

# Impact of labour market reforms on economic activity in European Union: short term costs and long term benefits

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## Abstract

*The main objective of this paper was to quantify the long- and short-term impacts of labour market reforms on economic activity in EU countries, including Croatia. Therefore, we derived a model using the pooled mean group estimator (PMG) for the period from 2000 to 2011. Before performing dynamic panel analysis based on the PMG estimator, the unit root and panel cointegration tests were performed. According to the results, labour market reforms have positive and statistically significant long-term impact on GDP per capita. On the other hand, labour market reforms also have a statistically significant and negative effect on GDP per capita in the short-run. Control variables (industrial production and the rate of the active population) also have significant impacts on GDP per capita. In addition to econometric analysis, we also present an overview of empirical and theoretical research on labour market reforms in developed, developing and transition countries.*

*Keywords: labour market reforms, European Union, economic crisis, PMG estimator*

## 1 INTRODUCTION

In the period from 2008 to 2013, the economic and financial crisis in European Union (EU) resulted in the loss of nearly ten million jobs. However, the impact of the crisis on the labour market significantly varies among EU countries, and has resulted in total unemployment rates ranging from 5.3% in Germany to 26.4% in Spain (according to data for 2013). These differences can be only partially explained by differences in the economic slowdown in the countries, and debates are currently being more and more diverted towards understanding the role of various factors in the labour market as well as their implications for future economic development (ECB, 2012). At the same time, this has resulted in initiatives for the implementation of structural reforms aimed at increasing labour market flexibility.

Labour market reforms, which are at the centre of research in this paper, are currently being extensively theoretically and empirically analysed on different samples of countries and through the use of different methodologies. Nevertheless, this paper contributes to the field of research through analysis of the impact of the reforms on the level of economic activity in 28 EU countries, including Croatia as its newest member state. In this sense, the main objectives are defined as follows: (1) to analyse the impact of labour market reforms on economic activity in the EU-28, and (2) to investigate whether there are some differences between the 15 “old” and 13 “new” EU member states. For this purpose, following the methodology of Pesaran, Shin and Smith (1999), the pooled mean group (PMG) estimator is used.

The paper is structured as follows. Section 2 provides an overview of selected empirical evidence as well as theoretical arguments from the literature focused on

labour market reforms. Section 3 brings a descriptive analysis of labour market reforms implemented in EU member states using two databases. These are LABREF database of the European Commission and that of the Fraser Institute, which in combination provide an insight into countries' reform activities. Section 4 describes the model used for the analysis, as well as the reasons behind the choice of the PMG estimator. Section 5 delivers the results of the econometric analysis and their interpretation. Finally, section 6 provides concluding remarks and describes the limitations of existing and recommendations for future research in this area.

## 2 REVIEW OF CONTEMPORARY RESEARCH ON THE IMPACT OF LABOUR MARKET REFORMS

There is a general consensus on the necessity of implementing structural reforms with the goal of improving countries' economic and social development. However, there is a gap between the theoretical discussions of the potential benefits of reforms and the results of specific empirical analyses that indicate the heterogeneity of the results (for details see Babetskii and Campos, 2007; IMF, 2004). While the reforms were successful in some countries, in others they did not result in the expected outcomes which brought into question whether the reforms had affected the economic progress of the country? It is important to bear in mind that there is no universal "recipe" for the implementation of reforms. They must be tailored to the specific circumstances in individual countries and based on high-quality research in terms of their expected final outcomes (Bergsten and Williamson, 1994). Thorough economic analysis of reform effects can provide a useful insight into the possible long-term effects of reforms on economic performance, as well as insights into the adjustment process after their implementation and potential spillovers across countries (Arpaia et al., 2007).

Therefore, we offer a review of recent research on labour market reforms, and describe various empirical approaches used for the analysis of correlation between labour market reforms and economic growth and development. In this regard, Barnes et al. (2013) emphasize that the largest benefits for GDP per capita in the long run can be achieved through the implementation of reforms to increase labour market competition, reduce the level and/or duration of unemployment benefits and reduce regulations on the employment protection. Moreover, the authors also stress that although there is a general consensus on the benefits of various structural reforms in the long run, one must take into account the potential short-term costs associated with them. Therefore, this aspect of the research should also be further analysed, since the short-term costs may result in reversing the reforms later in the process of their implementation.

Cacciatore, Duval and Fiori (2012), using the DSGE models investigate short-term effects of labour and product market reforms. Although they indicate that reforms stimulate growth even in the short term, some reforms result in an in-

crease in unemployment, which causes high costs in the short term. In particular, job protection reform initially increases more layoffs than it creates jobs. Furthermore, they show that product market reform can also temporarily lead to net job destruction as incumbents downsize, while the reallocation of laid-off workers takes time. However, the application of the broad range of measures of labour and product market reforms allows governments to reduce and/or mitigate such transitional costs. The authors conclude that it takes several years for reforms to pay off, which can be partially explained by the fact that their benefits materialize through the entry of new enterprises and increased employment, both of which are gradual processes, while any reform-driven layoffs are immediate.

Furthermore, according to a study of the OECD (2012), while some structural reforms can rather quickly boost growth, on the other hand, there are reforms that can be harmful in “bad” times. In terms of labour market reforms, Bouis et al. (2012) based on an empirical analysis of structural reforms in OECD countries in the last 30 years, pointed out that reforms (particularly in the area of unemployment benefits and employment protection) are more quickly paid off in good than in bad times, which can result in significant short-term losses in economies that are in recession. They also point out that the benefits of reforms are visible only in the long run.

Gomes et al. (2011), using the dynamic general equilibrium model, estimate macroeconomic effects of increased competition in the labour and services markets in Germany and the rest of the eurozone, and alternatively, in Portugal (as a small economy) and the rest of the eurozone. The main results indicate that: (1) gradual implementation of reforms in the period of five years allows a new level of output to be attained, in the long run, in seven years, (2) coordination of reforms across countries provides additional benefits for each country in the euro area (i.e. spillover effects), and finally (3) coordination between countries is essential to achieve more homogeneous economic outcomes (i.e. coordination results in higher and more evenly distributed positive effects).

Bouis and Duval (2011) examined the impact of structural reforms of product and labour markets on potential GDP for a period of 5-10 years. Their research shows that reforms in the product market may increase the level of overall labour productivity by a few per cent over a period of 10 years in OECD countries, and more than 5% in most countries of continental Europe, as well as in the BRIICS countries<sup>1</sup>. Furthermore, higher labour market flexibility can also increase productivity in many OECD countries, although the authors estimate that these effects are small in comparison to the effects of product market reforms. According to the scenario in which reform of the labour market (in the areas of unemployment benefit systems, active labour market policies, labour taxes and pension system) are implemented relatively quickly, the employment rate would increase by sev-

<sup>1</sup> BRIICS comprises Brazil, Russia, India, Indonesia, China and South Africa.

eral percentage points in the OECD countries over a 10-year horizon. Furthermore, the authors estimate that in such a scenario there would be an increase in potential GDP of 10% in 10 years, which indicates a significant potential of structural reforms in terms of compensation of losses caused by the economic crisis.

Then, Hobza and Mourre (2010) explore scenarios of the Europe 2020 strategy, with the aim of perceiving possible gains. Results indicate that progress in implementing structural reforms in line with the main priorities defined in the EU 2020 strategy can generate significant benefits in terms of increased production and job creation. According to the authors, by 2020, GDP may increase from about 1.5% to 7% compared to the initial level, due to the implementation of policy reforms (i.e. between 400 and 2,000 euro of additional output per person). Furthermore, under the ambitious scenario, gains in employment would be significant: about 0.5% and 4.5%, which means the creation of an additional 1.6 to almost 11 million jobs. At the same time, progress in structural reforms would have a positive impact on the unemployment rate, which could fall to between 0.5 and 5 percentage points.

Everaert and Schule (2008) on the basis of the calibrated model examined long-term gains in output and employment from boosting competition in product and labour markets. The authors conclude that the combination of reforms could avoid a fall in real wages. Moreover, they conclude that in the short term, stand-alone reforms cause inflation to fall and real interest rates to increase in the reforming country, slowing the investment response and deferring consumption. However, synchronization of reforms would prevent a temporary fall in consumption and reforms in a monetary union would prevent a transitory decline in GDP and consumption.

Arpaia et al. (2007), using different economic models, examine the impact of the reforms implemented in the period from 1995 to 2003 within the framework of the strategy of the European Commission “Growth and Jobs Strategy” in which the product and labour markets were at the centre of the reform agenda. The authors estimate that the reforms in the areas of unemployment benefits, taxes and the ease of entry for new companies reduce the structural unemployment rate by almost 1.4 percentage points and increase GDP in the EU-15 by 2% since 1995. They also emphasize that a positive outcome is largely the result of the interaction of product market reforms when creating new jobs (i.e. facilitating wage moderation and the entry of new companies to markets). The authors believe that these benefits would have been even higher if the simulation took account of the positive impact of the reforms on the participation rate.

We can conclude that the literature finds a positive long term correlation between structural reforms in the labour markets and economic performance; while in the short term the impact of reforms can be small or even negative due to adjustment

costs. As has been presented, authors proxy economic activity through a fairly large number of indicators such as GDP per capita, productivity, (un)employment, GDP growth rates, etc. On the other hand, the results vary among authors due to several factors: (1) the selected indicators of reforms; (2) the characteristics of the data used for the analysis; (3) choice of econometric model; (4) the size and heterogeneity of the sample; and (5) selection of different control variables. All of this reinforces the point that with interpretation of results, one should take into account all the potential methodological limitations.

### 3 LABOUR MARKET REFORMS IN EUROPEAN UNION MEMBER STATES

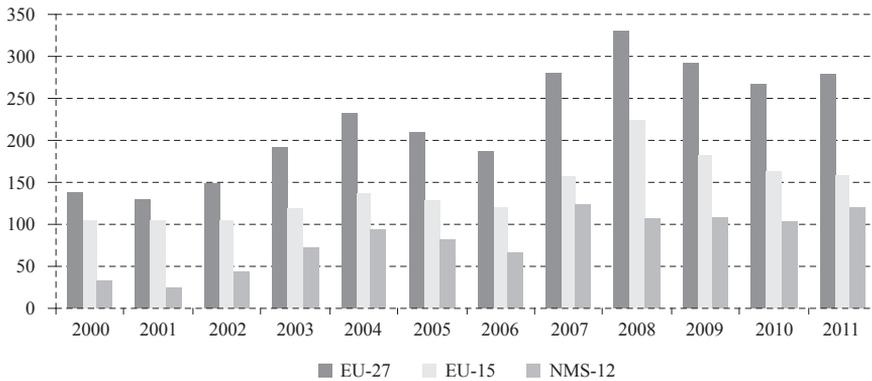
For the analysis of labour market reforms implemented in EU, we use in parallel two databases: the LABREF database of European Commission, which contains information on the policy measures related to labour market institutions, and the Fraser Institute database of Economic Freedom of the World<sup>2</sup>. Accordingly, we can combine two approaches to measuring reforms (see Buti, Turrini and Van den Noord, 2010:12-13): *ex ante* and *ex post*. The first (*ex ante*) approach refers to the construction of different indicators based on reforms implemented in different countries; measuring the occurrence of legislative changes. An example of this approach is the LABREF database of the European Commission, which is organized around nine policy areas: labour taxation, unemployment, welfare-related benefits, active labour market programmes, job protection, disability and early retirement schemes, wage bargaining, working time organisation, immigration and mobility. The indicators of this type are then constructed as *dummy* variables that provide information about the number of actions (reforms) taken and are silent on the impact of policy measures. The second approach (*ex post*) consists of indicators measuring the existing distortions associated with the government policies whereby the effect of the reforms is then measured as the change in their levels. Examples of this approach are the indicators developed by the OECD (Employment Protection Legislation Index) and the Fraser Institute (Economic Freedom of the World). While the first approach gives an insight into the actions taken by policy makers in order to reform the existing market or state institutions; the second approach does not account directly for government reform initiatives, but permits us to gauge the impact of such initiatives on the structural conditions of the different sectors, also permitting assessment of the extent to which reforms are needed.

Based on the data from LABREF, figure 1 shows the total number of reform measures in the EU member states in the period from 2000 to 2011, with the aim of analysing the timing of reforms by groups of countries.

<sup>2</sup> See: <http://www.freetheworld.com/>.

**FIGURE 1**

*The number of reform measures in the EU member states (EU-27, EU-15 and NMS-12), 2000-2011*



*Source: Authors' calculation according LABREF database (2014).*

The figure shows that the total number of reform measures in the EU-27 countries varies over time. The minimum number of measures implemented by EU-27 member states was recorded in the year 2001, while the most measures were implemented in 2008, followed by a decrease in the number of reforms, mostly due to the effects of the global economic crisis. Economic crises can generally stimulate or slow down the implementation of reforms. While an economic downturn implies that existing policies are no longer sustainable thus encouraging reforms (Drazen and Easterly, 2001; Alesina, Ardagna and Trebbi, 2006; Høj et al., 2006; IMF, 2004), there is also the view that reforms are easier to implement under favourable macroeconomic conditions since the costs of the reforms are less painful and distributional effects are less visible when aggregate income is growing rapidly (IMF, 2004:114-115).

This is confirmed by the analysis carried out in Turrini et al. (2014). Using the LABREF database, the authors analyse the determinants and impact of the labour market reforms in the European Union for the period from 2000 to 2011. Their results suggest that countries with similar institutional settings tend to follow analogous reform patterns and that the 2008 crisis spurred reforms in most of the policy domains on labour markets in a number of EU countries. Furthermore, they show that reforms are more likely when the environment is characterized by under-performance of the labour market (particularly by high and rising unemployment) and by high initial levels of regulation or fiscal burden. Other macroeconomic and fiscal factors have a less clear role.

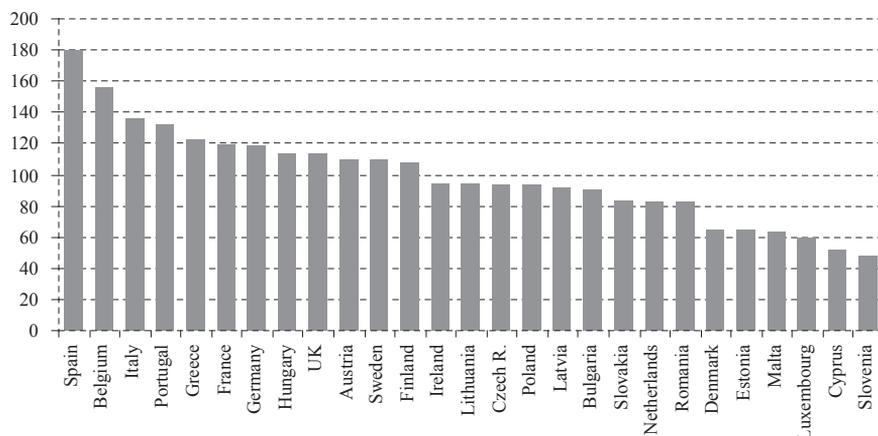
If we look at the differences between the groups of the EU-15 and NMS-12 we can also observe some variations. The years in which the new member states implemented the largest number of reforms are the years of EU enlargement (i.e. 2004

and 2007), indicating the strong international influence on reform intensity during the process of economic integration. According to the political economy aspects of reforms, pressure to reform can also come from a variety of binding rules, such as meeting the criteria for joining the EU where the EU's influence is especially significant from the aspect of "hard" policy instruments (such as the criteria for entering the European Monetary Union) and "soft" forms of coordination within which different strategies indicate desirable changes in the labour market (Thompson and Dang, 2010). Also, in terms of changes in the number of reforms after the year 2008, we note that in the NMS-12 countries there has been no significant reduction in the number of reforms, implying that in this group of countries (compared to the EU-15) the crisis was an incentive to the implementation of further reforms in labour markets.

Further analysis of labour market reform measures by individual EU countries (figure 2) shows that the most measures in the observed period were implemented in Spain, Belgium, Italy, Portugal and Greece versus Slovenia, Cyprus and Luxembourg, which carried out the smallest number of reform measures. The data also reflect the differences between the EU-15 and NMS-12 countries, where new member states implemented only just over half the number of measures. Data for Croatia are not available within the LABREF database for the entire period from 2000 to 2011<sup>3</sup>. However, although at this stage of research Croatia is not included in the analysis, experience of the NMS-12 regarding the implementation of reforms is significant for Croatia as the newest member of the EU.

## FIGURE 2

*The number of reform measures in the labour market, data by member states in the period from 2000 to 2011*

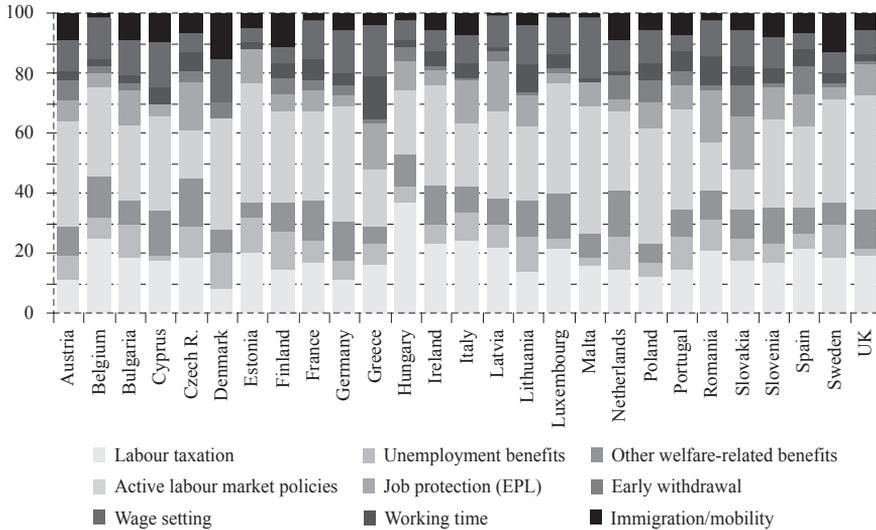


Source: Authors' calculation according to LABREF database (2014).

<sup>3</sup> Data for Croatia are available only for two years (2010 and 2011).

It is also interesting to analyse reform measures in the each of the nine policy areas, expressed as a share in the total number of reforms (i.e. the reform profile of countries). The figure 3 shows that member states implemented the largest number of reforms in the area of active labour market policies and labour taxation, while the smallest number of reforms is recorded in the area of policies related to the labour market exit.

**FIGURE 3**  
*Reform profile of EU-27 member states*



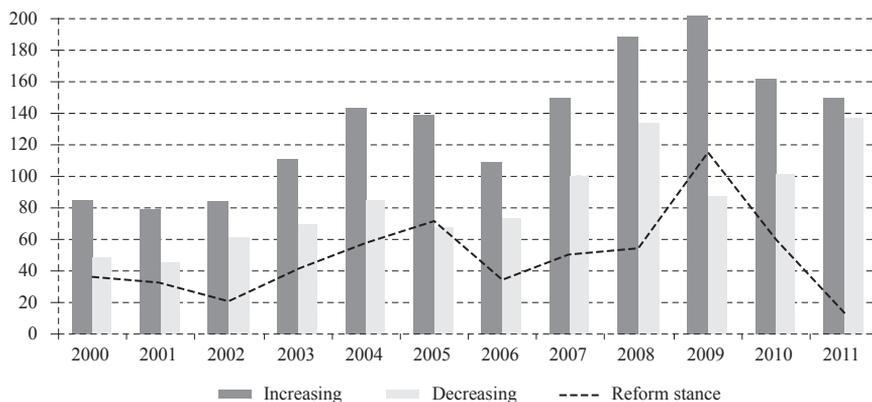
Source: Authors' calculation according to LABREF database (2014).

Since the reform measures contained in the database can be heterogeneous in terms of their impact on labour market institutions (e.g. regulatory requirements, taxes and contributions), it is recommended to take into account the definition of the reform direction, which is also presented in the database for each of the individual policy domains<sup>4</sup>. Reforms “increasing” (“decreasing”) underlying policy settings are those that increase (decrease) the scope and level of corresponding taxes, monetary benefits or the stringency of corresponding regulations (Turrini et al., 2014:9). It is therefore necessary to take into account the fact that in a given year and in a given country, reforms with different directions can co-exist. With this goal, Turrini et al. (2014) construct a variable *reform stance* expressed as the difference between the reforms with increasing direction and reforms with decreasing direction. Thus, the following figure shows the ratio between the number of “decreasing” and “increasing” reform measures, as well as their differences. The obtained numbers show that in the observed period from 2000 to 2011, the EU member states (on average) implemented the larger number of reforms with growing direction of their effects on labour market institutions.

<sup>4</sup> Coverage and structure of the Labour Market Reform (LABREF) Database (2014), available under: [http://ec.europa.eu/economy\\_finance/db\\_indicators/labref/documents/guide\\_en.pdf](http://ec.europa.eu/economy_finance/db_indicators/labref/documents/guide_en.pdf).

FIGURE 4

Number of reforms according to their direction



Source: Authors' calculation according to LABREF database (2014).

Taking into account the previously described trends, it can be concluded that reform activity varies among individual EU member states as well as over the course of time. It is expected, therefore, that these measures also had an effect on the quality of the labour market approximated by the composite index of labour market regulations which is published annually by the Fraser Institute as part of the Economic Freedom of the World project<sup>5</sup>. It provides a composite measure of labour market flexibility and more specifically indicators of labour market flexibility in the six policy areas: (1) the minimum wage; (2) the regulation of hiring and firing; (3) centralized wage bargaining; (4) the cost of hiring; (5) cost of dismissal; and (6) recruitment. The index takes values ranging from zero to ten, where higher numbers indicate a higher level of economic freedom in the labour markets. Therefore, figure 5 shows the correlation between the total number of implemented reforms in the EU-27 countries and labour market regulation index from the Fraser Institute database (for the period from 2000 to 2011).

We conclude that, at the level of the EU-27, there is a significant correlation between the two indicators, as indicated by the calculated coefficient of correlation coefficient (0.81)<sup>6</sup>. Thus, it is apparent that increased reform activity resulted in an increase of labour market flexibility. However, the key question that arises is that concerning the efficiency of the reforms implemented from the aspect of economic activity, which is

<sup>5</sup> Economic Freedom of the World database provides extensive information on the various dimensions of economic freedom through the use of more than 40 variables with the aim of calculating the index which measures the degree of economic freedom in 5 areas. These are: the size of government, the legal structure and security of property rights, access to sound money, freedom to trade internationally and regulation of credit, labour and business. Reports have been published since 1996, and are based on the definition of economic freedom, according to which individuals possess economic freedom when the property they acquire without the use of force, fraud or theft is physically protected from other individuals and when their assets are free to be used, shared or given to others, provided that this does not violate the equal rights of other persons (Gwartney, Lawson and Block, 1996).

<sup>6</sup> The correlation coefficient between these two indicators for NMS-12 is even higher, amounting to 0.90.

further investigated in the following section through an econometric analysis of the short- and long-term effects of labour market reforms (approximated by the change in the level of index of labour market regulation) on the GDP per capita.

**FIGURE 5**

*Total number of reforms and the index of labour market regulation (EU-27), 2000-2011*



*Source: Authors' calculation according to LABREF and Fraser Institute database (2014).*

## 4 METHODOLOGY

In order to estimate the dynamic and cointegrated panels there are usually two procedures used. These are the Mean Group Estimator (MG) and traditional Pooled estimators, each of which has its own advantages and disadvantages (for details see Pesaran and Smith, 1995).

In this paper, the pooled mean group (PMG) estimator is used, since it includes pooling imposed by restrictions on the homogeneity of long-term coefficients and averaging through groups, in order to obtain the mean of the estimated coefficients to correct errors and other current parameters in the model. In addition, the estimator allows constant members, short-run coefficients and error variances to differ by groups, while at the same time constraints long run coefficients to be identical in groups.

### 4.1 DATA AND VARIABLES

Initial panel model analyses the impact of labour market reforms on economic activity in 28 European Union member states (including Croatia). In addition, with the goal of comparing the variations in effects of labour market reforms on economic performance, the EU-28 member states are divided into two groups (i.e. sub-panels): the EU-15 and NMS-13<sup>7</sup>. Based on the analysis of reform patterns

<sup>7</sup> More specifically, the new member states include the countries that joined the European Union in 2004 (Cyprus, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovakia, Slovenia and Malta) and in 2007 (Bulgaria and Romania), as well as Croatia, which joined the European Union on 1 July 2013. EU-15 countries encompass Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom.

carried out in section 3, we assume that there is a different impact of reforms in these two groups of states. The analysis includes the period from 2000 to 2011. The years after 2011 are not included in the analysis since the latest available data on labour market flexibility were published in 2013, and refer to the year 2011, thereby excluding the reform measures implemented in the last two years. Further on, labour market reforms are proxied by the composite index of labour market regulations published by the Fraser Institute<sup>8</sup>. Although these indexes entail the same disadvantages that are attributed to composite indices in general (for details see OECD, 2008) and although aware of all the shortcomings of the index in question<sup>9</sup>, we emphasize several advantages. First, the advantage of the approach used in this work is reflected in the application of the aggregate index. The government is potentially affected by the series of policy actions and changes in one of the areas are often correlated with changes in other policy areas (according to Buti et al., 2010). Thus, the key advantage of aggregated in relation to individual indicators and methods that evaluate the effect of various reforms on economic outcomes is that the use of individual indicators can result in methodological problems as a result of attributing the effects of excluded or unobserved measures to those that are included in the analysis. Moreover, regarding the criticism that such indexes do not encompass real reform process, it has been highlighted (in section 3 of the paper) that in a sample of EU countries, there is a positive correlation between the number of the reforms and the value of the Fraser Index of labour market regulations on the other hand. Finally, critics also focus on the use of the indexes developed by organizations that are biased towards free-market policies (an example is such index is also the Economic Freedom of the World index used in this paper) (Chang, 2011). However, in this paper, the authors do not give value judgements regarding the desired degree of flexibility and freedom in the labour market, but the research focuses on the *ex post* analysis of the impact of reforms on economic activity. According to the economic literature, it is expected that the reforms that increase economic freedom and flexibility in the labour market have a positive effect on economic activity in the long and negative in the short term.

Structural reforms are considered to contribute to growth potential, creating the conditions for sustainable and balanced growth and leading to improvements in employment and living standards (European Commission, 2014). Therefore, as the dependent variable in the model we use GDP per capita. Independent variables included in the model, in addition to the index of labour market regulation, are the

<sup>8</sup> From the aspect of economic freedom, there is also the “Index of Economic Freedom” (Heritage Foundation; <http://www.heritage.org/index/book/chapter-7>) database according to which economic freedom is seen as the condition in which individuals can act with autonomy, and in economically free society, decision-making by the government is transparent and guarantees equal opportunity for all. However, the goal of economic freedom is not simply an absence of government coercion or constraint, but the creation and maintenance of a mutual sense of liberty for all in which individuals have the responsibility to respect the economic rights and freedoms of others within the rule of law. This index comprises ten specific components of economic freedom: property rights, freedom from corruption, fiscal freedom, government spending, business freedom, labour freedom, monetary freedom, trade freedom, investment freedom and financial freedom. However, the database is limited in terms of availability of long time series in the components of freedom in the labour market.

<sup>9</sup> For more detail overview see Aleksynska (2014).

dummy variable for the economic crisis, industrial production and the share of the active population in the total population. The dummy variable for economic crisis takes the value 1 when the value of the output gap is -4% of GDP or higher (according to Duval and Elmeskov, 2006; Høj et al., 2006). Furthermore, a dynamic manufacturing sector is considered a prerequisite for an innovative and fast-growing economy (European Commission, 2013), making it an important determinant of economic activity. Moreover, the new approach of the European Commission to industrial policy is based on the revival of the role of industry in Europe, from the share of about 16% of GDP (in 2012) to 20% by 2020. In addition, industry accounts for more than 80% of European exports, private R&D and innovation. Finally, about one of four jobs in the private sector, is located in the industry sector (European Commission, 2013). Therefore, by including the indicator of industrial production in the empirical analysis, the paper also explores the extent to which macroeconomic policies influence the short-term and long-term impact of reforms on economic growth. In addition to industrial production, the activity rate (expressed as the proportion of the active population (15-64) in the whole of the population aged 15-64) is also used as a control variable in the model. The variables of per capita GDP and industrial production are expressed in log values, while the activity rate is expressed as a percentage. The sources of the data used and the expected signs of the estimated coefficients are given in appendix.

#### 4.2 MODEL SELECTION

Empirical analysis starts with the following equation:

$$BDP\_pc_{it} = \gamma_{0i} + \gamma_{1i}ind\_pro_{it} + \gamma_{2i}lm\_reg_{it} + \gamma_{3i}act\_r_{it} + crisis + \varepsilon_{it}, \quad (1)$$

$$i = 1, 2, \dots, N, t = 1, 2, \dots, T_i$$

where:  $BDP\_pc_{it}$  is the logarithm of gross domestic product *per capita*,  $ind\_pro_{it}$  is the logarithm of industrial production index;  $lm\_reg_{it}$  is the labour market regulation index,  $act\_r$  is the activity rate and  $crisis$  is binary (dummy) variable for economic crisis. Subscripts  $i$  and  $t$  denote country and time period, respectively<sup>10</sup>. The error term ( $\varepsilon_{it}$ ) represents the effects of unexpected shocks to economic activity, approximated by gross domestic product *per capita*.

Coefficients  $\gamma_{1i}$ ,  $\gamma_{2i}$  and  $\gamma_{3i}$  denote the effects of permanent changes on gross domestic product *per capita*, sustainable in the long run that can be interpreted as the elasticities. Deviations from the long run relationship given in equation (1) are possible in the short run. Namely, there are various reasons for such deviations that preclude instant adjustment of gross domestic product *per capita* to changes in its determinants, thus they should be taken into account.

<sup>10</sup> Since  $T$  has a subscript  $i$ , the analysed panel is unbalanced.

Accordingly, econometric specification in this paper allows for different short run effects (for each country within a sample) of selected determinants on gross domestic product *per capita*, which is formally implemented in the model by choosing lag length for each variable according to standard statistical criteria. After choosing appropriate lag length according to Schwarz Bayesian Criterion (SBC)<sup>11</sup> for each variable<sup>12</sup>, panel *ARDL(1,0,0,0)* model, showed to be adequate for the empirical analysis, and it is given in by:

$$\begin{aligned} BDP\_pc_{it} = & \delta_i + \beta_{10i}ind\_pro_{it} + \beta_{20i}lm\_reg_{it} + \beta_{30i}act\_r_{it} \\ & + \gamma_i BDP\_pc_{i,t-1} + crisis + \eta_{it} \end{aligned} \quad (2)$$

Since Pesaran and Shin (1995) have shown that modelling approach using *ARDL* model is not reasonable unless all the variables in equation (2) are integrated of order one, reparametrisation of equation (2), expression (3) or *panel error correction model* is obtained:

$$\begin{aligned} \Delta BDP\_pc_{it} = & \phi_i (BDP\_pc_{i,t-1} - \gamma_{0i} - \gamma_{1i}ind\_pro_{it} - \gamma_{2i}lm\_reg_{it} - \gamma_{3i}act\_r_{it} - crisis) \\ & - \beta_{11i}\Delta ind\_pro_{it} - \beta_{21i}\Delta lm\_reg_{it} - \beta_{31i}\Delta act\_r_{it} + \eta_{it} \end{aligned} \quad (3)$$

Whereas  $\Delta$  is the first difference operator, so:

$$\phi_i = -(1 - \gamma_i), \gamma_{0i} = \frac{\delta_i}{1 - \gamma_i}, \gamma_{1i} = \frac{\beta_{10i} + \beta_{11i}}{1 - \gamma_i}, \gamma_{2i} = \frac{\beta_{20i} + \beta_{21i}}{1 - \gamma_i}, \gamma_{3i} = \frac{\beta_{30i} + \beta_{31i}}{1 - \gamma_i} \quad (4)$$

Since according to the Engle and Granger (1987) theorem, there is a clear connection between the cointegration mechanism and the error correction mechanism, equation (3) represents the basis for the estimation of the long run relationship between economic activity (gross domestic product *per capita*) on one side and selected independent variables on the other side.

In the defined framework, Pesaran, Shin and Smith (1999) suggest that coefficients of long run relationship in equation (3) be equal across countries (long-run homogeneity restriction) whereas constant terms, adjustment coefficient, short run coefficients and error variances can vary among countries<sup>13</sup>.

<sup>11</sup> The Schwarz Bayesian criterion (SBC) is the criterion for the model selection based on the parsimony principle. It is considered to be most rigorous criterion, since it gives the models with least number of parameters. It is defined by the following formulae:  $SBC = -2 \cdot \ln(L) + M \ln(T)$ , whereas  $L$  denotes maximum of the likelihood function,  $M$  is the number of estimated parameters ARMA(p,q) model and  $T$  is the number of data used in the estimation and it doesn't have to be the same length as the length of array,  $n$ . (For more details please refer to Bahovec and Erjavec, 2009.)

<sup>12</sup> Results of the analysis where the adequate number of lags is selected for every variable of interest are not presented here, but they are available from the authors upon the request.

<sup>13</sup> In other words, there are  $(N-1) \cdot k$  restrictions on model given in equation (4), namely:  $\gamma_i = \gamma$  for every  $i$ . Estimator based on the maximum likelihood method is called *PMG estimator* and it has asymptotically normal distribution in case of stationary as well as non-stationary regressors.

Also, under the homogeneity of the slope assumption, the *PMG* estimator is consistent and efficient, whereas the *MG* estimator is consistent, but it is not efficient, so in order to compare these two estimators, a test of a Hausman type can be employed (Pesaran, Shin and Smith, 1999). Furthermore, with the aim of checking robustness, the main panel of EU-28 is divided into two sub-panels, namely: panel EU-15 and panel of the new member states (NMS-13). Also, we employ the *dynamic fixed effects estimator*, DFE in order additionally to check the robustness of the results of the empirical analysis.

## 5 RESULTS OF THE EMPIRICAL ANALYSIS

As a first step of the empirical analysis panel unit root tests were conducted and the results are presented in table A2. Accordingly, all the variables of interest are integrated of order one, so the next step of the empirical analysis was to test the existence of the cointegrating relationship among them. For this, we use four new tests developed by Westerlund (2007)<sup>14</sup>. According to the results of panel cointegration tests (given in table A3), there is a cointegrating relationship between analysed variables.

Since all the variables of interest are nonstationary and cointegrated, estimation of equation (3) using the *PMG* estimator allows for the reliable inference of long run and short run effect of reforms on the labour market on economic activity (*GDP per capita*). In table A4 the results of the empirical analysis<sup>15</sup> along with the Hausman specification test and standard errors of estimate (given in brackets) for the whole panel EU-28<sup>16</sup> are presented.

The results of the Hausman specification test show that the appropriate estimator in our case is the *PMG* estimator<sup>17</sup> and that the model specification is appropriate, so the results can be interpreted.

Long run coefficient of the labour market regulation is statistically significant at the 1% significance level, suggesting that the elasticity of GDP per capita to changes in market regulation is 0.251. Furthermore, industrial production and the rate of activity are statistically significant on 1% significant level, with the elasticity coefficients of GDP per capita to changes in aforementioned variables of 1.290, and 0.022, respectively. Binary (dummy) variable economic crisis in the long run has significant impact on GDP per capita with the elasticity coefficient of -0.581.

<sup>14</sup> These tests are based on structural dynamics and are not residual-based, so they do not impose *common-factor restriction*. Two tests are designed to test the alternative hypothesis of cointegration of whole panel ( $P_{\alpha}$  and  $P_{\tau}$ ), while the rest two tests, test the alternative hypothesis that at least one unit of a panel is,  $G_{\alpha}$  and  $G_{\tau}$  (Persyn and Westerlund, 2008).

<sup>15</sup> The reported short-run coefficients and the speed of adjustment are simple averages of country-specific coefficients.

<sup>16</sup> The empirical analysis is performed using statistical software STATA 12.

<sup>17</sup> Since it allows for the heterogeneity of parameters in the short run.

Furthermore, the adjustment factor<sup>18</sup> is  $-0.357^{19}$ , with the appropriate negative sign and is statistically significant on 1% significance level, so it can be concluded that the long run cointegrating relationship between economic activity and selected independent variables is reached in a bit less than three years. Also, GDP per capita adjusts to its long run equilibrium with lags.

In the short run, the reform of the labour market has the expected negative sign and is statistically significant at the significance level of 10% with the elasticity coefficient of  $-0.0375$ . Other variables have no statistically significant impact on economic activity in the short run.

Furthermore, within our econometric exercise, the model given in equation (4) is estimated for two sub-panels, that is, for panel of old member states (EU-15) and a panel of new member states (NMS-13), in order to determine the influence of labour market reforms on economic activity in the aforementioned groups of countries. The results of empirical analysis are given in table A5. Accordingly, it can be concluded that for both groups of countries in the long run there is a statistically significant influence of labour market reforms on economic activity at the 1% significance level. Furthermore, in the case of the EU-15 panel the coefficient of elasticity of economic activity to the changes in labour market reforms is  $0.291$ , suggesting a higher impact of labour market reforms on economic activity in the old member states (EU-15) than in the new member states (NMS-13), where the coefficient is much lower and has the value of  $0.074$ . Interestingly, the impact of crisis on economic activity in the long run is more pronounced in the case of new member states (in comparison to EU-15) with statistically significant and negative coefficient of  $-0.523$  (in the case of EU-15 that coefficient has the value of  $-0.362$ ). In contrast, in the long run, industrial production and the rate of activity of the population influence economic activity more significantly in the NMS-13 than in the EU-15, with the coefficients of  $1.720$  and  $0.044$ , respectively (the coefficients for EU-15 are  $1.338$  and  $0.032$ , respectively).

Furthermore, speed of adjustment in the case of old member states is  $-0.295$ , whereas for the new member states it has the value of  $-0.442$ . Both coefficients have the correct negative sign and are statistically significant at the 1% significance level. Moreover, they imply that the long run equilibrium given by the cointegrating relationship between GDP per capita, industrial production, market regulation and the rate of activity is reached more quickly in the new member states than in the old member states. Also, labour market reforms in the short run have a statistically significant coefficient just in the case of old member states.

<sup>18</sup> Error correction term is given in table A4 and is calculated as a simple arithmetic mean corresponding error correction terms for 28 countries in a panel (which are heterogeneous according to PMG procedure).

<sup>19</sup> Error correction term or the speed of adjustment ( $\phi$ ) is statistically significant in the estimated model and it has expected negative value since it is expected (and estimated model proves it) that the deviation between economic activity and selected independent variables from their long run equilibrium is gradually decreasing. Since the quarterly data are used, long run equilibrium is reached in a bit less than three years (detail description of error correction model is given in Bahovec and Erjavec, 2009).

Other analysed variables do not have a statistically significant impact on economic activity in the short run.

In order to check the robustness of the estimated models apart from PMG estimator, we used the DFE estimator (*dynamic fixed effects estimator*), that presumes that the coefficients of cointegrating vector are equal across all countries within a panel and that all short run coefficients and the speed of adjustment are equal for all countries. Only constant terms can vary between countries. Results of the estimation of the whole panel (EU-28) and the two sub-panels are given in table A6. According to the results of estimated DFE model, it is obvious that in the case of all three panels there is a statistically significant long run effect of labour market reforms on economic activity, which confirms the results of the estimated PMG model. However, the only exception noticed is for the variable industrial production; the short run coefficients for industrial production are statistically significant, but they have different signs for the two sub-panels. This can be explained by the fact that production suffered losses caused by long term economic crisis, which can lead to permanent loss of production capacities, especially in the new member states. Other results of the empirical analysis given in table A6, confirm the robustness of the baseline model.<sup>20</sup>

## 6 CONCLUSION

The global economic crisis has changed the perception of the role of structural reforms in the economy, especially at the EU level, considering that the traditional measures of economic policies are being “exhausted”. Hence, the current crisis represents a major challenge in terms of structural reforms, and not for the EU countries alone. One of these challenges is the reform of labour markets which is, due to its complexity and high short-term costs, often delayed.

According to the obtained results of empirical analysis performed in this paper, labour market reforms which increase flexibility and economic freedom have a positive and statistically significant long-term impact on GDP per capita in the EU-28 countries. Furthermore, also in the long run, reforms have a statistically significant positive effect on GDP per capita both in the EU-15 and in the 13 new EU member states. However, in the short run, the reforms have a statistically significant but negative impact on the GDP per capita in the EU-27 and EU-15 countries, while in the 13 new member states the short-term effect is not statistically significant. The obtained results for NMS-13 could be explained by the fact that timing of reforms in these countries differs from that in EU-15. We can conclude that the results obtained in this paper are consistent with the economic theory and

<sup>20</sup> *Dynamic Fixed Effects Estimator*, DFE as well as Pooled Mean Group Estimator, PMG impose the restriction of equal coefficients of the cointegrating vector for every country within a panel. However, according to DFE the speed of adjustment and short run coefficients are equal for each country (cross-section unit) as well. Since, according to strict DFE estimator, all coefficients have the right sign and are comparable in magnitude with the coefficients resulting from PMG estimator for each country in a panel, it can be concluded that the model according to PMG estimator is robust (details of estimators MG, PMG and DFE can be found in Blackburne and Frank, 2007).

previous research described in the paper (e.g. Banes et al., 2013; Cacciatore, Duval and Fiori, 2012) which point out that the benefits of labour market reforms are seen only in the long run.

Finally, we can also conclude that, since they are among the more “painful” reforms due to their short term costs, labour market reforms should be the responsibility of all the key actors: governments, the business community, employees and trade unions. In fact, just like every reform, labour market reforms produce winners (in the long run) and losers (in the short run), and policy makers are sometimes not even aware of the widespread resistance to reforms. This resistance could stem from the lack of understanding of why a specific reform should be implemented. The issue of how to ensure political support for reforms by taking into account the results of econometric analysis conducted in this paper is seen as one of the pathways for future research in this complex area.

**TABLE A1**  
*Data sources and expected signs*

Variable	Variable description	Data source	Expected sign
<i>BDP<sub>pc</sub></i>	GDP per capita (nominal prices)	World Economic Outlook	Positive
<i>Lm<sub>reg</sub></i>	Proxy variable for labour market reform (labour market regulation)	Economic Freedom of the World (Fraser Institute)	Negative in short run, positive in long run
<i>crisis</i>	Dummy variable for economic crisis (gap between the real and potential GDP per capita)	AMECO	Negative
<i>Ind<sub>pro</sub></i>	Industrial production (industrial production index; processing industry)	Eurostat	Positive
<i>Act<sub>r</sub></i>	Rate of activity (15-64)	Eurostat	Positive

Source: Calculation of the authors.

**TABLE A2**  
*Results of panel unit-root tests*

Variable		Method	Prob.*	Obs.
<i>BDP<sub>pc<sub>it</sub></sub></i>	Constant and trend	Levin, Lin & Chu t	0.0000	280
		Im. Pesaran and Shin W-stat	0.7383	280
		ADF-Fisher Chi-square	0.9732	280
		PP-Fisher Chi-square	0.9977	308
<i>Lm<sub>reg<sub>it</sub></sub></i>	Constant and trend	Levin, Lin & Chu t	1.0000	298
		Im. Pesaran and Shin W-stat	1.0000	298
		ADF-Fisher Chi-square	1.0000	298
		PP-Fisher Chi-square	1.0000	300
<i>Ind<sub>pr<sub>it</sub></sub></i>	Constant and trend	Levin, Lin & Chu t	0.0000	299
		Im. Pesaran and Shin W-stat	0.8610	299
		ADF-Fisher Chi-square	0.9051	299
		PP-Fisher Chi-square	0.9302	308
<i>act<sub>r<sub>it</sub></sub></i>	Constant and trend	Levin, Lin & Chu t	0.0000	267
		Im. Pesaran and Shin W-stat	0.3089	267
		ADF-Fisher Chi-square	0.1383	267
		PP-Fisher Chi-square	0.8899	278

\* probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality. Im, Pesaran and Shin, ADF-Fisher and PP-Fisher test-Null Hypothesis: Unit Root (Individual Unit Root process), Levin, Lin & Chu Test-null Hypothesis: Unit Root (common Unit Root process). Automatic lag length selection based on Schwarz Criterion and Barlett Kernel.

Source: Calculation of the authors.

**TABLE A3***Results of panel cointegration tests*

Test	Nul hypothesis	Alternative hypothesis	Test statistic	p-value
Westerlund	No cointegration	All panels contain EC	Gt	0.00
			Ga	0.00
		At least one panel unit is cointegrated	Pt	0.00
			Pa	0.00

*Source: Calculation of the authors.***TABLE A4***PMG estimates of effects of the labour market reforms on GDP per capita for the EU-28 panel*

Variable	Panel EU-28
Long run coefficients	
<i>lm_reg</i>	0.251** [0.017]
<i>crisis</i>	-0.581** [0.114]
<i>Ind_pro</i>	1.290** [0.074]
<i>act_r</i>	0.022** [0.008]
Short run coefficients	
Adjustment coefficient	-0.357** [0.054]
$\Delta Ind\_pro$	-0.336 [0.421]
$\Delta lm\_reg$	-0.0375* [0.021]
$\Delta act\_r$	0.028 [0.091]
<i>constant</i>	-1.553** [0.247]
Hausman specification test	
Chi square test statistics	0.51 [0.97] <sup>a</sup>

<sup>a</sup> *p*-value is given in parenthesis and it denotes that on 0.05 significance level the null hypothesis cannot be rejected, so the parameters are homogeneous in the long run.

All equations include a constant term; standard errors are in brackets, *p*-value for Hausman specification test is in parenthesis; \*\*\*, \*\*, \* denote significance at 1, 5 and 10 percent significance level, respectively.

*Source: Calculation of the authors.*

TABLE A5

PMG estimates of effects of the labour market reforms on GDP per capita for two sub-panels: EU-15 and NMS-13

Variable	EU-15	NMS-13
	PMG estimates of long run coefficients	
<i>lm_reg</i>	0.291*** [0.187]	0.074*** [0.019]
<i>crisis</i>	-0.362*** [0.104]	-0.523** [0.204]
<i>Ind_pro</i>	1.338*** [0.168]	1.720*** [0.063]
<i>act_r</i>	0.032** [0.014]	0.044** [0.010]
	PMG estimates of short run coefficients	
Adjustment coefficient	-0.295*** [0.046]	-0.442*** [0.087]
$\Delta Ind\_pro$	0.161 [0.154]	-0.939 [0.919]
$\Delta lm\_reg$	-0.071*** [0.019]	0.009 [0.035]
$\Delta act\_r$	0.002 [0.021]	0.042 [0.029]
<i>constant</i>	-1.639*** [0.273]	-2.945*** [0.596]
	Hausman specification test	
value	0.27 [0.99] <sup>a</sup>	0.28 [0.99] <sup>b</sup>

<sup>a</sup> *p*-value is given in parenthesis and it denotes that on 0.05 significance level the null hypothesis cannot be rejected, so the parameters are homogeneous in the long run, so the model is specified correctly.

<sup>b</sup> *p*-value is given in parenthesis and it denotes that on 0.05 significance level the null hypothesis cannot be rejected, so the parameters are homogeneous in the long run.

All equations include a constant term; standard errors are in brackets, *p*-value for Hausman specification test is in parenthesis; \*\*\*, \*\*, \* denote significance at 1, 5 and 10 percent significance level, respectively.

Source: Calculation of the authors.

**TABLE A6**  
*Robustness check of the baseline model – DFE estimator*

	<b>EU-28</b>	<b>EU-15</b>	<b>NMS-13</b>
Adjustment coefficient	-0.522*** [0.050]	-0.256*** [0.040]	-0.724*** [0.086]
Long run coefficients			
<i>lm_reg</i>	0.178*** [0.036]	0.209*** [0.036]	0.145*** [0.053]
<i>crisis</i>	-0.0354 [0.102]	-0.389*** [0.114]	0.065 [0.156]
<i>Ind_pro</i>	1.321*** [0.197]	0.400 [0.270]	1.721*** [0.247]
<i>act_r</i>	0.039** [0.018]	0.059*** [0.019]	0.007 [0.024]
Short run coefficients			
$\Delta Ind\_pro$	-0.174 [0.179]	0.198* [0.104]	-0.608* [0.331]
$\Delta lm\_reg$	-0.061 [0.025]	-0.041*** [0.014]	-0.047 [0.046]
$\Delta act\_r$	0.011 [0.017]	0.009 [0.010]	0.021 [0.029]
<i>constant</i>	-2.822 [0.788]	-0.691 [0.431]	-3.469** [1.634]
Number of observations	299	163	136
Number of cross-section units	28	15	13

Source: Calculation of the authors.

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