Competitiveness and Labour Productivity in Context of Composite Indicators[1]

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Abstract

The productivity measurement constitutes an important part of economic analysis. It is always connected to a competitiveness analysis of a country. Labour productivity represents one of the most suitable measurements for compiling the composite indicators which measure multidimensional concepts that single indicators are unable to capture. In the first part, this paper identifies global competitiveness index and global competitiveness index as two main competitiveness composite indicators. After that the methodological issues of composite indicators and labour productivity is discussed. Finally, using the regression analysis this paper investigates composite indicators along with the labour productivity of EU members in the period between the years 2010 and 2011 to identify whether the composite indicators are necessary in the competitiveness analyses.

Keywords

Composite indicator, global competitiveness index, labour productivity, world competitiveness index

JEL code

J24, O47

INTRODUCTION

Measuring competitiveness represents a very popular part of economic analyses. However, it is not a new concept. Economic analysis always looked for an opportunity to evaluate the efficiency of an economy. The difference lies only in the terminology used. Nowadays, one can use labour productivity or several composite indicators for that purpose. Ranking countries by composite indicators is becoming more and more popular because the indicators illustrate a complex view on some issues that cannot be captured by a single indicator. For this purpose it is necessary to choose from several definition of competitiveness. One of them is given by the World Economic Forum which describes competitiveness as the "set of institutions, policies and factors that determine the level of productivity of a country" (WEF, 2011).

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Another definition states: "Competitiveness should be seen as a basic means to raise the standard of living, provide jobs to the unemployed and eradicate poverty." (Competitiveness Advisory Group, 1995b). Another definition of competitiveness claims: "Competitiveness implies elements of productivity, efficiency and profitability. But it is not an end itself or a target. It is a powerful means to achieve rising living standards and increasing social welfare – a tool for achieving targets. Globally, by increasing productivity and efficiency in the context of international specialization, competitiveness provides the basis for raising peoples' earnings in a non-inflationary way." (Competitiveness Advisory Group, 1995a).

On the other hand, labour productivity represents a revealing indicator that offers dynamic measures of economic growth, competitiveness and living standards. It helps to explain the principal economic foundations that are necessary for economic growth and social development (OECD, 2001). Porter and Ketels give another definition adopted by several authors: "A nation's standard of living is determined by the productivity of its economy, which is measured by the value of its goods and services produced per unit of the nation's human, capital and natural resources. Productivity depends both on the value of a nation's products and services, measured by the prices they can command in open markets, and the efficiency with which they can be produced. True competitiveness, then, is measured by productivity. Productivity allows a nation to support high wages, a strong currency and attractive returns to capital and with them a high standard of living." (Porter and Ketels, 2003).

Apparently there is a very strong relationship between productivity and competitiveness. Productivity can be measured by one single index. Competitiveness can be evaluated by composite indicator (hereafter: CI). The main question remains whether we need an index for measuring competitiveness. This index has to be a composite indicator which means certain ambiguity in its construction (Freudenberg, 2003). The selection of indicators is an initial and questionable step. It takes a lot of time and effort to gather all necessary data. If one indicator is unavailable, the whole indicator is ruined or data imputation has to be done. It brings more uncertainty into the CI. Weighting and aggregation system have an essential effect on outcome of composite indicators. The issues such as (non)compensability among individual indicators and interpretation of weights as coefficients of importance are discussed in (Munda & Nardo, 2005). There are multiple methods for the purpose of weighting and aggregation. This part in constructing of the CI is the most discussed and criticized by opponents of CIs. Composite indicators may send a misleading message if it is poorly constructed or misinterpreted. If one dimension is ignored, it may lead to wrong or simplistic policy conclusions. It could be a target of the political disputes and speculation. To conclude, in the construction of composite indicators many subjective choices have to be made. Taking into account the disadvantages of composite indicators of competitiveness the question arises whether the measure of labour productivity is sufficient.

In this paper we select the most appropriate competitiveness composite indicators and analyze them along with common used measure of competitiveness – labour productivity. We work with the hypothesis that competitiveness provides a condition for higher productivity and we examine the necessity of using the composite indicators in competitiveness analysis instead of commonly used labour productivity measurement. In this paper we carry out the analysis of labour productivity and composite indicators of competitiveness on the national (macroeconomic) level of the chosen countries in the period between the years 2010 and 2011. The selection of the countries was based on availability of the dataset.

1 METHODOLOGY

For the analysis we assume the labour productivity this to be the ratio of output over input used. As the input, one can use the hours worked, total number of employees or labour services which reflect the quality of labour force. As the output variable, gross value added is recommended instead of gross domestic product because gross value added excludes taxes. In this analysis, we chose to use gross domestic product per hour worked as a measure of labour productivity. It is because hours worked is a better

indicator as people work different hours per week in different countries. The composite indicators are compiled in US dollars and the gross value added is not published in the US dollars (only the national currency is available in the OECD database) that is why we use gross domestic product in US dollars in PPP (constant prices) as the output of the production function.[4]

There are two well-known composite indicators which focus on assessing competitiveness of a country – Global Competitiveness Index and World Competitiveness Index. We employ them in this analysis because of their correlation with the productivity measurement. There are more analyses and concepts, e.g. the European Competitiveness Index created by the University of Wales Institute, The Atlas of Regional Competitiveness – Eurochambers or country specific or regional indices (Annoni & Kozovska, 2010).

The Global Competitiveness Index (hereafter: GCI) has been annually published in the Global Competitiveness Report by the World Economic Forum. We decided to use the GCI because it captures the complexity of the phenomenon of national competitiveness, which can be improved only through an array of reforms in different areas that affect the longer-term productivity of a country (Sala-i-Martin et al, 2011).

The index aims to assess the foundations for strong competitiveness and in this way provides a ranking. GCI merges over 100 indicators which describe 12 major pillars of competitiveness (see Table 1).

Table 1 12 pillars of GCI

Institution	Higher Education and Training	Technological Readiness
Infrastructure	Goods Market Efficiency	Market Size
Macro-economy	Labour Market Efficiency	Business Sophistication
Health and Primary Education	Financial Market Sophistication	Innovation

Source: WEF (2011)

The computation of the GCI is based on successive aggregations of scores from the most disaggregated level i.e. individual indicators all the way up to the overall score. Twelve pillars named in Table 1 are compiled into three sub-indices: Basic Requirements, Efficiency Enhancers and Innovation Factors. The sub-indices are weighted not equally for every country. Weights to the sub-indices are assigned according to the country's development. The World Economic Forum published a comprehensive report with a fully described methodology (WEF, 2011). It included detailed evaluation of each country in terms of its score of indicators, weights etc.

The Labour Market Efficiency pillar contains measures of productivity. Labour Market Efficiency has 17% in the category of efficiency enhancer, irrespective of the country's stage of development. The weight put on each of the three sub-indices (category) is flexible. The sub-index called Efficiency Enhancer could comprise from 35 to 50% of the overall index. Therefore, Labour Market Efficiency could receive a ratio from 5.95% to 8.50%, depending on each country's stage of development.

The World Competitiveness Index (hereafter: WCI) is annually published in the World Competitiveness Yearbook. The purpose of WCI is analysing and ranking the ability of countries to provide an environment that sustains the competitiveness of enterprises (IMD). The competitiveness of enterprises is crucial for using the definition of competitiveness. It is believed that the wealth of nations is created by enterprises (private or public = state-owned).

[4] Input and output variables to the productivity function are discussed in Vltavská, Sixta (2011).

WCI consists of four underlying pillars. Each of these four pillars gathers five sub-indices which describe different aspects of competitiveness (see Table 2).

Table 2 4 pillars of WCI

Economic Performance	Government Efficiency	Business Efficiency	Infrastructure
Domestic Economy	Public Finance	Productivity & Efficiency	Basic Infrastructure
International Trade	Fiscal Policy	Labour Market	Technological Infrastructure
International Investment	Institutional Framework	Finance	Scientific Infrastructure
Employment	Business Legislation	Management Practices	Health and Environment
Prices	Societal Framework	Attitudes and Values	Education

Source: IMD (2011)

The sub-scores of each sub-index are aggregated in order to obtain the score. Each index, independently of the number of variables it contains, is assigned an equal weight of 5% of the overall score. Simply 4 pillars × 5 sub-factors × 5% = 100. We can conclude Labour Market has 5% and Productivity and Efficiency 5% in the overall score. These two pillars are in some way related to productivity. We have to notice that results are influenced by the normalization method (z-score). WCI is compiled from more than 300 indicators; 70 from them are in the pillar called Business Efficiency. Due to this fact we are not able to find out the contribution of individual indicators such as labour productivity.

The drawback of WCI is the data demands. The World Competitiveness Index comprises 329 criteria. About two-thirds of the data used are hard statistics; the rest is the survey data. Hard data are taken from international or national organizations, private institutes and partners. Survey data are drawn from our annual Executive Opinion Survey (4 200 respondents). Note that the indicators are strongly correlated. Therefore their actual individual weight as a coefficient of importance can be different (IMD, 2011).

The usage of the assessment of business environment or a nation, supporting international investment decision or evaluating the impact of various public policies are the advantages of the composite indicators mentioned.

For quantitative analysis of relationship between indicators we used Spearman correlation coefficient and Kendall's tau, and a linear regression model. Several linear regression models were tested. The dependent variable represents labour productivity as a measured output of the economy and the competitiveness composite indicators as the explanatory variables. This can be expressed by following formula:

$$LP_{2011} = a + b \times CCI_t \text{ or } LP_{2011} = b \times CCI_t , \quad (1)$$

where LP_{2011} stands for labour productivity in 2011, CCI_t stands for competitiveness composite indicator (either WCI or GCI) in time t (where t = 2008, 2009, 2010, 2011).

2 RESULTS

Firstly, it is necessary to examine if there is a correlation between the World Competitiveness Index, the Global Competitiveness Index and labour productivity. As we work with rankings we use Spearman's correlation coefficient[5] (Table 3).

[5] For more information see Hindls et al (2004).

Table 3 Spearman's rho and Kendall's tau b (correlation matrices)

	WCI	GCI	LP
WCI	1.000	0.923**	0,719**
GCI	0.923**	1.000	0.660**
LP	0.719**	0.660**	1.000

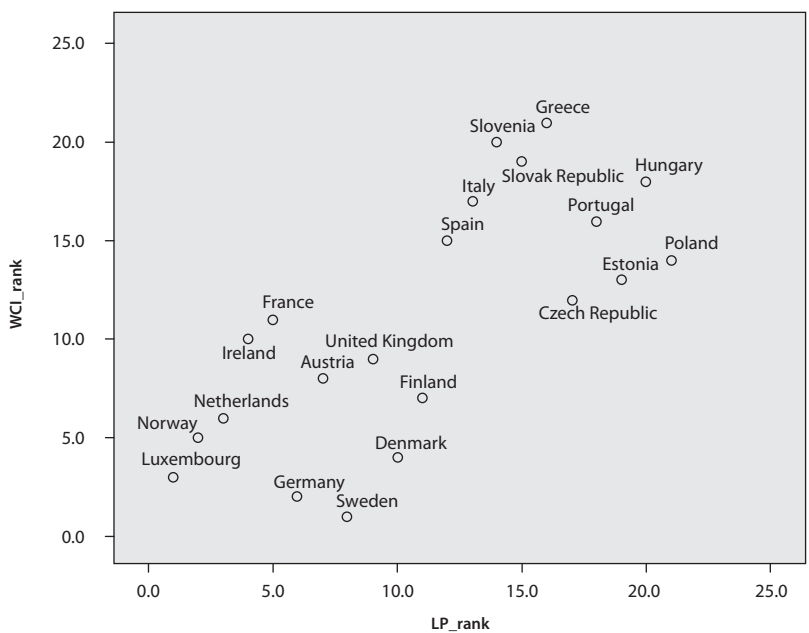
	WCI	GCI	LP
WCI	1.000	0.794**	0.505**
GCI	0.794**	1.000	0.411**
LP	0.505**	0.411**	1.000

** Correlation is significant at the 0.01 level (2-tailed).
Source: Authors' computations

Correlations between competitiveness indicators are close to one, which means strong positive correlation between these two composite indicators. Even if the correlation between competitiveness indicators and labour productivity is smaller, it is significant at the 0.01 level.

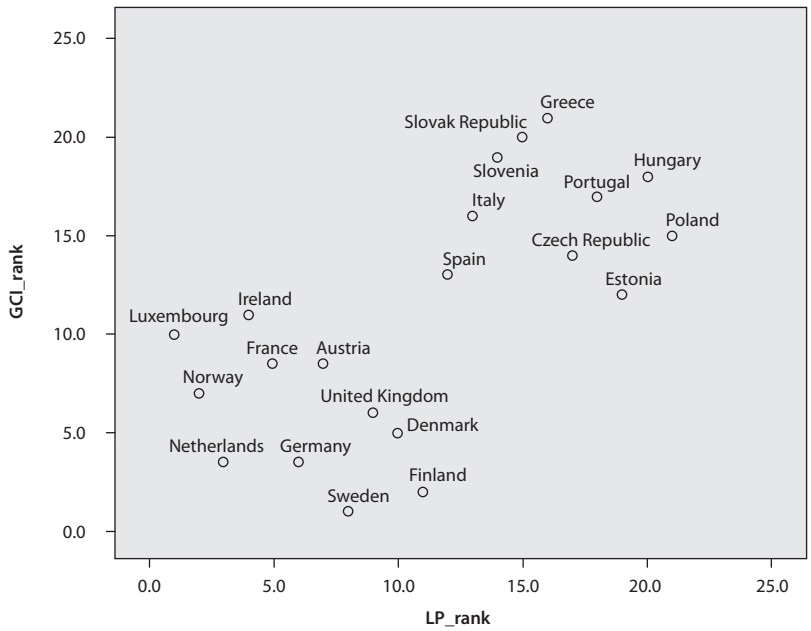
The correlations between two indicators among the countries used are displayed in the following figures (Figure 1 and 2). Spider graph (Figure 3) shows the overall correlation between all the indicators used. Figure 1 shows the relationship between labour productivity and WCI. There is clear difference between new member states from the Central and Eastern Europe and long-term member countries. Figure 2 shows the relationship between labour productivity and GCI. One can see that the countries are rather clustered into two groups according to their productivity level and global competitiveness. The gap between the two groups implies that there is a clear distinction between counties with high and low level of competitiveness and productivity. For majority of countries there is difference in their ranking according to labour productivity and composite indicators; however they are still in a same group which means that the shift in ranking is not significant. A country on a line means the same place in ranking according to both indicators. Figure 1 shows differences between the new and long-term EU member states.

Figure 1 WCI and labour productivity – ranking



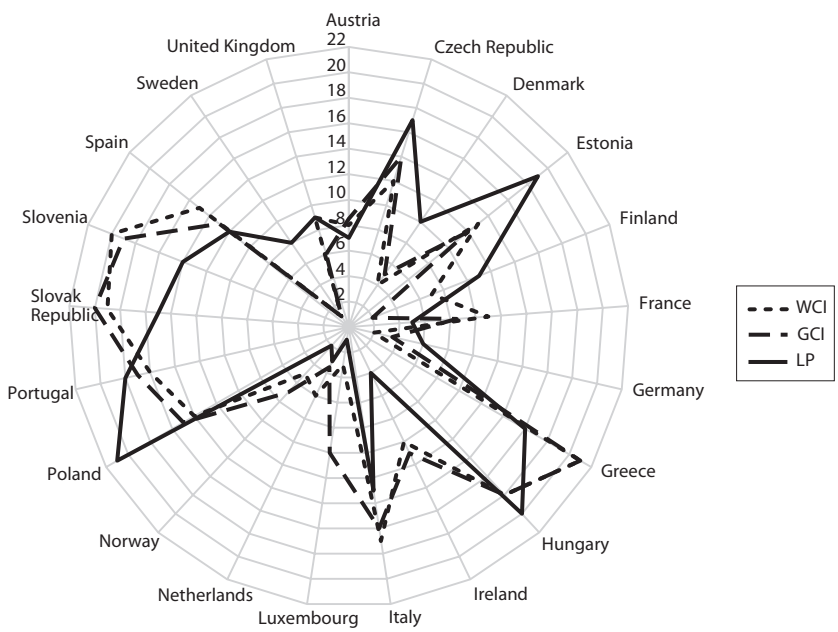
Source: Authors' computations

Figure 2 GCI and labour productivity – ranking



Source: Authors' computations

Figure 3 Spider graph



Source: Authors' computations

Figure 3 depicts the summery of all the indices used. Overlapping points mean that a country ranks the same places.

The hypothesis that competitiveness provides a condition for higher productivity was tested by means of linear regression of cross sectional data. Labour productivity was considered to be a dependent variable because it measures output of an economy and the WCI and GCI aim to assess input (conditions for economic growth). The predictors were the WCI and/or the GCI in 2011 and the previous years. Different models were tested. The GCI was not found to be a good predictor. This parameter was statistically insignificant in all tested models. The WCI can be used as a predictor. The model with one WCI predictor in 2010 is considered to be suitable.

Table 4 Linear regression model

		coefficient	t	Sig.
intercept model	intercept	–10.009	–1.111	0.281
	WCI 2010	0.694	5.560	0.000
no-intercept model	WCI 2010	0.558	22.809	0.000

Source: Authors' computations

For the model with an intercept, the R-square equals 0.619, without an intercept the R-square equals 0.963. Note that for a regression through the origin (the no-intercept model), the R-square measures the proportion of the variability in the dependent variable about the origin explained by regression. This cannot be compared to the R-square for models which include an intercept. It indicates that the measure of competitiveness is a predictor for a level of labour productivity in the following year. However GCI did not confirm that statement. GCI is an insignificant predictor for labour productivity, even if we take lags into account.

Table 5 Year-on-year changes in %

	WCI			GCI			LP		
Year	**08/09**	**09/10**	**10/11**	**08/09**	**09/10**	**10/11**	**08/09**	**09/10**	**10/11**
Austria	5.69	6.04	–2.93	–1.91	–0.78	0.98	–0.19	2.18	0.45
Czech Republic	7.24	–1.96	8.48	1.08	–2.14	–1.09	–1.55	1.64	0.59
Denmark	9.41	–6.71	0.97	–2.15	–2.56	1.50	–1.79	3.86	1.26
Estonia	–10.16	0.11	8.98	–2.36	1.10	0.22	2.54	5.80	–1.09
Finland	17.79	–9.47	5.47	–1.27	–1.10	1.86	–5.20	3.12	1.48
France	3.12	9.26	–4.00	–1.72	0.00	0.19	–0.57	1.35	1.35
Germany	11.74	–0.93	6.16	–1.65	0.37	0.37	–2.52	1.82	1.65
Greece	4.14	3.00	–0.81	–1.70	–1.24	–1.75	–4.85	–3.34	–2.67
Hungary	1.86	0.38	8.86	0.00	2.61	0.69	–3.60	0.95	0.37
Ireland	–0.88	1.54	–1.33	–3.01	–2.07	0.63	4.40	4.03	3.27
Italy	10.95	8.18	11.41	–0.92	1.39	1.37	–2.21	2.41	0.08
Luxembourg	2.22	0.69	–0.45	2.27	1.81	–0.40	–1.30	1.00	–1.00
Netherlands	9.05	–2.40	0.07	–1.66	0.19	1.50	–2.41	2.23	0.23
Norway	8.91	3.91	–4.08	–0.96	–0.58	0.78	0.38	0.40	–0.52
Poland	12.39	19.57	3.69	1.17	4.16	–1.11	2.17	3.65	3.76
Portugal	14.51	–8.78	11.72	–1.57	–0.45	0.46	–0.16	3.69	0.78
Slovak Republic	7.66	–20.06	14.68	–2.05	–1.39	–1.41	–2.33	4.40	2.24
Slovenia	11.63	–24.67	16.82	1.11	–2.86	–2.71	–6.15	3.15	3.88
Spain	0.58	1.56	13.49	–2.75	–2.18	1.11	2.51	1.98	1.36
Sweden	9.77	0.41	3.49	–0.36	0.91	0.90	–2.21	3.87	1.32
United Kingdom	5.79	0.97	4.52	–2.08	1.16	2.67	–2.01	2.23	–0.44

Source: Authors' computations

Inspired by the regression outcome we focused on year-on-year changes (see Table 5). If we compare the results for competitiveness indicators and those for labour productivity, we can see that not even the same signs of the coefficients for each country were observed.

The one year time lag between the level of competitiveness and the level of productivity was not confirmed. We cannot observe the same evident trend for competitiveness and subsequently not even for productivity.

CONCLUSION

Making a decision about the level of competitiveness of a country could lead to a simplified conclusion. It is important to know what lies beneath the composite indicator. This paper examines the necessity of using the composite indicators in competitiveness analysis instead of commonly used labour productivity measurement. We chose two well-known composite indicators which relate to the productivity analysis – Global Competitiveness Index and World Competitiveness Index. In this paper we work with the hypothesis that competitiveness provides a condition for higher productivity. The results showed that there was strong positive correlation between composite indicators. Although the correlation between competitiveness indicators and labour productivity is smaller, it is significant at the 0.01 level. We considered labour productivity as a dependent variable because it measures output of an economy and World Competitiveness Index and Global Competitiveness Index aim to assess input as they are conditions for economic growth. The predictors were World Competitiveness Index and/or Global Competitiveness Index in 2011 and 2010. Global Competitiveness Index was not found to be a good predictor. This parameter was statistically insignificant in all models. On the other hand, World Competitiveness Index can be used as a predictor. The model with one World Competitiveness Index predictor in 2010 was considered to be suitable. In order to verify one year lag between a change of level of competitiveness indicators and labour productivity we observed year-on-year changes. Based on our results we cannot conclude that a higher level of competitiveness in one year brings about a higher level of labour productivity in the following year.

A composite indicator facilitates the ranking of countries on a multidimensional basis; nevertheless a conclusion based on a composite indicator could be easily misinterpreted. The most important is the soundness and transparency of a composite indicator. To understand and interpret the results, a deconstructing composite indicator is useful. A look at the separate indicators can help extend the analysis but cannot provide country rankings. A large number of underlying indicators causes ambiguities. It is not even clear which indicators are included let alone their contribution to the final score. Due to the complexity, composite indicators of competitiveness do not meet the requirement of transparency and understandability. The construction of composite indicators makes estimating the contribution of productivity basically impossible.

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