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EVALUATION OF THE EFFICIENCY OF FLEXICURITY IMPLEMENTATION IN OECD COUNTRIES

Andrzej Szuwarzyński
Department of Management, Gdansk University of Technology
e-mail: Andrzej.Szuwarzynski@zie.pg.gda.pl

Abstract: Flexicurity is a policy of flexible and secure labour market. It has been the subject of many analyses, however, a coherent evaluation methodology is difficult to specify. The purpose of this paper is to propose a Data Envelopment Analysis based model for the evaluation of the efficiency of flexicurity implementation in OECD countries. The results will be used to create the ranking of countries, to determine changes in time, and to identify the reasons for inefficiency. On top of that, it will be possible to formulate recommendations for decision makers.

Keywords: flexicurity, Data Envelopment Analysis, active labour market policy, lifelong learning, composite indicators

INTRODUCTION

Flexicurity is to become the target policy governing the labour market in the European Union (EU). The European Development Strategy – Europe 2020 – foresees that the implementation of flexicurity will result in lower unemployment and lower segmentation of the labour market. Also, flexicurity-related activities are undertaken by many non-EU countries. Although the issue of flexicurity implementation has been the subject of many studies, it has been emphasised that the distinct effects of the flexicurity policy are not easy to measure, which is seen as the key methodological issue with strong implications for forming the labour market policy [Wilthagen 2012].

The aim of this paper is attempt to create an efficiency evaluation model for activities relating to the implementation of flexicurity. The model is based on the Data Envelopment Analysis (DEA) thus making it possible to determine the efficiency of implementation in the compared countries. The OECD countries have been evaluated by taking into account parameters which characterise the concept of flexicurity. The source data for the evaluation have been taken from the OECD labour market database for the years 2000-2010.

Flexicurity is defined as an integrated strategy aimed at simultaneous increase in the flexibility and the security of the labour market [Commission 2007]. This combination of a flexible labour market model on the one hand and a social security model on the other hand is based on consecutive transitions during person's professional life: from the completion of education to starting the professional career period, to subsequent changes of jobs, to periods of unemployment, and to retirement.

The historical roots of flexicurity lie in the Netherlands and Denmark. The main driving force behind making labour relations flexible were the economic needs of modern organisations which, in order to remain competitive, must be able to adapt to changes quickly and easily. In 2007, the European Commission defined common flexicurity implementation principles, which encompass four basic dimensions [Commission 2007]:

- Flexible and reliable contractual arrangements (FCA), achieved through modern labour law, collective agreements and work organisation.
- Comprehensive lifelong learning (LLL) strategies, ensuring that all employees are always able to adapt to the changes on the labour market.
- Active labour market policies (ALMP), providing assistance in dealing with the changes and making it possible to shorten the periods of unemployment.
- Modern social security systems (MSS), ensuring adequate income support (unemployment benefits, retirement pensions and healthcare services).

The proper functioning of the labour market has been the focus of attention of all decision makers. Forming policies requires measurement and evaluation. One example of flexicurity measurement is the study prepared under the European Commission project [Manca et al. 2010] which applied a simple methodology of measurement based on Composite Indicators (CIs) [Hoffman et al. 2008]. CIs are calculated according to the indicators measuring four above mentioned dimensions of flexicurity.

USING DATA ENVELOPMENT ANALYSIS TO CREATE COMPOSITE INDICATORS

CIs are regarded as a useful tool for the analysis of public policies. They integrate a large amount of information in a transparent and comprehensible format, which is easy to interpret by the general public [Shen et al. 2011]. CIs are crucial for taking operational decisions as well as for forming policies. Composite Indicators are created by mathematical aggregation of the set of individual indexes according to the CIs construction rules [Hoffman et al. 2008].

DEA is a nonparametric technique of mathematical programming which enables the measurement of relative efficiency of a homogeneous group of objects called Decision Making Units (DMUs) [Charnes at al. 1978]. The efficiency measurement is based on the determination of relation between multiple inputs and multiple outputs of a given entity's functioning in the context of a given goal, with the use of linear programming techniques [Cooper et al. 2011].

The efficiency measurement consists in determining reference objects and comparing all other objects to them. Consequently, the relative efficiency of DMUs is measured by classifying them as fully efficient on the basis of available data [Cooper et al. 2011]. The first and the most commonly used DEA formulation is the CCR model [Charnes et al. 1978], where the efficiency measure of each DMU is obtained as the maximum of the quotient of weighted outputs to weighted inputs. The measure of efficiency θ_o for the DMU reference group $(j = 1,...,n)$ is calculated for the outputs $(y_{rj},\ r = 1,...,s)$ and inputs $(x_{ij},\ i = 1,...,m)$, which may be expressed with the following formula:

$$\max_{v,u} \theta_o = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \tag{1}$$

subject to:

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_r x_{ij}} \leq 1 \quad j = 1,...,n \tag{2}$$

$$u_r, v_i \geq 0 \quad r = 1,...,s \quad i = 1,...,m, \tag{3}$$

where: u_r, v_i are variable weights which are determined by solving the above problem on the basis of data from all DMUs.

DEA is also used for constructing CIs, because this method facilitates aggregating many indicators without referring to the *a priori* knowledge of their weights [Shen et al. 2011]. Each DMU receives its own set of best possible weights assessing the relative performance of a particular DMU. The DEA-based structure of Composite Indicators has been subject to many studies [e.g. Lovell et al. 1995, Cherchye et al. 2009, Despotis 2005].

The problem in using DEA to construct CIs for the evaluation of macroeconomic policies is the determination what should be the inputs. Here the concept of the helmsman (or central planning board) is used. It was first introduced by Koopmans, who examined the issues of attainment of efficiency under a regime of decentralised decisions [Koopmans 1951], where each country has control tools for conducting its own macroeconomic policy. The outcomes depend on one input only, i.e. the macroeconomic decision-making apparatus, which is called the helmsman [Lovell 1995]. Consequently, in the DEA model, the vector of inputs is limited to a dummy variable, whose value equals to one for every DMU [Lovell et al. 1995, Despotis 2005]. Such a model may be a tool for the aggregation of several indicators into the general CI without reference to inputs, assuming that all countries have the same level of capacity to achieve full efficiency [Cherchye et al. 2009]. The evaluation of the performance of the examined unit differs from the evaluation of efficiency, because only the outputs are assessed and how they have been achieved is irrelevant. Consequently, the model is simplified and since the inputs are not converted into outputs, the process should be described as the measurement of effectiveness rather than the measurement of efficiency [Cooper at al 2009].

The use of the CCR model without additional weight restrictions enables each DMU to achieve the most beneficial possible result in the efficiency score, which is often related to zero values of weights, which are not acceptable in real-life applications [Roll, Golany 1993]. In practice, in many cases, classic DEA models evaluate inefficient units using the reference points on the frontier of the production possibility set (PPS), which are not Pareto-efficient. These models assign zero weights to optimal multipliers which means that not all sources of inefficiency are taken into account [Ramón et al. 2010].

The flexibility of weights is considered as one of DEA's main advantages, although full flexibility is also a disadvantage because important factors may be ignored in the analysis. This DEA deficiency may be remedied by the means of weight restrictions, which also improve the discrimination between the examined DMUs and consequently the number of efficient DMUs is reduced [Angulo-Meza, Lins 2002].

The process of imposing weight restrictions is highly case-dependent and there are no general rules in this area [Roll, Golany 1993]. However, the weight restrictions may be determined by referring to the opinion of experts [Cherchye et al. 2009] or on the basis of the value of variables of evaluated DMUs [Ramón et al. 2010, Roll, Golany 1993]. The following technique may be applied [Roll, Golany 1993]:

1. An unbounded CCR model is initiated and average weights u_r and v_i for outputs and inputs are obtained.
2. The magnitude of variability is established within the weights for the same factor as the relation of the highest value to the lowest *d*:1.
3. The basic CCR model is extended by adding a set of restrictions of the type:

$$\frac{2 \times u_r}{1+d} \leq u_{rj} \leq \frac{2 \times d \times u_r}{1+d} \tag{4}$$

4. The bounded model is initiated.

Average weights are calculated from the reduced vector of weights by ignoring extreme values [Roll, Golany 1993] or by using only the extreme efficient DMUs. [Angulo-Meza, Lins 2002]. Similarly, restrictions may be imposed on virtual outputs. This is the share of the entire virtual DMU$_j$ output devoted to *r* output or in other words, the "importance" attached to output *r* for DMU$_j$ may be restricted to the range between [φ_r, ψ_r] in the following form [Allen et al. 1997]:

$$\phi_r \leq \frac{u_r y_{rj}}{\sum_{r=1}^{s} u_r y_{rj}} \leq \psi_r \tag{5}$$

STRUCTURE OF THE MODEL

The goal of the examination is to determine the degree of performance in implementing flexicurity in OECD countries for the years 2000, 2005 and 2010. Due to insufficient data, six out of 34 OECD countries were excluded: Chile, Iceland, Israel, Mexico, New Zealand and Turkey. An output oriented, weight bounded model was used. A single constant input with the value equal to one was adopted (helmsman). The basic output variable is the harmonised unemployment rate (UNEMPL). The following variables characterise four main flexicurity dimensions:

- LLL_GDP - percentage of GDP allocated for the training of employees,
- ALMP_GDP - percentage of GDP allocated for active labour market policies,
- MSS_GDP - percentage of GDP allocated for the unemployment benefits,
- EPL_TOT- complex Employment Protection Legislation (EPL) index, which includes various aspects of legal regulations protecting employees.

For UNEMPL and EPL_TOT outputs, inverse values were used in order to fulfil the DEA requirement for the direction of preference for output variables (the higher the value is the better).

The restrictions on virtual outputs were determined on the basis of the unbounded CCR model, calculating mean values of weights attached to outputs for extreme efficient DMUs, i.e. such which were fully efficient and had zero slacks. The value *d* from formula (4) was determined on the basis of the model output variability range analysis. Based thereon, the lower and upper bounds on virtual outputs were formulated. By adding the restrictions (5) for all outputs of the model, subsequent calculations were made with the output oriented Assurance Region Global model (ARG) with constant returns to scale, available in the Saitech's software: DEA Solver Learning version 3.0.

RESULTS AND INTERPRETATION

Calculations were made for 28 OECD countries, for which complete data were available. The scores for three examined years, according to the CCR model, are presented in Table 1, in the CCR column.

Full efficiency was achieved by 4 countries in 2000, by 7 countries in 2005 and by 10 countries in 2010. In the examined period only 3 countries maintained full efficiency: Denmark, the Netherlands and the United States; 4 countries recorded a drop in efficiency and all other countries recorded growth. The results of the CCR model cannot, however, constitute the basis for a reliable evaluation of efficiency because of the occurrence of zero weights. This may be exemplified by fully CCR-efficient countries having only one non-zero weight in five outputs (e.g. Luxemburg in 2000 and Norway in 2010 have a non-zero weight only for the UNEMPL variable, which means that that variable dominated the results while all four remaining variables were not used in the evaluation).

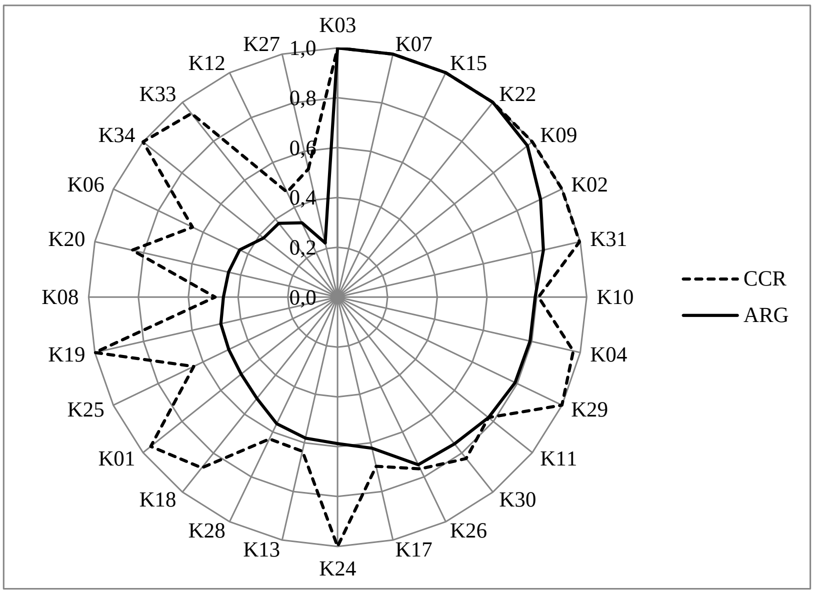
Table 1. Efficiency scores according to CCR and ARG models

Item	DMU	Coutry	CCR			ARG		
			2000	2005	2010	2000	2005	2010
1	K01	Australia	0,7851	0,9096	0,9604	0,2326	0,3325	0,4954
2	K02	Austria	0,8415	0,8588	1,0000	0,6698	0,6557	0,9051
3	K03	Belgium	0,8901	1,0000	1,0000	0,8206	0,8470	1,0000
4	K04	Canada	0,9482	0,9377	0,9707	0,9126	0,8512	0,7929
5	K06	Czech Republic	0,4312	0,5679	0,6467	0,3522	0,2916	0,4373
6	K07	Denmark	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000
7	K08	Estonia	0,3779	0,5351	0,4922	0,2601	0,1025	0,4589
8	K09	Finland	0,8739	0,8212	1,0000	0,8178	0,7517	0,9751
9	K10	France	0,6841	0,6795	0,8069	0,6689	0,6382	0,7929
10	K11	Germany	0,7983	0,8675	0,7749	0,7741	0,7316	0,7749
11	K12	Greece	0,3854	0,4524	0,4682	0,3509	0,0536	0,3307
12	K13	Hungary	0,5549	0,6240	0,6341	0,5154	0,5178	0,5801
13	K15	Ireland	0,8838	1,0000	1,0000	0,8441	0,8883	1,0000
14	K17	Italy	0,5014	0,5911	0,6956	0,4894	0,5604	0,6213
15	K18	Japan	0,7054	0,9188	0,8761	0,5630	0,5017	0,5195
16	K19	Korea	0,6842	1,0000	1,0000	0,1706	0,1916	0,4813
17	K20	Luxembourg	1,0000	0,8586	0,8463	0,2447	0,6262	0,4500
18	K22	Netherlands	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000
19	K24	Norway	0,8842	0,9820	1,0000	0,5099	0,6260	0,5873
20	K25	Poland	0,5277	0,5454	0,6417	0,4842	0,5088	0,4857
21	K26	Portugal	0,7257	0,6175	0,7641	0,6461	0,5837	0,7467
22	K27	Slovak Republic	0,5783	0,5521	0,5277	0,3292	0,4653	0,2229
23	K28	Slovenia	0,4705	0,6323	0,6311	0,3738	0,4529	0,5639
24	K29	Spain	0,5867	0,6239	1,0000	0,5700	0,6023	0,7904
25	K30	Sweden	0,9414	0,9052	0,8276	0,8974	0,8396	0,7533
26	K31	Switzerland	0,7524	0,9630	0,9966	0,6525	0,8461	0,8482
27	K33	United Kingdom	0,8339	1,0000	0,9422	0,5632	0,4421	0,3794
28	K34	United States	1,0000	1,0000	1,0000	0,5064	0,2562	0,3799

Source: own elaboration

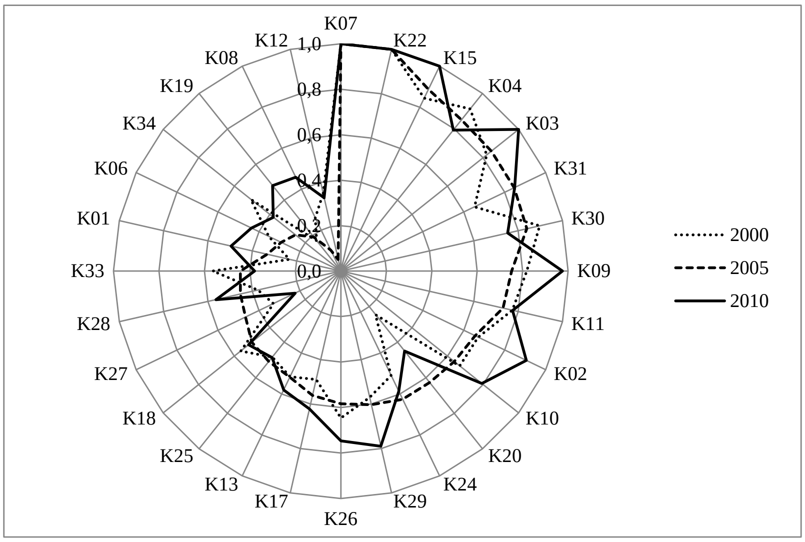
Average values of virtual outputs and the ranges of variability on the virtual outputs were calculated as was mentioned above. For instance, the value of parameter *d* for the UNEMPL variable for all examined years equals to 4. The analysis of sensitivity to weight restriction range was also conducted. The narrowing of the variability range resulted in obtaining no optimal solution (lack of DMUs with 100% efficiency). The radical widening of the range does not resulted in enlarging the number of fully efficient DMUs.

Figure 1. Comparison of efficiency scores for the year 2010



Source: own elaboration

Figure 2. Efficiency scores according to ARG model for the years 2000, 2005 and 2010



Source: own elaboration

For the so-determined restrictions, calculations were made with the Assurance Region Global model. The results are presented in Table 1, in the ARG column. The application of this model eliminated zero weights and non-zero slacks. This model has greater discrimination power so the number of full efficient DMUs dropped. In all three years, only Denmark and the Netherlands were efficient, just like in the CCR model. Figure 1 contains the comparison of results obtained in the CCR and ARG models for the year 2010.

Figure 2 shows the ARG results presented in the decreasing order according to values of 2005, which enables illustrating changes in subsequent years.

For decision makers, besides the ranking, it is important that the reasons for inefficiency be diagnosed and recommendations for situation improvement activities be formulated. Four countries were selected for the analysis: Greece, Ireland, Poland and Spain. They are characterised by high unemployment rates but very different efficiency scores – the effect of different labour market policies. The values observed for two benchmark countries (Denmark and the Netherlands) were presented, too. This is shown in Table 2 for the 2010 data.

Table 2. Example of efficiency scores and observed and projected output values

DMU	Country	Efficiency score	UNEMPL	Observed				Projected			
				MSS_GDP	ALMP_GDP	LLL_GDP	EPL_TOT	MSS_GDP	ALMP_GDP	LLL_GDP	EPL_TOT
K12	Greece	0,33	12,6	0,71	0,20	0,02	2,97	2,99	0,50	0,46	1,39
K25	Poland	0,49	9,7	0,34	0,65	0,04	2,30	2,30	0,98	0,44	1,60
K29	Spain	0,79	20,1	3,14	0,69	0,20	3,11	1,92	1,16	0,36	1,85
K15	Ireland	1,00	13,7	2,99	0,50	0,46	1,39	-	-	-	-
K07	Denmark	1,00	7,5	1,57	1,49	0,42	1,91	-	-	-	-
K22	Netherlands	1,00	4,5	1,75	1,09	0,13	2,23	-	-	-	-

Source: own elaboration

First four countries have the unemployment rates above the average (8.9% for all OECD countries in 2010) with very different efficiency scores (0.33-1.00). Analysing the observed values of the variables of the model (column „Observed" in Table 2), one may assess labour market policies conducted by these countries. Despite high unemployment rate (13.7%) Ireland has full efficiency - the effect of active policy, which is confirmed by high LLL_GDP and ALMP_GDP values (0.46% of GDP and 0.50% of GDP respectively). Very high value of MSS_GDP (2.99% GDP) – nearly threefold the OECD average, indicates very high social security of the unemployed. Of key importance is the low value of EPL_TOT, which reflects high flexibility of the labour market. Spain and Greece have the EPL_TOT value close to the maximum, which reflects low flexibility of their labour markets. Spain has a very high value of MSS_GDP (high expenditure on social security) and ALMP_GDP value above the average, however, its LLL_GDP value is relatively low. This reflects a rather passive labour market policy. Greece has very low values of ALMP_GDP and LLL_GDP and a very low value of MSS_GDP, which may reflect the general weakness of the conducted labour market policy. In Poland, the situation is similar and the MSS_GDP value is close to the minimum (extremely low unemployment benefits). In Table 2, the "Projected" column shows how the output values should change for the inefficient countries in order to achieve full efficiency. All countries should make their legislation more flexible, as indicated by the changes required in EPL_TOT. In all cases, the expenditures on training should be increased (LLL_GDP): over 20 times in Greece and over 10 times in Poland. Also, the expenditures on active policy (ALMP_GDP) should be increased, but to a smaller extent. As far as MSS_GDP (social security) is concerned, a circa four-fold increase in Greece and an almost seven-fold increase in Poland are necessary. In Spain, however, the value should be reduced by about 40% (which indicates that the social security is too high).

SUMMARY

The obtained results allowed creating a ranking of evaluated countries. For the inefficient countries, the ways of determining the reasons for inefficiency as well as the way of forming recommendations for actions for these countries to achieve full efficiency were indicated. DEA method has proved well suited for this type of analysis and the results may be useful tool in the decision making process regarding the labour market policy.

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