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Flexicurity models and productivity interference in C.E.E. countries: a new approach based on cluster and spatial analysis

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ABSTRACT

The research conducted within this paper focuses on the basic coordinates of flexicurity models for ten E.U. Member States in Central and Eastern Europe (C.E.E.), both through the efforts performed nationally within the framework of flexibility and security as well as by the flexicurity states, and effects on workers and the overall economic activity. The aim is to form clusters that will group the analysed countries according to their performances achieved under three basic flexicurity dimensions: external numerical flexibility, income security, and employment security. The results show that the C.E.E. countries have adopted different flexicurity models and associated measures, some focusing on improving flexibility by softening the employment protection legislation or designing flexible working arrangements, while others are concentrating more on employee protection with tight employment regulations (associated with relatively high degrees of income security) with different performances in terms of flexicurity output (states and effects) and labour market outcomes. The impact of various flexicurity measures upon labour productivity in C.E.E. countries is also extremely significant, being largely discussed within the paper.

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1. Introduction

The world economy is significantly shaped by a complex and dynamic globalisation process that has decisively influenced the labour markets, thus inducing significant effects among various types of actors, mainly companies and individuals (workers). Employers face an important need to design flexible working arrangements that will allow employment and dismissal of employees through a straightforward uncomplicated procedure, with fewer restrictions and reduced costs. These types of flexible arrangements become an incentive for active labour market participation of women, elderly people, or of those with disabilities or numerous family care responsibilities. On the other hand, employees continue to ask for

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a higher social protection level that will counterbalance the insecurity induced by part of the flexible working arrangements.

Within this context, the flexicurity notion has been introduced as a strategic and efficient policy to solve this problematic and to combine the two conflicting perspectives of employers and employees (Shahidi et al., 2016; Burroni & Keune, 2011; Auer, 2010). Therefore, flexicurity describes a new framework for the regulations on work and employee welfare, through combining labour market flexibility (obtained mainly by softening contractual provisions) with a proper level of social security. This new configuration implies that the impact of labour market deregulation needs to be counterbalanced by active labour market policies promoting employment, and generous measures of income replacement that will offset the short-term effects of unemployment.

Despite its significance, the research on flexicurity coordinates and productivity interference with a specific focus on Central and Eastern European (C.E.E.) economies is still in its infancy and there is a growing need for comprehensive studies in order to provide empirical evidence in developing better flexicurity policies for these countries. An attempt to understand the impact of flexicurity measures on productivity and economic performance of C.E.E. countries is however a challenging analytical issue since the effects may vary across time and place. There is nevertheless a need for continuous assessment through a novel approach which is not limited to certain components, ensuring an integrated perspective of the flexicurity efforts performed by nations, institutions and companies to ensure flexibility and security and its states/effects. This approach would pave the way for treating flexicurity not only as an interesting theoretical model, but as a complex process with important economic effects.

Thus far, a number of studies were undertaken to depict the adverse and beneficial consequences of flexicurity policies, particularly on productivity and labour market outcomes (unemployment levels). Some of these studies concurred that selected flexicurity measures increased labour and total factor productivity (Laporšek & Dolenc, 2011; Dolenc & Laporšek, 2013; Muffels & Wilthagen, 2013; Rotar, 2017), while others challenge the flexicurity coordinates as being the main contributors to labour market performance (Andersen & Svarer, 2007). Yet others concluded that flexicurity reforms spur job creation and can substantially reduce unemployment in countries where severance payments are initially high (Kettemann et al., 2017). Differently from others, Seifert and Tangian (2007) bring some empirical evidence for Europe on a possible reconciliation between social security with flexibility and show a positive dependence between aggregate flexibility and aggregate precariousness of work all over Europe. Later, Tangian (2008) brings new empirical evidence, critical remarks and reform proposal in trying to highlight whether Europe is ready for flexicurity. Muffels and Wilthagen (2013) analyse the normative and analytical meanings of the flexicurity concept both from a theoretical and empirical perspective. Thus, they show empirical evidence based on the definition of dynamic outcome indicators for assessing the performance of 26 countries in the E.U. in balancing flexibility and security. While previous empirical studies comprehensively described some individual flexicurity measures and labour market outcomes, these impacts cannot be considered independent from a comprehensive flexicurity approach both in terms of the efforts performed nationally and its states/effects. Hence, this research provides an integrative framework of analysis for the flexicurity process from a twofold perspective (efforts-states/effects) compared to previous literature analysing only parts of this process (Cazes & Nešporová, 2007; Funk, 2009;

Cazes & Tonin, 2010; Heinz & Rusinova, 2011). From this perspective, the present research aims to identify and assess the basic coordinates of flexicurity models (external numerical flexibility, income and employment security) for ten E.U. Member States in Central and Eastern Europe and their interdependencies with labour productivity per person employed.

The paper is thus structured on five main parts. The following section briefly describes the main theoretical fundamentals of flexicurity policies and strategies, while the third section details the data, methodology and model specification. The fourth section focuses on empirical results and discussions, being divided into two sub-sections according to the main objectives followed by the research performed: one sub-section identifies and evaluates flexicurity models for ten new E.U. Member States in Central and Eastern Europe based on cluster forming and analysis, while the other sub-section examines the effects induced by different measures of flexibility and security upon labour productivity per person employed. The final section of the paper summarises the concluding remarks and implications of the research. Moreover, a large amount of information taking the form of tables and figures that justify the work undertaken are included in the Appendix.

2. Theoretical framework and literature review

Flexicurity matches into a relatively new and complex framework for employment regulations and legislation, aiming to conjoin labour market flexibility with social security. Therefore, the promoters of such policies argue that by reaching the equilibrium between flexibility and security, firms can get advantages from softening the contractual arrangements within a dynamic and increasingly competitive economic environment, while workers are protected from the adverse effects and social consequences of flexible forms of employment (Shahidi et al., 2016).

The economic literature on flexicurity is quite recent, dating to the end of 1990 and early 2000, with flexicurity being approached as strategy, state and analytical instrument (Nardo & Rossetti, 2013). Firstly, Wilthagen (1998) defines flexicurity as a coordinated strategy and policy. Later on, Wilthagen and Rogowski (2002) refer to it as a synchronised strategy directed towards the weak groups in the labour market, while Ferrera et al. (2001) associate flexicurity with the sustained efforts performed by countries to struggle against social exclusion. A completely different approach on flexicurity is expressed by Tangian (2004) who analyses it as a response to the economic needs to increase the competitiveness of European economies, thus promoting liberalisation as a fundamental coordinate of regional integration, regardless of the major security concerns that are being used to ensure a balance between employers and workers. At the same time, Madsen (2004) shapes the way towards a more pragmatic vision on flexicurity, by proposing the idea of a *golden triangle* based on flexible labour markets, along with generous unemployment benefits and active labour market measures such as education and training programmes that allow the unemployed to acquire new skills to aid them in finding a job. The European Commission (2007, 2015) broadly continues this perspective on flexicurity, but adopts an institutional definition centred on four pillars that rather focus on lifelong learning and work–life balance, compared to the Madsen (2004) approach. Moreover, Wilthagen and Tros (2003, 2004) shape a set of flexicurity profiles in order to ensure adequate monitoring of the policies developed by the E.U. Member States. To this end, they have identified various types of flexibility and security, thus revealing the historical evolution of the flexicurity concept. For every identified

type, they have developed different quantification forms and have compiled a complex set of indicators used within the empirical analyses. Fernandez Rodriguez et al. (2012) focuses on how flexicurity should be developed and implemented by public employment agencies, mentioning that it is a fundamental instrument to tackle the issues of vulnerability and social exclusion.

Each of these approaches is not neutral and involves a distinct highlight of different flexicurity components. Chung (2012, p. 154) states that by using a certain definition and analytical framework of flexicurity, the researcher consciously adopts a decision about its own focus on certain coordinates.

Therefore, in the economic literature there are several flexicurity definitions, even though there is not a unitary approach. However, there are two basic coordinates of this concept revealed by numerous researches, one that analyses flexicurity as a strategic policy focused on the efforts accomplished by states and companies to ensure flexibility and security and the other which reveals the states and effects/results of the flexicurity policies. Wilthagen (1998) has defined five forms of flexibility (internal numerical, external numerical, internal functional, external functional and wage flexibility) and seven different forms of security (job security, work security, income security, employment security, employment opportunities, representation, work–life balance).

Based on all these elements there have been developed various flexicurity models, out of which we extracted two (Muffels et al., 2010; Chung, 2012) that offer a coherent unitary approach on flexicurity, thus revealing that its analysis both as a strategic policy and state should take into account a measurement of the efforts performed by nations, institutions and companies to ensure flexibility and security, along with measuring the specific states that embody the results of flexicurity policies in terms of income security, productivity and high levels of employment (Figure 1).

In the literature there is evidence to attest that countries with tight employment protection legislation (E.P.L.) for full-time workers are characterised by dual labour markets,

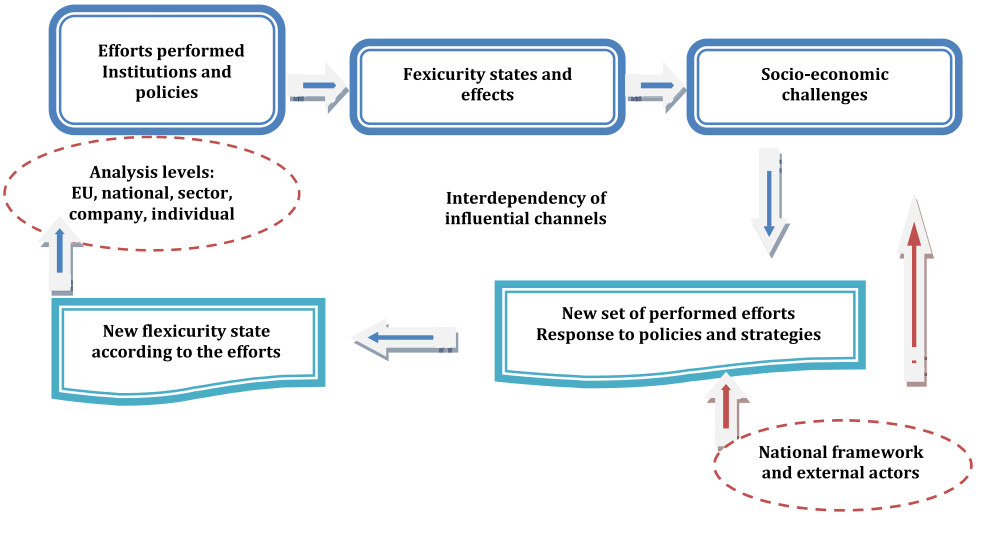

Figure 1. Flexicurity as a strategic policy: the E.S.C. model. Source: rearranged after Muffels et al. (2010), Nardo and Rossetti (2013), p. 18.

with a segment of highly protected workers coexisting with another segment of part-time or temporary workers that are less protected (Kahn, 2007). Boeri et al. (2003) have shown that countries with higher degrees of employment protection are also characterised through low levels of unemployment benefits (U.B.). By contrast, in countries with functional flexicurity models (comprised by the so-called golden triangle involving low E.P.L. levels, high U.B. and active labour market policies; A.L.M.P.), temporary workers can feel secure, thus being satisfied by their job and work–life balance, with positive productivity outputs.

Laporšek and Dolenc (2011) empirically analyse the relationship between flexicurity and labour productivity. They attest a positive impact of security in the labour market on productivity, along with considerable differences in labour market flexibility and security across E.U. Member States, the least successful at simultaneous implementation being the new Member States. Later, Dolenc and Laporšek (2013) extend their initial analysis beyond labour productivity by taking into account the association between three flexicurity policy components and total factor productivity growth, but remaining up to the 2008 period. They show that labour market policies (L.M.P.) and participation in lifelong learning programmes have a statistically significant positive association with labour and total factor productivity growth, while rigid employment protection and high expenditures for passive labour market policies negatively relate to productivity growth. At the same time, Rotar (2017) considers the association between labour productivity and labour market policies (A.L.M.P. and passive L.M.P.; P.L.M.P.) based on panel regression for 20 E.U. Member States over the 2004–2013 period. The econometric results suggest that expenditures on L.M.P. positively relate to labour productivity growth. At the same time, Cazes and Nešporová (2007) study the role of flexibility and security on labour market performance and argue that flexicurity is the most relevant approach for Central and Eastern European countries (namely, Croatia, Bulgaria, Hungary, Lithuania and Poland).

3. Data, methodology and model specification

Based on the fundamental theoretical flexicurity coordinates, this empirical study focuses on the two essential dimensions related to flexibility and security. The main objective is thus to assess the actions, efforts and results induced by various flexicurity policies defined and implemented by ten E.U. Member States in Central and Eastern Europe (Bulgaria, Romania, Hungary, Slovenia, Slovak Republic, Czech Republic, Poland, Lithuania, Latvia, Estonia).

Having as background the research performed by Chung (2012) who approaches and defines flexicurity as a combination of external numerical flexibility, income security and employment security, I expanded the analysis beyond the three basic coordinates of the *golden triangle* (E.P.L., U.B., A.L.M.P.), as mentioned in the Danish model of flexicurity (Madsen, 2004), to embody numerous specific indicators and associated proxies (Figure 2).

Therefore, the focus is on two main coordinates (stages) of the efforts-states-challenges (E.S.C.) model, respectively on *efforts and states of affairs*, the study being performed at a national level, but also using other relevant measures (company, individual).

In order to better capture the *external numerical flexibility* for the ten E.U. countries considered within the panel, two proxy indicators associated with the *efforts* performed nationally and by the companies have been used in the empirical analysis: (i) the *E.P.L. index* – a composite indicator of Employment Protection Legislation governing regular contracts, individual dismissals (Eurostat and Organisation for Economic Co-operation

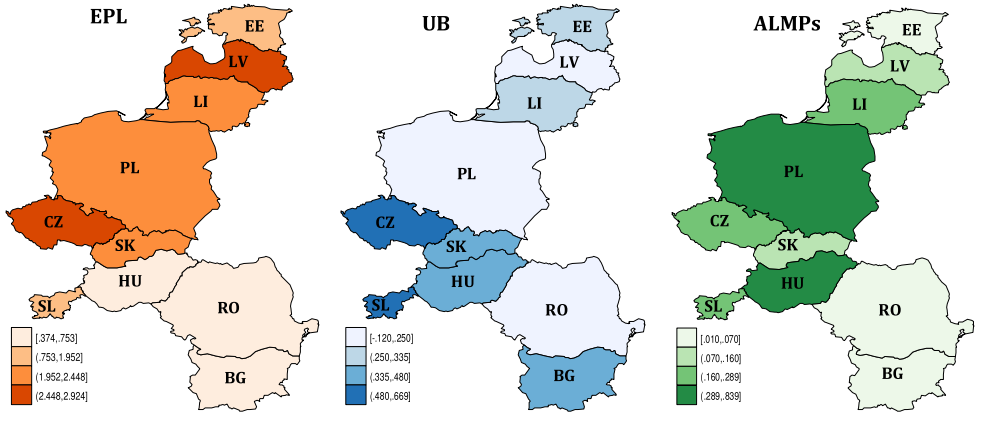

Figure 2. The three basic coordinates of the 'golden triangle' (E.P.L., U.B., A.L.M.P.) in the case of the ten considered countries from Central and Eastern Europe (E.U. Members), 2015. Source: Author's research.

and Development (O.E.C.D.) Employment Protection Indicators); and (ii) the employees with *temporary contracts* as share of the total number of employees (temporary = when the employer and employee commonly establish that its termination is determined by objective conditions). Also, a specific indicator for the *external flexibility state* at individual-aggregated level has been introduced, namely the *duration of working life*, respectively the number of years spent by a 15-year-old person as being actively on the labour market throughout its lifetime.

In the case of *income security* the focus was on income levels measured through the *average wages* (per capita, Euros) and *at-risk-of-poverty rates* (share of individuals with a disposable income, after social transfers, placed below the poverty level established at 60% of the national median of disposable income). The *passive labour market policies* (P.L.M.P. expenditures as a % of G.D.P.) that ensure income support programmes during unemployment were also considered (*net social benefits* and *unemployment benefits* measured through net social protection as a percentage of G.D.P.). Social protection includes transfers to households (disability, sickness/healthcare, old age, survivors, family/children, unemployment, social exclusion) intended to relieve them of the financial burden of several risks and needs (Eurostat, 2017).

For the *employment security* dimension, two proxies were used to capture the *efforts* performed nationally: (i) *active labour market policies* (A.L.M.P. expenditures as a % of G.D.P.): labour market services, training programmes, employment incentives, supported employment and rehabilitation, direct job creation and start-up incentives, and (ii) *lifelong learning (L.L.L.)*: a fundamental indicator that comprises persons aged between 15 and 64 years old which have attended an educational or training programme as a percentage of the total population on the same age group (Eurostat, 2017). *Employment* and *unemployment rates* were used to account for the individual aggregated *states and effects*.

3.1. Research methodology: models, estimation, configuration

The standardisation method was used in the first stage of the performed research to ensure a proper comparability of data between countries by removing the variations and associated

differences. This method allowed us to develop a composite indicator calculated according to the following formula (O.E.C.D., 2005; Seifert & Tangian, 2007; Chung, 2012, p. 167): $y_i = \frac{x_i - mean}{sd}$, where x_i represents the crude value of the indicator, and *sd* is the standard deviation. Thus, a proper analysis of the indicators' score obtained for each country is ensured by reporting to the scores of the other countries included in the panel. Therefore, by using the compounded indicators we can better assess the relationship and interdependence between the sum of flexicurity efforts and states/effects. Moreover, to complete the data series for the ten countries considered within the panel during 2006–2015 we have firstly proceeded to interpolation and extrapolation. The crude and standardised values (scores) are presented and detailed in the Appendixes (Tables A1–A3).

Cluster forming and analysis was performed based on the standardised values of flexicurity indicators, by using the *Ward method* for hierarchical clusters, which relies on calculating the Euclidian distance between two subjects (Cornish, 2007). Moreover, in the case of the overall flexicurity models formed by combining aspects of external flexibility with income and employment security, the *complete linkages method* was also used for the cluster analysis (complete-link clustering). In this case the distance between clusters is given by the maximum distance between its members, respectively:

$$d(A, B) \equiv \max_{\overset{\rho}{x} \in A, \overset{\rho}{y} \in B} \left\| \overset{\rho}{x} - \overset{\rho}{y} \right\| \tag{1}$$

The empirical analysis of the *impact generated by various flexicurity measures on labour productivity* is based on developing various double-log multiple regression models with panel data which are processed through the correlated panels corrected standard errors (P.C.S.E.) method of estimation. The general configuration of these models is: $y_{it} = x_{it}\,\beta + \varepsilon_{it}$, where $i = 1, \ldots, m$ represents the number of units (or countries/ sub-panels); $t = 1, \ldots, T_i$; T_i is the number of time periods within the panel; and ε_{it} is the error term that can be autocorrelated across *t* or contemporaneous correlated between *i*.

The P.C.S.E. method generates ordinary least squares (O.L.S.) estimators of parameters when the autocorrelation is not specified, and Prais-Winsten estimators when the autocorrelation is mentioned. In this particular case, the coefficient estimators are conditioned by the estimators of the autocorrelation parameter(s). A P.C.S.E. method was selected rather than a classical O.L.S. since the panel unit-root tests applied gave different results (Appendix – Table A10), and thus there was a keen interest to produce valid estimates (avoiding spurious regression; Granger & Newbold, 1974) with accurate economic meaning.

At the same time, in order to account for spatial interference (spatial spillover effects) between the C.E.E. countries in the productivity impact models and to further observe if the observations cluster or are randomly spread, and thus ensure robust results, *two spatial lag (autoregressive)* and *spatial error* models have been applied. These models were processed through the maximum likelihood estimator (M.L.E.) method and have the following general configuration (Viton, 2010):

Spatial lag models: $y = \lambda W y + X\beta + u$, where u is assumed to be classical; Spatial error models: $y = X\beta + u$ and $u = \rho W u + v$, where v is assumed to be normal with $E(v) = 0$, $E(vv') = \sigma^2 I$; W represents the spatial weights matrix.

The presence of spatial autocorrelation is tested through Patrick Moran (Moran's *I*) test by (Viton, 2010, p. 8):

Table 1. Clusters associated with external numerical flexibility.

	External numerical flexibility		
Clusters	Flexicurity efforts (E.P.L. and Temp_contracts)	Flexicurity states/effects	Clusters
Bulgaria, Romania, Hungary	High (loose E.P.L.)	High	Slovak Republic, Poland, Lithuania, Estonia, Latvia
Lithuania, Estonia, Slovenia, Poland, Latvia	Medium	Medium (to high)	Czech Republic, Slovenia
Czech Republic, Slovak Republic	Low (tight E.P.L.)	Low	Bulgaria, Romania, Hungary

Source: Author's research.

$$I = \frac{R}{\sum_i \sum_j \omega_{ij}} \frac{\sum_i \sum_j \omega_{ij}(x_i - \overline{x})(x_j - \overline{x})}{\sum_i (x_i - \overline{x})^2} \tag{2}$$

Moran's I test is used to examine the presence of positive or negative spatial autocorrelation, thus allowing identification of whether or not the analysed countries are clustered in terms of flexicurity models applied and productivity output.

The standard macroeconometric model used follows the theoretical configuration of the 'golden triangle', focusing on employment protection, unemployment benefits and active labour market policies, with one effort measure for each flexicurity dimension previously considered (external numerical flexibility, income security, employment security). It is defined as a baseline panel regression model, but reconfigured through the spatial procedures, and estimated accordingly both through P.C.S.E. and M.L.E. (Equations 3):

$$\begin{gathered} P.D.V._{it} = \beta_0 + \beta_1 E.P.L._{it} + \beta_2 U.B._{it} + \beta_3 A.L.M.P._{it} + u_{it} \\ P.D.V._i = \lambda WPDV_i + \beta_0 + \beta_1 E.P.L._i + \beta_2 U.B._i + \beta_3 A.L.M.P._i + u_i \\ P.D.V._i = \beta_0 + \beta_1 E.P.L._i + \beta_2 U.B._i + \beta_3 A.L.M.P._i + \rho W u_i + \upsilon_i \end{gathered} \tag{3}$$

These variables/ indicators were also used in other econometric studies with significant results (Boeri, 2003; Tangian, 2008; Cazes and Nešporová, 2007; Laporšek and Dolenc, 2011; Chung, 2012; Dolenc and Laporšek, 2013; Rotar, 2017). However, in order to ensure a proper assessment of the interference between productivity and flexicurity coordinates in C.E.E. countries in our twofold approach (efforts-effects) we also took into account other specific flexicurity measures previously described and the resultant models were subject to various econometric procedures (panel regressions with P.C.S.E. estimates). Therefore, five alternative models were estimated (summarised in Table 1), respectively:

$$P.D.V._{it} = \beta_0 + \beta_1 E.P.L._{it} + \beta_2 N.S.B._{it} + \beta_3 L.L.L._{it} + \beta_4 A.L.M.P._{it} + \beta_5 Transit\_H_{it} + \varepsilon_{it} \tag{4}$$

$$P.D.V._{it} = \beta_0 + \beta_1 E.P.L._{it} + \beta_2 N.S.B._{it} + \beta_3 L.L.L._{it} + \beta_4 A.L.M.P._{it} + \beta_5 Transit\_L_{it} + \varepsilon_{it} \tag{5}$$

$$\begin{aligned} P.D.V._{it} = {} & \beta_0 + \beta_1 E.P.L._{it} + \beta_2 N.S.B._{it} + \beta_3 L.L.L._{it} + \beta_4 A.L.M.P._{it} \\ & + \beta_5 Transit\_H_{it} + \beta_6 Pov\_risk_{it} + \varepsilon_{it} \end{aligned} \tag{6}$$

$$P.D.V._{it} = \beta_0 + \beta_1 E.P.L._{it} + \beta_2 N.S.B._{it} + \beta_3 L.L.L._{it} + \beta_4 A.L.M.P._{it} + \beta_5 Transit\_H_{it} + \beta_6 Pov\_risk_{it} + \beta_7 Temp\_empl_{it} + \varepsilon_{it} \quad (7)$$

$$P.D.V._{it} = \beta_0 + \beta_1 E.P.L._{it} + \beta_2 U.B._{it} + \beta_3 L.L.L._{it} + \beta_4 A.L.M.P._{it} + \beta_5 Transit\_H_{it} + \beta_6 Pov\_risk_{it} + \beta_7 Temp\_empl_{it} + \varepsilon_{it} \quad (8)$$

where:

P.D.V. – Labour productivity per person employed;
E.P.L. – Employment Protection Legislation;
N.S.B. – Net Social Benefits;
U.B. – Unemployment Benefits;
L.L.L. – Lifelong Learning – participation rate in education and training;
A.L.M.P. – Active Labour Market Policies;
Transit_H – Transition to the same or higher employment security as previous year;
Transit_L – Transition to less employment security than last year;
Pov_risk – At-risk-of-poverty rate;
Templ_empl – Temporary employees (temporary contracts) as a percentage of total employment.

The panel includes ten countries, new E.U. Members States from Central and Eastern Europe since 2004 and 2007 (Bulgaria, Romania, Hungary, Slovenia, Slovak Republic, Czech Republic, Poland, Lithuania, Latvia, Estonia), that are analysed during 2006–2015 and a complex set of flexibility and security indicators (descriptive statistics are presented in the Appendix, Table A9). The main sources used for constructing the database/ indicators are Eurostat – E.U. /L.F.S.; O.E.C.D.–Employment Protection Indicators; I.L.O.–Employment; World Bank – World Development Indicators.

4. Empirical results and discussions

4.1. Assessing flexicurity models for ten new E.U. Member States in Central and Eastern Europe based on cluster forming and analysis

The main objective of the first part of the research is to identify and assess the basic coordinates of various flexicurity models specific for the new E.U. Member States in Central and Eastern Europe. The focus is on three flexicurity dimensions related to external numerical flexibility, income security and employment security considered both under the efforts performed and the states of affairs/ effects induced. The results obtained after applying the clustering techniques are detailed in the Appendix, Tables A4–A8.

- *External numerical flexibility*

In order to quantify and pattern the *efforts* accomplished by the ten considered countries within the framework of external numerical flexibility, the Ward clustering method specific for hierarchical clustering was applied, by using standardised indicators associated with this dimension (employment protection legislation, temporary contracts). For the *flexibility states and effects* one main indicator at individual-aggregated level was considered, namely the duration of working life (years). The correlation matrix of these indicators is presented

in the Appendix (Figure A1). Thus, three hierarchical clusters have been identified, both in terms of the efforts performed nationally and external flexibility states, as reflected by the dendrograms in Figure 3, by Table 2 and summarised by Appendix Table A4.

The cluster units highlight tight employment protection legislation and relatively high shares of temporary contracts in the case of Czech Republic, Slovak Republic, Poland, Slovenia. This indicates a focus on employee protection and can thus provide a good working environment for workers that do not feel insecure about their job (in terms of unjustified dismissals). Czech Republic focuses on a combination of very tight E.P.L., large unemployment benefits and relatively significant A.L.M.P./L.L.L. expenditures, representing a version of the golden triangle focused on increased protection for the employees. This flexicurity model proves to generate positive effects on labour market fundamentals, significantly improving the expected number of years on the labour market and the employment degree for a 15-year-old person throughout their lifetime, as well as significantly reducing the unemployment rate.

At the same time, the Baltic States have tight E.P.L., but low shares of flexible working arrangements, which in terms of labour market outcomes tends to have positive effects. Estonia, Lithuania and Latvia have the longest duration of working life compared to the other C.E.E. countries considered, as well as the highest employment levels.

At the opposite end, Hungary, Romania and Bulgaria have the lowest index of employment protection among the ten considered economies. However, compared to Romania

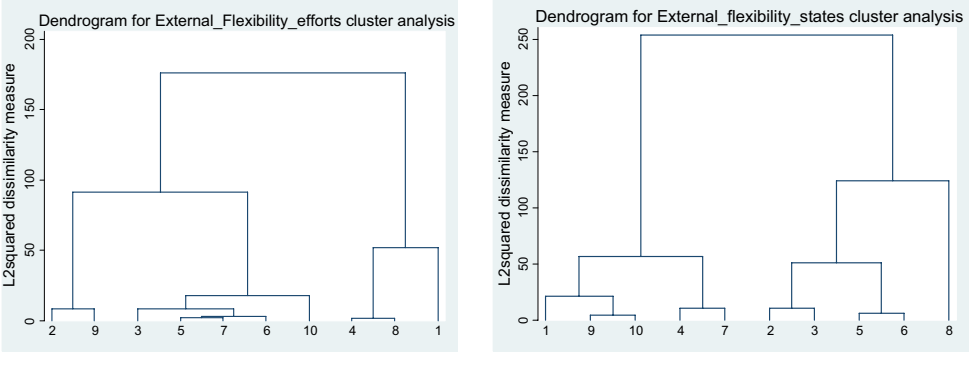

Figure 3. Dendrogram for cluster analysis of country efforts and states in the case of external numerical flexibility Source: Author's research.

Table 2. Clusters associated with the income security dimension.

	Income security		
Clusters	Flexicurity efforts (U.B. and P.L.M.P.)	Flexicurity states/effects	Clusters
Bulgaria, Slovak Republic, Czech Republic, Slovenia, Hungary	High	High	Slovak Republic, Poland, Hungary, Slovenia
Lithuania, Estonia, Poland, Latvia, Romania	Low	Low	Latvia, Estonia, Lithuania, Romania, Bulgaria, Czech Republic

Source: Author's research.

and Bulgaria, Hungary has made significant flexibility efforts and tends to differentiate itself through a large share of temporary contracts, focusing on increasing flexibility through flexible working arrangements and loose regulations that will allow employment and dismissal of employees through a straightforward uncomplicated procedure, with fewer restrictions and reduced costs, representing a significant advantage for companies operating on a global market. These types of flexible arrangements become an incentive for active labour market participation of women, elderly people, or of those with disabilities or numerous family care responsibilities. However, in output terms, some of the measures implemented by Hungary to this respect tend to fail in achieving the target since Hungary has the shortest duration of working life compared to the other analysed C.E.E. countries, being quite modest also in terms of employment levels.

On the other hand, a low protection degree for the employees in general, and especially in the case of part-time and temporary workers, proves to have a negative impact and low performances in terms of the flexicurity states and effects for these three economies, whereas in the other two clusters the implemented policies have led to high levels of external numerical flexibility and important positive effects measured at individual-aggregated level through a longer duration of the working life (and relatively high employment levels).

- *Income security*

In terms of income security, for the *efforts* performed, we have used a combination of two specific indicators, namely the average wage and P.L.M.P., followed by a different combination focused on N.S.B. and U.B. In case of the *effects* induced at individual-aggregated level, the at-risk-of-poverty-rate was used. The correlation matrix of these indicators is comprised in the Appendix (Figure A1). The Ward method outlined two main clusters, as reflected by the dendrogram in Figure 4, by Table 3 and summarised by Appendix Table A5. There tends to be a split of the countries analysed within the panel in two clusters, both in terms of the efforts performed (two clusters of five countries each) and for the states and effects (two clusters of four and six countries each) of income security reassurement measures.

The first cluster comprises five countries (Bulgaria, Slovak Republic, Czech Republic, Slovenia, Hungary) with high levels of net social benefits, mainly unemployment benefits granted in case of temporary job loss, associated with important expenditures on passive labour market policies focused on out-of-work income maintenance and support.

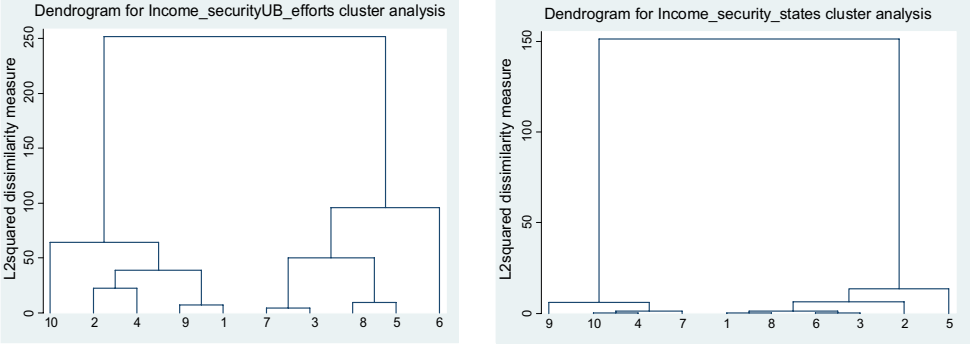

Figure 4. Dendrogram for cluster analysis of country efforts and states in the case of income security. Source: Author's research.

The positive effects of such measures are extremely important in the case of Slovak Republic, Hungary, Slovenia and Poland where the at-risk-of-poverty rate reaches very low levels compared to the other six countries analysed within the panel. By contrast, Bulgaria presents high poverty levels, even though it has developed and implemented important income security measures. At the same time, the Baltic States and Romania have the lowest shares of G.D.P. granted for unemployment benefits and P.L.M.P.; therefore the effects are small in terms of individual welfare, with the at-risk-of-poverty rates being at quite high levels.

- *Employment security*

As regarding the employment security, we have grouped the active labour market policies with lifelong learning and the participation rate in education and training in terms of the *efforts* performed by the ten considered panel countries, while for the *states and effects* at individual level the focus was on employment and unemployment rates (the correlation matrix of all these indicators is presented in the Appendix, Figure A2). Hierarchical cluster analysis and the linkages revealed by the Ward method highlighted the framework of three clusters, both in terms of the efforts performed and employment security states (Figure 5, Table 4 and Appendix Table A6). For this particular case, the Ward clustering method allowed for a differentiation of the two perspectives of employment security (efforts and states/effects) among the ten considered economies, revealing that the Baltic States, Romania

Table 3. Clusters associated with the employment security dimension.

	Employment security		
Clusters	Flexicurity efforts	Flexicurity states/effects	Clusters
Hungary	High (to medium in terms of L.L.L.)	High	Estonia, Czech Republic
Slovenia, Czech Republic, Poland	Medium	Medium (to low in terms of employment)	Latvia, Poland, Hungary, Bulgaria, Lithuania, Slovenia, Romania
Slovak Republic, Romania, Estonia, Lithuania, Bulgaria, Latvia	Low (to medium for L.L.L.)	Low	Slovak Republic

Source: Author's research.

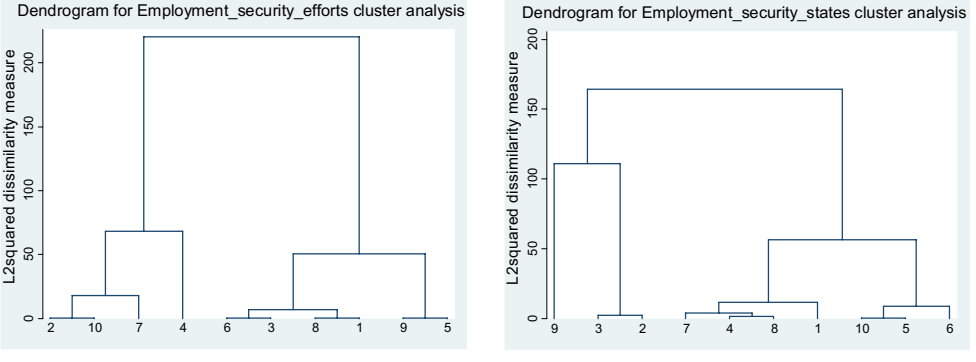

Figure 5. Dendrogram for cluster analysis of country efforts and states in the case of employment security.
Source: Author's research.

Table 4. Clusters by overall flexicurity efforts – all three considered dimensions.

Clusters by Ward method	Flexicurity – overall dimensions		Clusters by complete linkages method
	Flexicurity efforts		
Lithuania, Estonia, Czech Republic, Poland, Slovenia, Slovak Republic, Latvia	High (to low in terms of A.L.M.P.)	High	Czech Republic, Slovenia
Hungary	Medium (to high in terms of A.L.M.P.)	Medium	Lithuania, Estonia, Poland, Slovak Republic, Latvia
Bulgaria, Romania	Low	Low	Bulgaria, Romania, Hungary

Source: Author's research.

and Bulgaria are grouped together in the same cluster both in terms of the efforts performed and the effects generated by these measures at individual-aggregated level.

The other countries have different positions/results according to the analysed sub-dimension. Thus, Hungary is highlighted among the ten new E.U. Member States under the efforts performed with very high mean levels of expenditures on A.L.M.P. compared to the other countries, but not so ambitious in terms of the L.L.L.

However, these measures seem to be efficient only in terms of unemployment reduction, and not if we consider the employment levels, since the employment rate is still quite low when compared to the benchmark established by Europe 2020 strategy. Slovak Republic has quite modest G.D.P. shares granted for A.L.M.P. and L.L.L. measures with low performances/results in terms of the unemployment rate compared to the other two clusters and still quite modest if we consider the employment levels. At the same time, Estonia has the lowest share of G.D.P. granted for active labour market policies, together with Bulgaria and Romania, and a very low degree of participation in education and training, but has managed to register the highest level of employment compared to the other countries considered and, along with the Czech Republic, has the lowest unemployment rate. It also ranks among the first countries analysed in terms of external flexibility effects with the longest duration of working life.

- *Flexicurity*: *the overall framework of analysis (all three dimensions)*

In order to capture the general flexicurity models in terms of the efforts performed by the ten Central and Eastern European countries considered, as well as the hierarchical linkages between them revealed based on the three analysed dimensions, we have taken into account the fundamentals established by the 'golden triangle' of flexicurity (Madsen, 2004), namely a combination of the E.P.L., U.B., and A.L.M.P. Moreover, to ensure a more accurate assignation of flexicurity models, two clustering procedures were applied, respectively the Ward and complete linkages methods.

Cluster analysis and the connections revealed by Ward and complete linkages methods have allowed us to shape three clusters in terms of the *overall flexicurity efforts* performed by the ten considered countries (Figure 6, Table 5, Appendix Table A7). There is a large group of seven C.E.E. countries (Lithuania, Estonia, Czech Republic, Poland, Slovenia, Slovak Republic, Latvia) that have made significant flexicurity efforts in terms of flexibility through the employment protection ensured for workers and under income security through the unemployment benefits granted for temporary job loss.

Still, the Czech Republic and Slovenia tend to stand out with some of the tightest E.P.L. and relatively high percentages of G.D.P. devoted to U.B. and A.L.M.P. On the other hand,

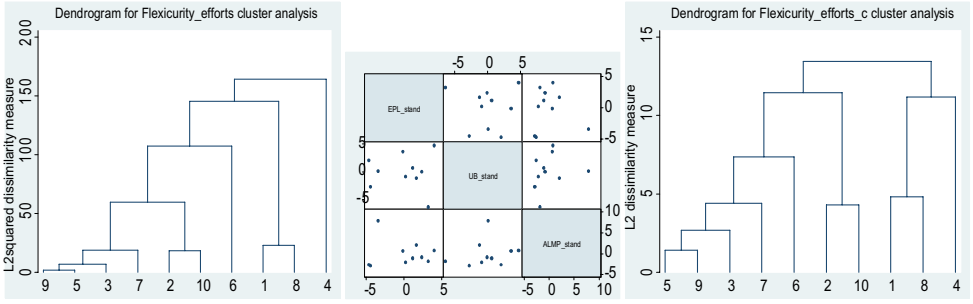

Figure 6. Dendrogram for cluster analysis of the efforts performed by the overall flexicurity: all three considered dimensions (Ward method – left; Complete linkages method – right) and the correlation matrix of the main flexicurity efforts indicators (middle). Source: Author's research.

Table 5. Clusters by overall flexicurity states and effects – all three considered dimensions.

	Flexicurity – overall dimensions	
Clusters by Ward method	Flexicurity states/effects	Clusters by complete linkages method
Slovak Republic	High (to medium in terms of the unemployment rate)	Slovak Republic
Slovenia, Czech Republic, Estonia, Latvia, Lithuania	Medium (to low in terms of at-risk-of-poverty rates)	Slovenia, Czech Republic, Estonia, Latvia, Lithuania
Poland, Romania, Bulgaria, Hungary	Low (to medium in terms of unemployment rates)	Poland, Romania, Bulgaria, Hungary

Source: Author's research.

Hungary has a low E.P.L. index, medium levels of U.B., and a focus on active labour market policies, having the largest share of G.D.P. devoted to A.L.M.P. compared to the other C.E.E. countries considered. Thus, Hungary follows the basic coordinates of the 'golden triangle'; however, the labour market effects induced by these measures are quite modest. At the opposite end there are Bulgaria and Romania with very low efforts performed in terms of flexicurity (low E.P.L. index and among the lowest percentages of G.D.P. granted for U.B. and A.L.M.P.).

In terms of the effects generated by various flexicurity measures at individual-aggregated level, three main clusters have also been configured by using the two clustering methods, respectively Ward and complete linkages, that reveal no differences with regard of their structure (Figure 7, Table 6, Appendix Table A8).

High flexicurity efforts and associated measures implemented by Slovenia, Czech Republic and the Baltic States have significant positive results in terms of the working life duration and unemployment levels. However, these policies need to be correlated with other socio-economic measures in order to temper high at-risk-of-poverty rates, respectively low levels of disposable income after social transfers.

The cluster analysis and forming points out the Slovak Republic as having high to medium performances on flexicurity states/effects, that cumulates a longer duration of working life with the lowest level of poverty risk (arising from large average wages). Still, the Slovak Republic has the highest unemployment rate among panel considered countries. Even though it has a low at-risk-of-poverty rate and a relatively low unemployment level as a result of good A.L.M.P., Hungary is placed among the countries with low flexicurity effects

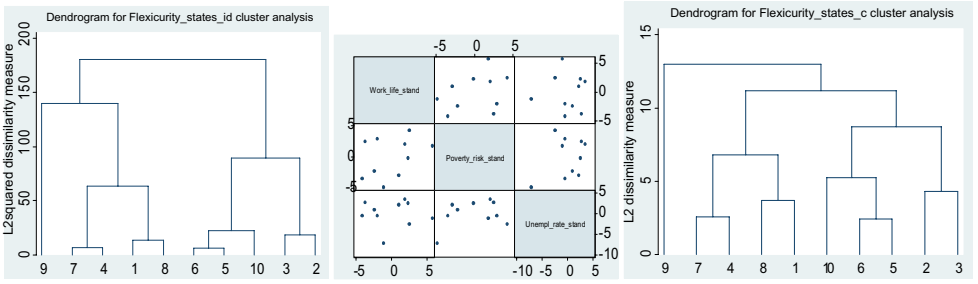

Figure 7. Dendrogram for cluster analysis of the effects generated by overall flexicurity: all three considered dimensions (Ward method – left; Complete linkages method – right) and the correlation matrix of the main flexicurity effects indicators (middle). Source: Author's research.

Table 6. Results of the macroeconometric models, P.C.S.E. method.

	(1)	(2)	(3)	(4)	(5)
	log_P.D.V.	*log_P.D.V.*	*log_P.D.V.*	*log_P.D.V.*	*log_P.D.V.*
E.P.L.	0.155***	0.155***	0.159***	0.144***	0.149***
	(0.00983)	(0.00983)	(0.0101)	(0.0107)	(0.0101)
N.S.B.	0.0195***	0.0195***	0.0149***	0.0161***	
	(0.00429)	(0.00429)	(0.00371)	(0.00363)	
L.L.L.	0.00146**	0.00146**	0.00105**	0.00124***	0.000741**
	(0.000488)	(0.000488)	(0.000352)	(0.000366)	(0.000283)
A.L.M.P.	0.190**	0.190**	0.0919	0.0891	0.139*
	(0.0600)	(0.0600)	(0.0562)	(0.0661)	(0.0606)
Transit_H	0.0174***		0.0177***	0.0219***	0.0227***
	(0.00276)		(0.00244)	(0.00298)	(0.00387)
Transit_L		−0.0174***			
		(0.00276)			
Poverty_risk			−0.00208***	−0.00223***	−0.00316***
			(0.000572)	(0.000542)	(0.000534)
Temp_contracts				0.0363**	0.0238*
				(0.0113)	(0.0118)
U.B.					0.0982
					(0.0576)
_cons	1.925***	3.663***	2.089***	1.612***	1.840***
	(0.267)	(0.0873)	(0.223)	(0.293)	(0.367)
N	85	85	85	85	85
R^2	0.710	0.710	0.752	0.767	0.714

Notes: Standard errors in parentheses.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Source: Author's research.

due to the shortest duration of working life among the other considered economies and low employment levels. At the same time, Poland, Bulgaria and Romania have quite low flexicurity performances, measured through short duration of working life and high levels of income poverty levels, as a result of low flexicurity efforts performed, mainly in terms on

income security in the case of Poland. Romania and Bulgaria have the lowest E.P.L. index, lowest shares of part-time and temporary contracts (for external numerical flexibility), and very low percentages of G.D.P. granted for U.B. (income security) and A.L.M.P. (employment security). However, these three countries have made significant efforts under the education component, thus having the largest participation rates in education and training, or L.L.L. programmes. Romania could use these measures to boost economic growth in the framework of a sound financial sector (Cristea et al., 2010).

4.2. Assessing the effects induced by different measures of flexibility and security upon labour productivity per person employed

In order to evaluate the impact of several measures specific for the flexicurity policies upon labour productivity we have firstly estimated a set of five macroeconometric models having the configuration of panel data semi-log (*log-lin*) multiple regression models, processed through *P.C.S.E.* (Table 1).

The results obtained reveal that the estimated coefficients have a high level of statistical significance, mostly at 0.1%, while the value of the determination coefficient points out a high degree of validity for developed models in terms of explanatory variables selection. Approximately 70% of the variation in labour productivity per person employed can be explained through the variation of independent variables specific for the flexicurity policies that are selected in various combinations on three main coordinates related to external numerical flexibility, income security and employment security.

Thus, there is evidence to attest that a tighter employment protection legislation ensures a higher degree of stability for workers, which leads to a significant increase in their labour productivity, along with other measures related to job transition (transition to the same or higher employment security as before) that have associated positive effects. Moreover, additional flexibility measures taking the form of temporary employment (share of employees with temporary or fixed term contracts) induce an increase in labour productivity. A positive impact is also generated by education, namely worker's attendance to various research, education and training programmes, as well as increased financing granted for labour market policies, especially for A.L.M.P.

Net social benefits and, particularly, the unemployment benefits also have positive effects, but to a lower extent, slightly increasing labour productivity. A negative influence upon labour productivity is induced by increased at-risk-of-poverty rates (in terms of income levels compared to other individuals, not necessarily their welfare), along with the transition to less employment security than last year.

In line with the general research objective, there was a keen interest in assessing specific ways in which labour productivity is influenced both by key flexicurity coordinates adopted by each of the ten C.E.E. countries considered, as well as through the performances achieved by neighbours and their dynamics over time (spatial spillover effects).

Therefore, we have developed two further spatial models: *(i) a spatial lag model* that controls for spatial autocorrelation in the dependent variable (productivity) and includes productivity outcomes in neighbouring locations as an additional explanatory variable and *(ii) a spatial error model* that controls for autocorrelation in both the dependent and independent variables, thus being more robust.

The models were processed separately as cross-section for 2015 (model 1 and 2) and by a panel structure covering 2006–2015 (model 3 and 4). Their configuration has theoretical

background in the 'golden triangle' model (Madsen, 2004) and uses labour productivity as a dependent variable, along with three fundamental coordinates of the golden triangle as explanatory variables, namely E.P.L., U.B., and A.L.M.P. The results obtained after processing these models are summarised in Table 7.

Lagrange multiplier tests are significant for the entire sample (2006–2015), thus indicating the presence of spatial dependence. Rho reflects the spatial dependence inherent in the sample data, measuring the average influence on observations by their neighbouring observations. It has a positive effect and is highly significant for the complete 2006–2015 sample. At the same time, lambda is positive and statistically significant for the entire sample in spatial-error models, thus proving positive autoregressive influence of flexicurity basic coordinates on labour productivity for C.E.E. countries.

Moreover, the Moran's I tests (detailed in the Appendix, Figure A3) highlight a positive global spatial autocorrelation ($I_{2006–2015} = 0.330$, $p = 0.000$; $I_{2015} = 0.043$, $p = 0.003$), while the local Moran's I are less significant and positive, except for Latvia (−0.061), Hungary

Table 7. Results of the spatial lag and error models, M.L.E. method.

	2015		2006–2015	
	(1 lag)	(2 error)	(3 lag)	(4 error)
	P.D.V._stand	P.D.V._stand	P.D.V.	P.D.V.
E.P.L._stand	0.682**	0.746***		
	(0.248)	(0.159)		
U.B._stand	0.234	0.410		
	(0.203)	(0.279)		
A.L.M.P._stand	0.306*	0.503*		
	(0.155)	(0.232)		
E.P.L.			6.192***	7.349***
			(0.758)	(1.271)
U.B.			1.147	−1.621
			(3.197)	(3.824)
ALPMs			7.066*	4.964
			(3.138)	(4.322)
_cons	−0.0665	0.0387	−12.94***	43.09*
	(0.789)	(0.179)	(2.713)	(19.75)
rho				
_cons	0.167		0.969***	
	(0.776)		(0.0317)	
sigma				
_cons	1.815***	1.349***	6.530***	7.227***
	(0.357)	(0.403)	(0.419)	(0.418)
lambda				
_cons		−2.220		0.960***
		(1.854)		(0.0412)
N	10	10	100	100
Wald test of rho/lambda = 0	0.046	1.434	932.834***	542.506***
	(0.829)	(0.231)	(0.000)	(0.000)
Lagrange Multiplier test	0.024	0.319	84.944***	49.433***
	(0.877)	(0.572)	(0.000)	(0.000)

Notes: Standard errors in parentheses.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Source: Author's research.

(−0.007) and Bulgaria (−0.161), where the values indicate negative spatial autocorrelation. Therefore, the flexicurity performances achieved by the neighbouring locations are also essential for impacting labour productivity.

The parameters obtained after processing these models are positive and have a high degree of statistical significance in the case of employment protection legislation, thus confirming the importance of strict legal framework for laying off, probations, notifications and all the necessary procedures that have to be performed in case of individual or collective dismissals, along with severance payments for early job terminations and the sanctions applied for unfair dismissals. All these measures provide a solid protective framework for the employees, with positive effects upon their labour productivity, thus confirming the results of previous models.

Consequently, the results obtained after processing different models reveal that for the analysed C.E.E. countries the `golden triangle` model of flexicurity implies a stricter employment protection legislation, along with important flexibility measures and A.L.M.P., while the P.L.M.P. and, particularly, unemployment benefits tend to impact labour productivity to a smaller (but also positive) extent. These measures tend to also increase the duration of working life and employment levels.

5. Concluding remarks

The labour market performance under flexicurity strategies and policies represents a highly debated subject in literature, especially in terms of the effects induced upon socio-economic development and workers' welfare within E.U. Member States. The three main coordinates of the flexicurity policies (employment protection legislation, unemployment benefits, active labour market policies) are also key elements of the European labour market. On one hand, these are protective mechanisms against specific labour market risks that ensure a certain income level and workers protection, and, on the other hand, they influence the labour market capacity to adapt itself to the various changes in economic conditions, mainly due to the fact that the institutional elements also affect the adjustment mechanisms and strategies developed by economic agents.

The empirical analysis performed in this context followed a comprehensive approach and pursued the development of complex methods (clustering, panel macroeconometrics, spatial procedures) to detect and highlight the basic coordinates of flexicurity models and associated performances for ten E.U. Member States in Central and Eastern Europe, thus adding value to the existing literature related to the outcomes of flexicurity models for these countries. Moreover, as another insight compared to previous research, the spatial estimations have revealed that labour productivity is influenced both by key flexicurity coordinates adopted by each of the ten C.E.E. countries considered, as well as by the performances achieved by the neighbouring locations and their dynamics over time.

The performed cluster analysis and productivity impact assessment have shown that in the particular case of C.E.E. countries, provided that the efforts enabled within the other flexicurity dimensions are also significant, the Danish model tends to generate positive effects focus on flexible working arrangements while embodying a tighter E.P.L. with stricter employment regulations that can ensure a higher level of stability and security for workers in case of unfair dismissals. The results show that increasing flexibility through additional temporary and fixed-term contracts, improving the participation rate in education and

training, along with higher financing granted for active labour market policies and prospects for job transition to higher employment security can have positive effects on labour productivity for the ten panel considered economies. Moreover, according to the results obtained, a stricter E.P.L. provides a solid protective framework for the employees, with positive effects upon their labour productivity that also tends to increase the duration of working life and employment levels.

In order to support flexibility and, at the same time, income and employment security, along with a reduction of labour market segmentation, there are a set of actions that can be implemented by the considered C.E.E. countries, each focusing on the weak component of its flexicurity model: (i) first, to customise employment legislation and to re-examine different contractual stipulations referring to the working time; (ii) second, a more detailed and coherent approach of undeclared work; (iii) third, a precise forethought and positive change management, especially related to economic reorganisation, market access, in order to minimise the social costs and to facilitate inclusion; (iv) fourth, to promote and implement various innovative and adjustable forms of work organisation, to improve labour productivity and job satisfaction, including health and security of workers; (v) fifth, to facilitate professional transitions.

The effects induced by different types of labour market policies on the employment degree are extremely complex among the Member States. Tight E.P.L. can steady employment and income levels, thus generating additional human capital investments performed by employers and employees, but the restrictive norms reduce the adjustment degree of labour markets, thus leading to an increase in long term unemployment and labour market segmentation, mainly because the employment protection legislation stabilises jobs for the insiders, at the expense of outsiders. At the same time, a relaxation of the restrictions applied for temporary or fixed term contracts leads to an increase in flexibility and contributes to an upward trend of the employment rates, thus easing the labour market entry for newcomers due to flexible jobs. Furthermore, the process of creating flexible jobs could lead to labour market segmentation if protective legislation against dismissals remains unchanged, taking into consideration the fact that the transition between flexible and stable jobs remains difficult to accomplish. Workers are passing through an extremely complex professional career path, due to the fact that the work organisation methods are becoming more and more diverse and unequal, so that the employees are bound to successfully face an increased number of transition situations during their working life. They should thus benefit from various lifelong learning possibilities to better comply with new working methods, including a better information technology and communication exploitation.

Disclosure statement

No potential conflict of interest was reported by the author.

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Appendixes

Table A1. *External numerical flexibility* specific variables for the ten analysed countries, crude and standardised values, 2015.

Stages	Efforts				States/effects	
Levels	National		Company		Individual-aggregated	
Indicators	E.P.L. national index		Temporary_contracts		Working life duration	
Form	Actual	Standardised	Actual	Standardised	Actual	Standardised
Czech Republic	2.92	4.029462	8.9	4.890876	34.9	2.500003
Estonia	1.81	0.210699	3.2	0.289245	36.4	5.705132
Hungary	0.75	−3.40421	10.7	−3.39206	31.8	−4.12393
Lithuania	2.45	2.398674	2.5	−1.41993	34.8	2.286323
Latvia	2.69	3.226027	3.1	0.15777	34.6	1.858971
Poland	2.23	1.65123	27.9	−0.23666	32.6	−2.41453
Slovak Republic	2.10	1.189171	8.5	4.49645	33.2	−1.13248
Slovenia	1.71	−0.11546	15.9	−2.99763	34.2	1.004275
Bulgaria	0.37	−4.70213	5.1	2.392848	32	−3.69658
Romania	0.45	−4.45743	1.3	−4.18091	32.8	−1.98718

Source: Own calculations based on O.E.C.D. – Employment Protection Indicators; I.L.O. – Employment; Eurostat – E.U./L.F.S. data.

Table A2. Income security specific variables for the ten analysed countries, crude and standardised values, 2015.

Stages	Efforts						States/effects	
Levels	National		National		National		Individual	
Indicators	Wage_avg ($)		U.B. (% of G.D.P.)		P.L.M.P. as % of G.D.P.		At-risk-of-poverty (%)	
Form	Actual	Standardised	Actual	Standardised	Actual	Standardised	Actual	Standardised
Czech Republic	7784	3.580408	0.67	4.746478	0.21	−1.97059	28.5	4.304958
Estonia	7654	3.278688	0.27	−0.88733	0.34	1.85294	20.5	1.805305
Hungary	4656	−0.64367	0.34	0.098592	0.18	−2.85294	13.2	−3.47174
Lithuania	4954	0.362064	0.33	−0.04225	0.16	−3.44118	18.6	−0.13887
Latvia	5915	1.669516	−0.12	−6.38028	0.41	3.911766	21	2.083044
Poland	5654	1.267223	0.25	−1.16901	0.27	−0.20588	15.9	−2.22191
Slovak Republic	7125	2.775822	0.38	0.661973	0.3	0.67647	11.5	−4.86044
Slovenia	1215	−5.47119	0.59	3.619718	0.41	3.911766	13.8	−2.91626
Bulgaria	3367	−2.85628	0.48	2.070424	0.38	3.029412	21.3	2.499653
Romania	2458	−3.96259	0.14	−2.71831	0.11	−4.91177	22.3	2.916262

Source: Own calculations based on O.E.C.D. – Employment Protection Indicators; I.L.O. – Employment; Eurostat – E.U./L.F.S. data.

Table A3. Employment security specific variables for the ten analysed countries, crude and standardised values, 2015.

Stages	Efforts				States/effects			
Levels	National		National		Individual		Individual	
Indicators	A.L.M.P. (% G.D.P.)		L.L.L. (%)		Employment rate (%)		Unemployment rate (%)	
Form	Actual	Standard	Actual	Standard	Actual	Standardised	Actual	Standardised
Czech Republic	0.29	0.753247	10.3	−3.93284	68.5	4.750324	5.1	−2.49193
Estonia	0.07	−2.1039	6.0	1.588911	68.8	5.236706	6.2	−1.05773
Hungary	0.84	7.896103	12.9	−2.91864	60.5	−2.22114	6.8	−0.5199
Lithuania	0.17	−0.80519	9.4	4.518819	63.5	0.372892	9.1	2.527788
Latvia	0.09	−1.84416	4.6	1.250845	65.9	2.480545	9.9	3.424166
Poland	0.39	2.051948	21.1	−0.66486	60.8	−1.89689	7.5	0.914306
Slovak Republic	0.15	−1.06494	9.8	4.856885	60.4	−2.38327	11.5	−7.1531
Slovenia	0.28	0.623377	10.2	−4.15822	62.8	−0.11349	9	2.169236
Bulgaria	0.03	−2.62338	24.9	−0.10142	60.2	−2.86965	9.2	2.707063
Romania	0.01	−2.88312	22.5	−0.43949	60	−3.35603	6.8	−0.5199

Source: Own calculations based on O.E.C.D. – Employment Protection Indicators; I.L.O. – Employment; Eurostat – E.U. /L.F.S. data.

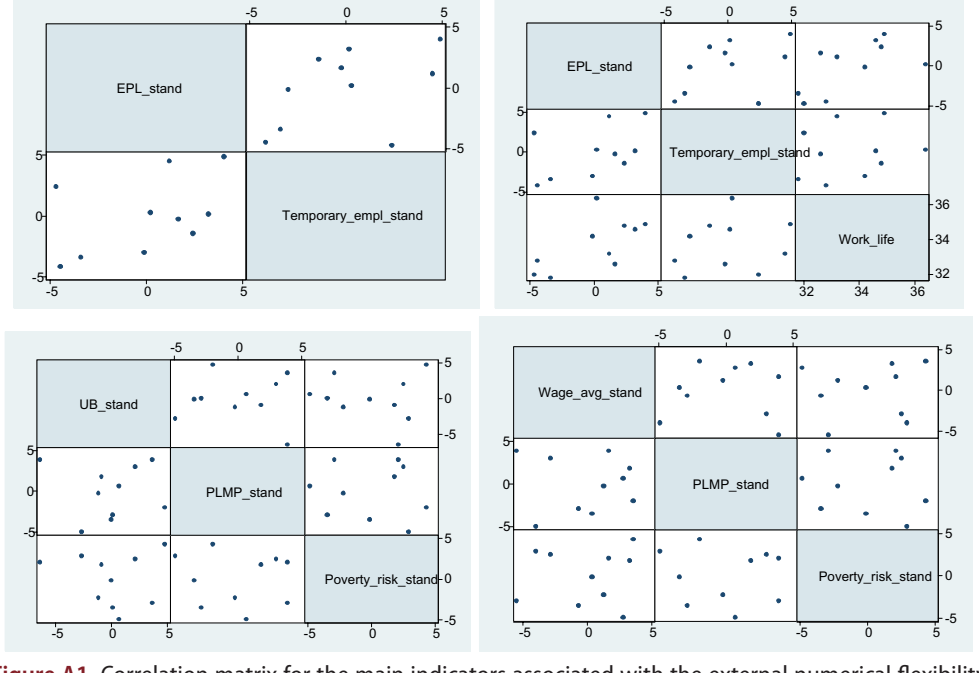


Figure A1. Correlation matrix for the main indicators associated with the external numerical flexibility dimension and the income security dimension. Source: Author's research.

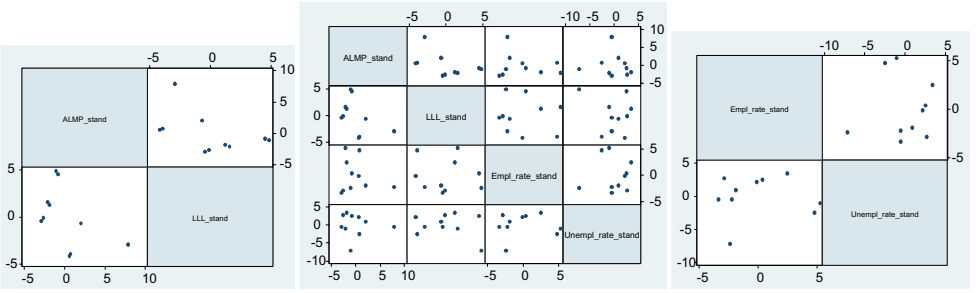


Figure A2. Correlation matrix for the main indicators associated with the employment security dimension. Source: Author's research.

Table A4. Cluster analysis results for external numerical flexibility efforts, respectively states and effects.

	Cluster 1			Cluster 2			Cluster 3				
Indicators	N	Mean	Sd	N	Mean	Sd	N	Mean	Sd	F	R-sq
E.P.L.	2	2.609	2.008	5	1.474	1.421	3	−4.187	0.689	20.657***	0.8551
Temporary contracts	2	4.69	0.278	5	−0.841	1.380	3	−1.726	3.589	5.912*	0.6282
Duration of working life	2	1.752	1.057	5	1.260	3.177	3	−3.269	1.130	3.664	0.5115

Source: Author's research.

Table A5. Cluster analysis results for income security efforts, respectively states and effects.

	Cluster 1			Cluster 2				
Indicators	N	Mean	Sd	N	Mean	Sd	F	R-sq
P.L.M.P.	5	0.558	2.974	5	−0.558	3.646	0.282	0.5534
U.B.	5	2.239	1.955	5	−2.239	2.508	9.914*	0.0341
Poverty_risk	4	−3.367	1.118	6	2.245	1.460	41.952***	0.8398

Source: Author's research.

Table A6. Cluster analysis results for employment security efforts, respectively states and effects.

	Cluster 1			Cluster 2			Cluster 3				
Indicators	N	Mean	Sd	N	Mean	Sd	N	Mean	Sd	*F*	*R-sq*
A.L.M.P.	1	7.896	–	3	1.142	0.789	6	−1.887	0.828	65.577***	0.949
L.L.L.	1	−2.918	–	3	−2.918	1.955	6	1.945	2.262	5.981*	0.6309
Employment rate	2	4.993	0.343	7	−1.086	2.084	1	−2.383	–	8.526*	0.7090
Unemployment rate	2	−1.774	1.014	7	1.528	1.589	1	−7.153	–	15.961**	0.8202

Source: Author's research.

Table A7. Cluster analysis results for overall flexicurity efforts.

	Cluster 1			Cluster 2			Cluster 3				
Indicators	N	Mean	Sd	N	Mean	Sd	N	Mean	Sd	F	R-sq
Ward method											
E.P.L.	7	1.798	1.524	1	−3.404	–	2	−4.579	0.173	19.068***	0.8449
U.B.	7	0.078	3.626	1	0.098	–	2	−0.323	3.386	0.010	0.0029
A.L.M.P.	7	−0.341	1.525	1	7.896	–	2	−2.753	0.183	19.589**	0.8484
Complete-link method											
E.P.L.	2	1.957	2.930	5	1.735	1.150	3	−4.487	0.689	17.774***	0.8355
U.B.	2	4.183	0.796	5	−1.563	2.787	3	−0.183	2.406	3.824	0.5222
A.L.M.P.	2	0.688	0.091	5	−0.753	1.657	3	0.796	6.149	0.229	0.0616

Source: Author's research.

Table A8. Cluster analysis results for overall flexicurity states and effects.

	Cluster 1			Cluster 2			Cluster 3				
Indicators	N	Mean	Sd	N	Mean	Sd	N	Mean	Sd	*F*	*R-sq*
Ward method											
Duration of working life	1	−1.132	–	5	2.670	1.790	4	−3.055	1.017	16.328***	0.8235
At-risk-of-poverty	1	−4.860	–	5	1.027	2.709	4	−0.069	3.251	1.656	0.3213
Unemployment rate	1	−7.153	–	5	0.914	2.547	4	0.645	1.531	6.045*	0.6333
Complete-link method											
Duration of working life	1	−1.132	–	5	2.670	1.790	4	−3.055	1.017	16.328***	0.8235
At-risk-of-poverty	1	−4.860	–	5	1.027	2.709	4	−0.069	3.251	1.656	0.3213
Unemployment rate	1	−7.153	–	5	0.914	2.547	4	0.645	1.531	6.045*	0.6333

Source: Author's research.

Table A9. Descriptive statistics.

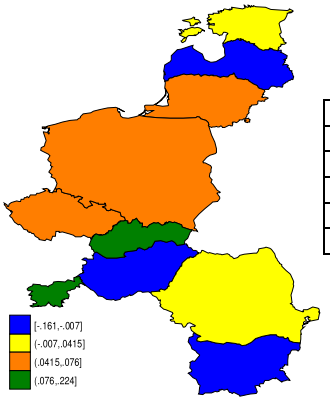
Variable		Mean	Std. Dev.	Min	Max	Observations
E.P.L.	overall	1.9746	.8810915	.3749778	3.305556	N = 100
U.B.	overall	.50055	.258054	.1200001	1.5	N = 100
N.S.B.	overall	16.8142	3.71521	8.860001	25.6	N = 100
L.M.P.	overall	.6749	.2960907	.15	1.58	N = 100
A.L.M.P.	overall	.2223	.1626911	.01	.84	N = 100
P.L.M.P.	overall	.378	.2134327	.08	1.35	N = 100
L.L.L.	overall	13.329	8.134256	4.5	39.5	N = 100
Trans_~L	overall	13.694	4.475699	5.3	32.8	N = 100
Trans_~H	overall	86.306	4.475699	67.2	94.7	N = 100
Work_lfe	overall	32.781	1.88587	28.4	36.5	N = 100
Poverty	overall	15.769	4.614201	7.5	25.8	N = 100
Empl_rat	overall	62.271	3.894526	54.5	70.1	N = 100
Temp_con	overall	8.49	7.633413	1	28.3	N = 100
Unempl~r	overall	9.353	3.369424	4.3	19.5	N = 100
P.D.V.	overall	66.255	12.64136	36.4	83.3	N = 100

Source: Author's research.

Table A10. Unit root tests of the residuals from the flexicurity-labour productivity model.

Resid		
LLC (Levin-Lin-Chu)	*p*-value	0.0000
	t-statistic	−3.9252
	A.D.F. regressions: 1 lag	
	L.R. variance: Bartlett kernel, 6.00 lags average	
Im-Pesaran-Shin	*p*-value	0.0499
	t-statistic	−1.6454
	Test critical values: 1%	−2.320
	5%	−2.060
	10%	−1.930
	A.D.F. regressions: No lags included	
Harris-Tzavalis	*p*-value	0.5850
	statistic	0.7460
	z	0.2147
Breitung	*p*-value	0.9733
	t-statistic	1.9318
Ho: Panels (some panels) contain unit roots		
Ha: Panels are stationary		

Source: Author's research.



2006-2015	Moran's I test for global spatial autocorrelation				
Variable	I	E(I)	sd(I)	z	p-value*
Productivity	0.330	-0.010	0.018	18.677	0.000
2015	Moran's I test for global spatial autocorrelation				
Variable	I	E(I)	sd(I)	z	p-value*
Productivity	0.043	-0.111	0.057	2.704	0.003

*1-tail test

Figure A3. Moran's I test for global and local (map) spatial autocorrelation. Source: Author's research.