Dependence of Unemployment Change on Selected Economic Factors: Panel Data Evidence

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Abstract

Unemployment, serious macroeconomic problem, varies depending on a multitude of different factors. Politicians and economists try to boost economic activity and fight unemployment using state employment aid and various policies. This study aims to investigate efficiency of choosing policies and to analyse unemployment trends in EU28, Norway, Japan and USA for years 2001-2010. The paper focuses on the relation of unemployment and selected economic factors (foreign direct investment flows as % of GDP, public expenditure on education as % of GDP, public expenditure on labour market policies as % of GDP and inflation rate). Thus, our panel data consist of 30 countries and 5 variables for 2001-2010. Our regression analysis revealed that foreign direct investment had no impact on unemployment, while public expenditure on education and inflation had a negative influence on employment. Public expenditure on labour market had a positive impact on employment after three to four years after its realization.

Keywords: global unemployment; panel data analysis; Fixed Effects Model (FEM)

JEL Classification: E24, C01, C23

1 Introduction

Unemployment presents a serious macroeconomic problem. Economic theories as well as previous empirical studies have identified a number of various determinants of unemployment, which include for example employment protection legislation, unemployment benefits, taxes, trade union bargaining power and the structure of collective bargaining, anti-competitive product market regulation, minimum wages and housing policies [2], [3], [4].

There probably exist many others factors in relation or having impact on the unemployment. Relying on some studies, it can be concluded there also exist certain association between unemployment and foreign direct investments (FDI) [4], [8], [15]. Last two studies found a positive relationship between unemployment rates and FDI, thus suggest that high unemployment attracts these investments. The question is if it works also to the contrary. Does the inflow of FDI to the country reduce also the unemployment? Schmerer [15] tested the hypothesis that FDI-receiving countries tend to have lower rates of unemployment, whereas an increase in FDI-outflows increases equilibrium unemployment. The results of this study support the model where net-FDI (difference between FDI inflows and outflows) is robustly associated with lower rates of aggregate unemployment.

According to Lauer [12], the level of educational attainment is expected to be a strong determinant of the individuals´ employability in so far as it constitutes an essential part of their human capital. There is also evidence that having more education helps people to keep or change their jobs during the recession [13]. For example, between the start of the downturn in 2008 and 2010, overall unemployment rates increased from 8.8% to 12.5% for people without an upper secondary education, and from 4.9% to 7.6% for people with an upper secondary education (on average across the OECD countries), but for people with higher education remained much lower, rising from 3.3% to 4.7% during this same period. Moreover, there exists

a certain presumption that the most educated people tend to be in countries where spending on all levels of education is among the highest.

In the context of unemployment, also the labour market policies are often discussed. Many countries try to get unemployed back into work through various forms of assistance which are generally called active labour market policies, even though the general view is that such policies can on balance be helpful, but need to be carefully designed and very often do not provide a very good return on the money spent [10]. Moreover, passive labour market policies, such as unemployment benefits, may affect the behaviour of the unemployed and in particular their intensity of job search and how selective they are over the jobs they are willing to accept, as there is an evidence that higher levels of benefits are associated with higher unemployment and in particular that countries with long duration benefit entitlement tend to have longer durations of unemployment [10].

The relationship between the unemployment and inflation rate is well known through the Phillips curve which says that inflation tends to be low when unemployment is high and vice versa. According to Fitzgerald et al. [7] if this relationship is stable it holds regardless of changes in the economic environment and policymakers might be able to trade off increases in inflation to achieve lower unemployment, or the inverse. The results of this study suggest that a 1-percentage-point-lower unemployment rate is associated with higher inflation of 0.3 percentage points over the next year, and the stability of the relationship suggests that it might provide a viable tool for policymakers.

Flaig and Rottmann [6] showed that the magnitude of the effects of institutions on unemployment differs considerably between countries and that higher centralization of wage negotiations decreases unemployment. Aurangzeb and Asif [1] found out that unemployment rate is affected by inflation, gross domestic product, exchange rate and the increasing rate of population. Boršič and Kavkler [5] study influence of age, gender, level of education, and region on unemployment. They suggest that it takes longer for female and older unemployed persons to find a job and on average the duration of unemployment decreases with increasing level of education. Moreover unemployed persons with a professional college degree or a bachelor's degree are better off than unemployed persons with a master's degree. Lalive [11] targeted program that extends the maximum duration of unemployment benefits from 30 weeks to 209 weeks in Austria. His results indicate that the duration of job search is prolonged by at least 0.09 weeks per additional week of benefits among men, whereas unemployment duration increases by at least 0.32 weeks per additional week of benefits for women. His findings are consistent with a lower early retirement age applying to women. Gabrisch and Buscher [9] demonstrated that a high trend rate of productivity and a high unemployment intensity of output growth have been observable since 1998 in post-communist countries. Authors conclude that labor market rigidities do not play an important role in explaining high unemployment rates. Özel et al. [14] showed that while the productivity and economic growth variables have significant and strong effects on the reduction of unemployment in the pre-crisis period, this effect of productivity becomes insignificant and small after the crisis whereas the effect of economic growth as a decreasing effect over unemployment continues and its impact level rises.

The present paper investigates unemployment trend in EU28, Norway, Japan and USA for a period 2001-2010 and analyzes association between unemployment and selected economic factors, such as foreign direct investment, public expenditure on education, public expenditure on labour market policies and inflation rate. The aim of this study is to examine the relationship between unemployment and particular factors and thus to better understand the joblessness in the developed world. Data and methodology are described in following section, empirical results in section three and its subsections, conclusion and discussion are in final section.

2 Material and Methods

The data in this paper cover 30 countries and the 10 years period from 2001 to 2010. Data source was Eurostat and OECD. We use panel data regression with five variables. Dependent variable is unemployment rate *(UN)* and independent variables are: foreign direct investment flows as a % of GDP *(FDI)*, public expenditure on education as a % of GDP *(EDUC)*, public

expenditure on labour market policies as a % of GDP *(LMP)*, harmonized indices of consumer prices *(HICP)*. All data were collected on the annual basis for EU28, plus Norway, USA and Japan. In total, we run five consecutive regressions. First regression aims to study direction and degree of influence of explanatory variables on variable in given year [see equation (1)] and four other regressions [see equations (2), (3), (4), and (5)] aim to study also lagged effects.

In our analysis, we apply a fixed effect model, because of various reasons. Firstly, we assume that each country is autonomous, therefore the entity's error term and the constant (which captures individual characteristics) shouldn't be correlated with the others. Another argument for fixed effect model is that values in our data set are not stochastic. Finally, a number of observations for a time component of our panel data is wide enough and there is not a lot of objects in the cross sectional component of data panel. Based on the above, we are likely to get a small difference between values of the parameters, which we estimated using a fixed effect model and random effect model. In this case, it is preferable to use the fixed effect model. Our model has the following equation:

$$UN_{it} = \alpha_0 + \beta_1 FDI_{it} + \beta_2 EDUC_{it} + \beta_3 LMP_{it} + \beta_4 HICP_{it} + \mu_i \quad (1)$$

where:

UN = unemployment rate measured in %
FDI = direct foreign investment flows as % of GDP
EDUC = public expenditure on education as a % of GDP
LMP = public expenditure on labour market policies as a % of GDP
HICP = harmonized indices of consumer prices
α_0 is unobserved heterogeneity
μ_i is the error term

In equation (1) subscript *i* stands for countries and subscript *t* stands for time.

3 Results

Table 1 shows results of fixed effects regression, already without statistically insignificant variable FDI.

Table 1. Fixed model effect

	Coefficient	Std. Error	t-ratio	p-value	
Const	0.312597	1.92729	0.1622	0.87127	
EDUC	0.677397	0.375876	1.8022	0.07261	*
LMP	3.09956	0.396156	7.8241	<0.00001	***
HICP	-0.173554	0.0514883	-3.3707	0.00086	***
Mean dependent var	7.812903	S.D. dependent var		3.714847	
Sum squared resid	1147.805	S.E. of regression		2.039292	
R-squared	0.730829	Adjusted R-squared		0.698646	
F(33, 276)	22.70825	P-value(F)		1.24e-60	
Log-likelihood	-642.7713	Akaike criterion		1353.543	
Schwarz criterion	1480.586	Hannan-Quinn		1404.329	
rho	0.740026	Durbin-Watson		0.401303	

Source: Authors

A quick glance at the results reveals that increase in inflation (HICP) by 1% results in decrease of unemployment by 0.17% and the rise of public expenditure on education (EDUC) induces growth of unemployment rate. A crucial variable in this analysis is public expenditure on labour market policies (LMP), which causes unemployment increase by 3.09% in the given year.

3.1 One Year Lag

In this subchapter we present regression analysis with lagged explanatory variables to examine delays in employment policies. Regression model has following equation:

$$UN_{it} = \alpha_0 + \beta_1 FDI_{it-1} + \beta_2 EDUC_{it-1} + \beta_3 LMP_{it-1} + \beta_4 HICP_{it-1} + \mu_i \quad (2)$$

where:

UN = unemployment rate measured in %
FDI = direct foreign investment flows as % of GDP
EDUC = public expenditure on education as a % of GDP
LMP = public expenditure on labour market policies as a % of GDP
HICP = harmonized indices of consumer prices
α_0 is unobserved heterogeneity
μ_i is the error term

In equation (2) subscript *i* stands for countries, subscript *t* stands for the present year and subscript *t-1* for the yesteryear. Table 2 depicts the results of regression, where statistically non-significant variables are not present.

One can see that lagging variables by one year brings the same impact of explanatory variables on unemployment, thus employment policies (LMP) are not efficient after one year of its adoption.

Table 2. Fixed model effect – one year lag

	Coefficient	Std. Error	t-ratio	p-value	
Const	-5.67414	1.94223	-2.9215	0.00381	***
EDUC_1	1.90431	0.395609	4.8136	<0.00001	***
LMP_1	2.45304	0.461939	5.3103	<0.00001	***
Mean dependent var	7.773118	S.D. dependent var		3.561135	
Sum squared resid	1058.659	S.E. of regression		2.074486	
R-squared	0.699715	Adjusted R-squared		0.660653	
F(32, 246)	17.91314	P-value(F)		1.18e-47	
Log-likelihood	-581.9136	Akaike criterion		1229.827	
Schwarz criterion	1349.657	Hannan-Quinn		1277.897	
rho	0.647353	Durbin-Watson		0.583851	

Source: Authors

3.2 Two Years Lag

Here we present an analysis of two years lags of explanatory variables. Regression model has following equation:

$$UN_{it} = \alpha_0 + \beta_1 FDI_{it-2} + \beta_2 EDUC_{it-2} + \beta_3 LMP_{it-2} + \beta_4 HICP_{it-2} + \mu_i \quad (3)$$

where:

UN = unemployment rate measured in %
FDI = direct foreign investment flows as % of GDP
EDUC = public expenditure on education as a % of GDP
LMP = public expenditure on labour market policies as a % of GDP
HICP = harmonized indices of consumer prices
α_0 is unobserved heterogeneity
μ_i is the error term

In equation (3) subscript *i* stands for countries, subscript *t* stands for the present year and subscript *t-2* for the year before yesteryear. Table 3 depicts the results of regression.

Table 3. Fixed model effect – two years lag

	Coefficient	Std. Error	t-ratio	p-value	
const	-0.996583	2.49674	-0.3992	0.69018	
HICP_2	0.288695	0.0628411	4.5940	<0.00001	***
EDUC_2	1.48954	0.473598	3.1452	0.00189	***
Mean dependent var	7.720161	S.D. dependent var		3.426982	
Sum squared resid	1080.292	S.E. of regression		2.241566	
R-squared	0.627591	Adjusted R-squared		0.572162	
F(32, 215)	11.32255	P-value(F)		5.06e-31	
Log-likelihood	-534.3700	Akaike criterion		1134.740	
Schwarz criterion	1250.683	Hannan-Quinn		1181.414	
rho	0.690944	Durbin-Watson		0.589060	

Source: Authors

Inspecting Table 3 reveals new facts. Increase of inflation (HICP) induces slight rise of unemployment and public expenditure on education (EDUC) cause increase of unemployment.

3.3 Three Years Lag

In this subsection, regression with three years lags is presented. There is a following equation for the regression model:

$$UN_{it} = \alpha_0 + \beta_1 FDI_{it-3} + \beta_2 EDUC_{it-3} + \beta_3 LMP_{it-3} + \beta_4 HICP_{it-3} + \mu_i \quad (4)$$

where:

UN = unemployment rate measured in %
FDI = direct foreign investment flows as % of GDP
EDUC = public expenditure on education as a % of GDP
LMP = public expenditure on labor market policies as a % of GDP
HICP = harmonized indices of consumer prices
α_0 is unobserved heterogeneity
μ_i is the error term

In equation (4) subscript *i* stands for countries, subscript *t* stands for the present year and subscript *t-3* for the time period three years ago. Table 4 depicts the results of regression. Only variables with the statistical significance of a regressive model are presented in Table 4.

Table 4. Fixed model effect – three years lag

	Coefficient	Std. Error	t-ratio	p-value	
const	10.0338	1.11861	8.9698	<0.00001	***
LMP_3	-2.19877	0.770202	-2.8548	0.00480	***
HICP_3	0.227729	0.0756461	3.0105	0.00297	***
Mean dependent var	7.654378	S.D. dependent var		3.361849	
Sum squared resid	1006.662	S.E. of regression		2.339014	
R-squared	0.587643	Adjusted R-squared		0.515929	
F(32, 184)	8.194229	P-value(F)		1.18e-21	
Log-likelihood	-474.4026	Akaike criterion		1014.805	
Schwarz criterion	1126.342	Hannan-Quinn		1059.861	
rho	0.687648	Durbin-Watson		0.635402	

Source: Authors

A quick glance at the results leads to an interesting discovery. Although inflation (HICP) has a negative impact on employment, public expenditures on labour market policies (LMP) start to have a positive impact on employment after three years of its application, thus we can conclude that employment policies start to be efficient.

3.4 Four Years Lag

In this analysis, we lag explanatory variables by four years. Equation of regression model takes the following form:

$$UN_{it} = \alpha_0 + \beta_1 FDI_{it-4} + \beta_2 EDUC_{it-4} + \beta_3 LMP_{it-4} + \beta_4 HICP_{it-4} + \mu_i \qquad (5)$$

where:

UN = unemployment rate measured in %
FDI = direct foreign investment flows as % of GDP
EDUC = public expenditure on education as a % of GDP
LMP = public expenditure on labor market policies as a % of GDP
HICP = harmonized indices of consumer prices
α_0 is unobserved heterogeneity
μ_i is the error term

In equation (4), subscript i stands for countries, subscript t stands for the present year and subscript t-4 for four years ago. Table 5 shows the results of regression. Not statistically significant variables are omitted in Table 5.

Table 5. Fixed model effect – four years lag

	Coefficient	Std. Error	t-ratio	p-value	
const	15.1498	1.58134	9.5804	<0.00001	***
LMP_4	-5.65188	1.06934	-5.2854	<0.00001	***
HICP_4	0.187725	0.0826515	2.2713	0.02452	**
Mean dependent var	7.546774		S.D. dependent var	3.307112	
Sum squared resid	793.2096		S.E. of regression	2.276923	
R-squared	0.607971		Adjusted R-squared	0.525978	
F(32, 153)	7.414908		P-value(F)	3.03e-18	
Log-likelihood	-398.8043		Akaike criterion	863.6085	
Schwarz criterion	970.0582		Hannan-Quinn	906.7460	
rho	0.595770		Durbin-Watson	0.776281	

Source: Authors

Here the direction of influence of explanatory variables is the same as in the case before, but public expenditure on labour market policies starts to have a significant positive impact on employment. Namely, the increase in public expenditures on LMP by one percent induces a decrease of unemployment by 5.65%.

4 Discussion and Conclusion

The findings of the presented study bring some insights into the employment policy issue. We ran a panel data regression with EU28 countries, Norway, USA and Japan. Summary results of the regressions are in Table 5, where only statistically significant regressors for given model are presented.

As indicated in Table 5, explanatory variables we have considered fairly describe unemployment evolution in countries with 1 billion inhabitants. Interesting fact about the results is that among all considered independent variables, only public expenditures on

employment (LMP) have the desired effect on unemployment and only after three to four years. Striking finding is that foreign direct investment (FDI) has no impact on the unemployment rate, and thus all state support and tax holidays for foreign companies are not efficient instruments in terms of employment. This result is not in conflict with Schmerers´ study [15], described in introduction. Another remarkable fact is that public expenditure on education (EDUC) raises unemployment by 0.67 to 1.9 %. In case of EDUC, we expected the reverse to be the case, especially for regression with four year lag, when students with a first university degree enter the labour market and should be more efficient in finding a job. This result is in line with phenomena we observe nowadays; budgets designed to finance education are from year to year larger and larger and unemployment of young people is real socio-economic problem in most economies - especially in EU countries. Changes in the price level (HICP) are in line with the theory which suggests that, in the short term, increases in price level cause decreases in unemployment. Slope of HICP in regression without lags is - 0.17, thus the higher the inflation is, the lower unemployment. This finding is also in line with conclusions of Fitzgerald et al. [7]. The limit of this study is that we have not incorporated dummies into regression, thus we are not able to control for structural breaks within economies, such as economic crisis, economic cycles and other possible phenomena.

Table 6. Summary table

	EDUC	HICP	LMP	FDI
Regression without lags	0.677397 %	- 0.173554 %	3,09956 %	
Regression with one year lags	1.90431%		2,45304 %	
Regression with two year lags	1.48954 %	0.288695 %		
Regression with three year lags		0.227729 %	- 2,19877 %	
Regression with four year lags		0.187725 %	- 5,65188 %	

Source: Authors

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