoted as π_{κ}. The goal of the inference is to estimate the parameters β_{κ}, the curves $\mu_{\kappa,t}$, $\Sigma_{\kappa,t}$, the apriori probabilities $\{\pi_{\kappa}\}_{\kappa=0}^{\mathscr{K}}$ and the posterior allocations $\pi_{i,\kappa} = \text{Prob}(i \in \kappa | \text{ Data})$, i.e., probabilities that country i belongs to the class κ.

Later, I extend the model and allow the probabilities to depend on observed characteristics such as indexes of regulation or quality of institutions. Let z_i be a vector of such indexes for country i. Then, the apriori probabilities are modelled using a logit model as:

$$\pi_{i,\kappa} = \frac{\exp(\delta_{\kappa,0} + \delta_{\kappa} z_i)}{\sum_{l=1}^{\mathscr{K}} \exp(\delta_{l,0} + \delta_l z_i)}, \tag{3}$$

where δ are coefficients. For identification reasons, I normalize $\delta_{\mathscr{K}} = 0$.

3.2 Data

To estimate the model formulated in the previous subsection, I consider three time series.

The first series is the real GDP relative to the year 2007 $\mathscr{Y}_{it}$ defined as:

$$\mathscr{Y}_{it} = 100 \log(Y_{it}/Y_{i,2007}),$$

where Y_{it} is the real GDP in year t in country i.

The second series is the unemployment relative to the same year:

$$\mathscr{U}_{it} = u_{it} - u_{i,2007},$$

where u_{it} is the unemployment rate in country i in the year t.

The third series is the growth of the labour share relative to the same base year 2007:

$$\mathscr{W}_{it} = 100\log(W^n_{it}/Y^n_{it}/W^n_{i,2007}/Y^n_{i,2007}),$$

where W^n_{it} is the nominal volume of compensation to employees and Y^n_{it} is the nominal GDP.

The source of all data for all countries is Eurostat and the dataset spans the years 2005Q1-2016Q4.

4. Estimation Results

Using the model outlined in Section 3, I identify four distinct patterns of economic and labour market development across E.U. countries.

Countries in **the first latent class** recorded an initial decline in GDP between 2008 and 2010 of 4.5% on average, associated with a rise in the unemployment rate of 3 percentage points on average. Over time, GDP growth resumed and unemployment, which was lower in all these countries after the crisis ended in 2016 than when it started in 2008, subsequently started to fall. Wage growth in this group of countries was subdued, broadly reflecting the usual cyclical pattern (Bruha and Polansky (2015)). At the start of the period under review, the average wage rose faster than whole-economy labour productivity, a phenomenon typical of advanced economies (a countercyclical labour share). In the period that followed, labour productivity started rising again and caught up with (or slightly overtook) wage growth. Typical representatives of countries in the first group are Germany, the Czech Republic, Slovakia, and the United Kingdom.

The second latent class of countries comprises Ireland, Lithuania, Latvia and Estonia, i.e. countries that were hit by a severe adverse shock in 2008 – 2010 and recorded a significant initial drop in GDP accompanied by a rapidly rising unemployment rate. The economic situation of these countries started to improve after 2011. This was reflected in a decline in unemployment, which, however, had still not fallen below the 2008 level by the start of 2016. Since 2010, labour productivity in this group of countries has been rising much faster than the average wage (which has been recording weakly positive or even negative growth). This is another characteristic in which these economies differ from the rest. We can therefore conclude that these countries overcame the crisis also thanks to subdued growth in wages, which rose more slowly than labour productivity and even declined at the start of the period under review. This helped reduce the unemployment rate from its initial high levels.

The third latent class consists of 'stressed countries' (Spain, Greece, Italy, Cyprus, Finland and Denmark), where the unemployment rate was higher at the start of 2016 than in 2008 (by more than 2 percentage points) and the GDP level was lower. Their labour markets did not start to significantly improve after 2011. In addition, these countries recorded rapid wage growth, which significantly outpaced labour productivity growth on average.

Lastly, **the fourth class** comprises France, Belgium, Austria and Sweden. In these countries, GDP has now reached the pre-crisis level, but unemployment is higher in 2016 than in 2008, albeit by less than 2 percentage points. Some countries cannot be categorized so clearly.

It is noteworthy that there are differences between the groups of countries in terms of hours worked and the unemployment rate in the age category of up to 25 years, i.e. in variables not used for classification. The first group is the only one where the number of hours worked was higher in 2016 than in 2008 and the youth unemployment rate did not rise markedly. In the second group, by contrast, the total number of hours worked is much lower in 2016 than in 2008. Unlike in the third group, however, the situation is improving. The similar comment applies for youth unemployment.

The differences between the latent classes are described using the sample moments. Table 1 reports the sample mean and median for the real GDP growth in various years after 2008 relative the the year 2007: $\mathscr{Y}_{it} = 100\log(Y_{it}/Y_{i,2007})$. Apparently, the countries in the first latent class started to grow very soon after the Great Recession, while the initial fall as largest in the third class. That initial fall has been then reversed. The results can be graphically illustrated on Figure 4, where the GDP growth $\mathscr{Y}_{it}$ is displayed for individual countries. I use colors to graphically distinguish various latent classes.

Table 1: Real GDP (growth relative to the year 2007)

Real GDP		2008	2009	2010	2012	2013	2016
Class 1	mean	1.76	-1.77	1.86	5.31	6. 71	16.04
	median	1.16	-2.31	-0.19	3.01	3.89	12.96
Class 2	mean	-2.68	-15.47	-15.25	-7.83	-5.54	8.40
	median	-4.09	-16.10	-15.36	-7.89	-6.58	4.28
Class 3	mean	1.28	-3.47	-3.79	-9.38	-12.14	-8.15
	median	1.11	-4.64	-4.36	-6.49	-8.21	-2.80
Class 4	mean	1.29	-3.94	-2.49	-1.95	-1.10	4.56
	median	0.44	-3.94	-2.06	-1.25	-0.79	5.00

A similar pattern that holds for real output applies also for unemployment. Table 2 show the evolution of the difference of unemployment relative to the pre-crisis year 2007 $\mathscr{U}_{it} = u_{it} - u_{i,2007}$. Only countries in first class have on average unemployment lower in 2016 than in 2007. Graphically, it is illustrated on Figure 4. A very similar pattern holds also for the youth unemployment rate, as can be seen from Figure 4.

Table 2: Unemployment (difference to the year 2007)

Δ Unemployment (%)		2008	2009	2010	2011	2012	2013	2014	2015	2016
Class 1	mean	-0.82	0.48	0.83	0.30	0.49	0.77	0.37	-0.21	-0.91
	median	-0.78	0.45	0.37	0.08	0.53	0.95	0.83	0.23	-1.35
Class 2	mean	1.56	9.41	12.11	9.79	8.39	6.45	5.20	3.79	3.18
	median	1.65	9.34	12.83	10.06	9.06	6.68	5.65	4.31	3.41
Class 3	mean	0.46	2.99	4.60	6.46	9.87	12.05	11.60	10.27	8.87
	median	-0.27	1.45	2.40	3.98	7.98	11.95	12.28	10.98	9.15
Class 4	mean	-0.26	1.41	2.14	2.22	2.69	2.87	2.10	1.65	0.92
	median	-0.41	1.35	2.01	2.01	2.23	2.50	2.09	2.39	1.96

Table 3 shows the growth rate of the labour share relative to the year 2007: $\mathscr{W}_{it} = 100\log(W^n_{it}/Y^n_{it}/W^n_{i,2007}/Y^n_{i,2007})$. Positive numbers mean that wages grew more rapidly than the output. The countries in the second latent class are countries were wage growth was much slower than the output growth and this might help to overcome the initial shock.

Table 3: Labour share (difference to the year 2007)

Δ Labour share (%)		2008	2009	2010	2011	2012	2013	2014	2015	2016
Class 1	mean	2.54	5.04	3.16	3.13	4.49	4.69	4.02	3.42	3.69
	median	2.23	5.00	3.97	3.12	4.45	4.89	4.24	2.72	3.34
Class 2	mean	7.49	7.26	0.16	-4.85	-5.10	-4.04	-3.50	-5.62	-2.68
	median	8.19	6.64	-0.24	-4.31	-4.84	-4.00	-4.13	-0.51	3.04
Class 3	mean	2.34	6.46	6.48	5.30	4.13	1.56	0.28	0.28	1.20
	median	2.25	5.81	7.44	4.95	3.98	3.00	1.11	1.02	2.04
Class 4	mean	1.61	3.88	1.44	-0.20	-0.37	-1.22	-1.52	-2.16	-0.52
	median	1.35	3.45	2.12	0.65	-0.58	-0.90	-2.04	-1.64	-0.43

Interestingly, countries systematically differ also in other characteristics that have not been used for classification. Table 4 shows the change in hours worked relative to the year 2007 across the four latent classes. Interestingly, only the countries in the first latent class that tend to have higher hours worked in 20015 and 2016 than in 2008. Other countries (especially in latent class 2 and 3) still have lower hours worked after the crisis than before. Graphically, this can be seen on Figure 4.

Table 4: Hours worked (difference to the year 2007)

Δ Hours		2008	2009	2010	2011	2012	2013	2014	2015	2016
Class 1	mean	2.54	0.38	0.68	1.91	2.05	2.19	3.89	5.36	7.26
	median	2.71	0.30	0.30	1.17	1.02	0.15	1.76	3.17	3.99
Class 2	mean	0.57	-13.82	-18.72	-17.73	-17.28	-15.84	-14.96	-12.99	-11.36
	median	-0.76	-12.07	-18.32	-17.28	-16.18	-14.98	-14.75	-12.60	-10.97
Class 3	mean	1.91	-0.76	-2.92	-5.33	-9.09	-12.29	-12.61	-11.02	-9.07
	median	1.05	-0.72	-4.39	-4.30	-6.85	-9.50	-10.91	-9.19	-6.90
Class 4	mean	0.34	-2.47	-4.46	-4.15	-6.15	-6.65	-5.45	-4.76	-3.54
	median	0.48	-2.47	-3.02	-1.89	-3.52	-4.13	-4.38	-3.85	-2.56

Figure 1: Dynamics of the Real GDP across clusters

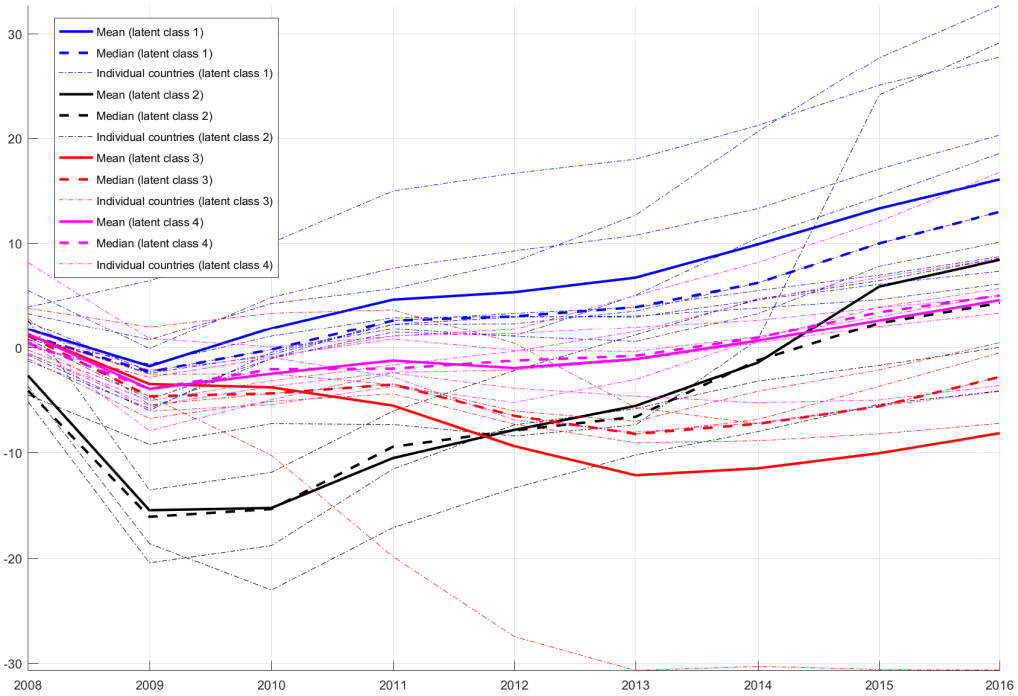


Figure 2: Dynamics of unemployment rate

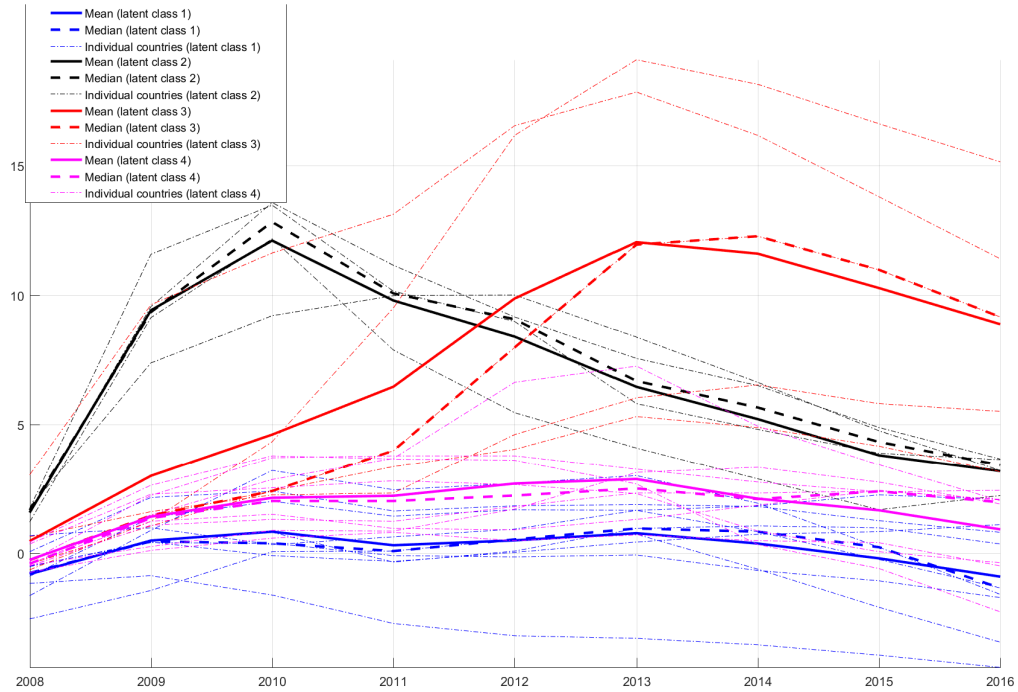


Figure 3: Dynamics of hours worked

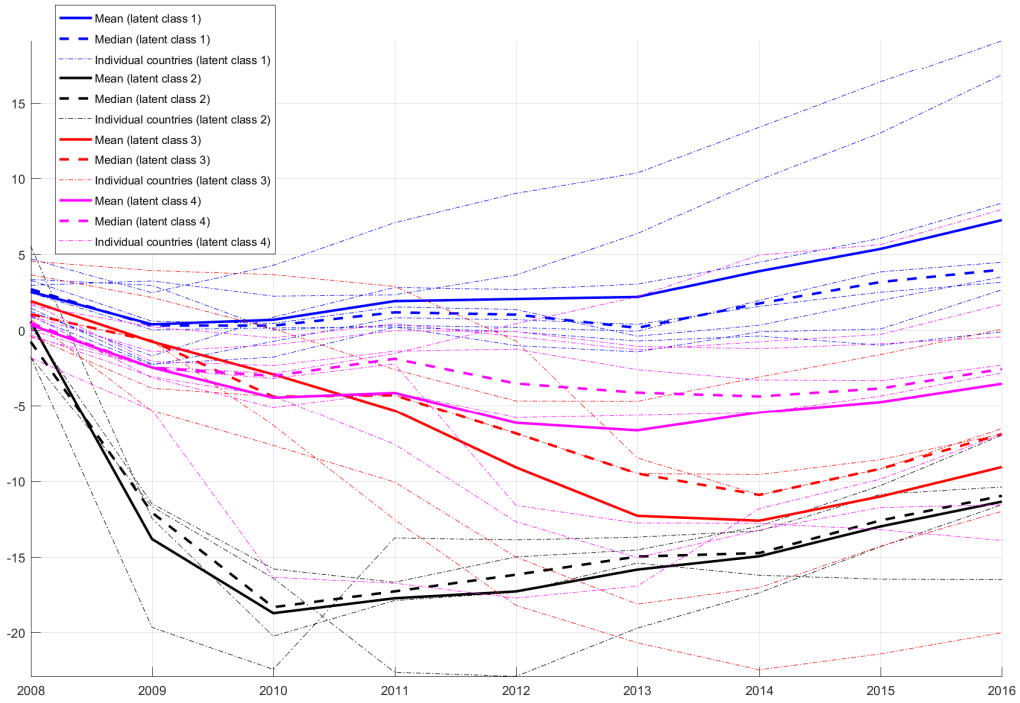
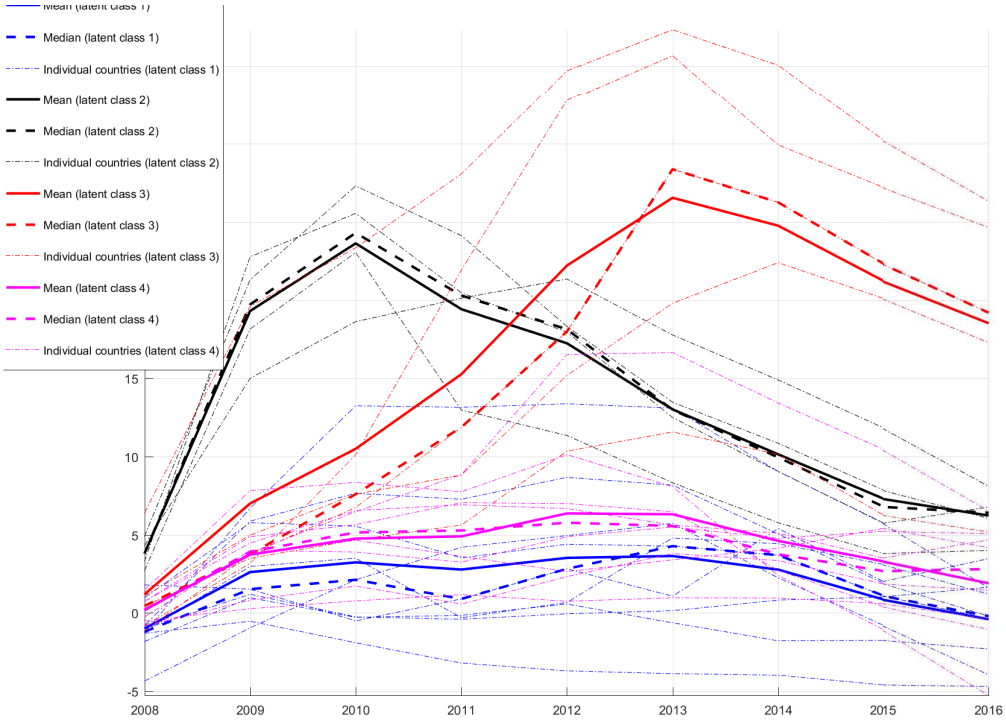


Figure 4: Dynamics of youth unemployment rate



5. The Role of Institutions

Labour market regulation and institution quality affect not only the levels of macroeconomic variables, but also the economy's ability to absorb shocks. It is therefore natural to inquire whether the latent classes of countries identified above systematically differ along these margins.

It turns out that indeed, there are clear differences in these characteristics between the groups of countries identified above. I consider the employment protection legislation index (constructed by the OECD) and two subindexes of the WorldWide Governance Indicator (constructed by the World Bank) and report their differences across countries in the latent classes. The following table displays sample means of selected indexes for latent classes identified above.

Table 5: Institutions for groups of countries (sample means)

	Employment protection legislation		Regulatory quality		Government effectiveness	
	2008	2013	2008	2013	2008	2013
Latent class 1	2.24	2.03	1.32	1.22	1.18	1.13
Latent class 2	2.01	1.60	1.37	1.45	0.96	1.15
Latent class 3	2.44	2.24	1.33	1.08	1.27	1.15
Latent class 4	2.44	2.42	1.54	1.47	1.67	1.60
All countries	2.44	2.23	1.26	1.17	1.12	1.13

In particular, a decrease in the EPL index and an improvement in the quality of state administration are apparent in the second group, i.e. in countries which had to overcome a strong adverse shock to economic activity. At the same time, it can be seen that the countries in the third and fourth groups (i.e. countries experienced worse labour market developments) have higher EPL index values on average than the other countries.

6. Conclusion

In this note, I apply a hierarchical Bayesian non-parametric model to investigate the patterns of economic and labour market development in the E.U. countries. The model is used to identify four latent patterns of the development. Countries in latent classes systematically differ in the initial downturn of GDP, the increase in unemployment, in the wage dynamics and in the number of hours worked. They also systematically differ in whether (and when) the initial downturn was overcome.

Moreover, countries in the distinct latent classes differ in indexes of the quality of institutions and of labour market regulations. Quality of institutions seems therefore important to macroeconomic stability and to resilience of economies to shocks.

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