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Economic productivity flip-flop in the Danube countries

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Abstract

Productivity emphasizes the strength and vigor of an economy, but could we use it to capture the strength and vigor of the society within which the economic processes take place? This paper analyzes economic productivity in relation with its social dimension. The research hypothesis on which the paper is built is that measuring economic productivity reveals the economic results, but hides the social effects. In order to test the hypothesis we start by computing the capital and labor productivity of the selected countries, scores which in a subsequent stage are summed up in order to establish the total productivity. Further in our analysis we adjust the level of productivity through three equations meant to reflect the fairness of the income distribution, the level of human development and also the sustainability of the economic processes that generate the computed levels of productivity. The paper uses the methodology developed by the author in a previous study. The countries chosen for the empirical analysis are the Danube countries: Austria, Bulgaria, Germany, Croatia, Hungary, Republic of Moldova, Romania, Serbian Republic, Slovak Republic and Ukraine. The research is based on statistical data provided by the World Bank, the Global Footprint Network, Eurostat and the UNDP. All the data we use in this study is for the year 2007, the purpose of the paper being to test the model developed and not to capture current events. The results confirm the hypothesis, showing that the levels of productivity would be much lower if economic activity were scaled by its social implications.

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1. Introduction and literature review

Most of the times researchers measure productivity solely from the economic perspective leaving out the social implications of the economic processes. Economists have defined productivity as the relationship between the output

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produced and the inputs needed to produce it (Antle & Capalbo, 1988; Manoilescu, 1986). This definition is simple and that makes it appealing because it stands invariable regardless of the production apparatus, social milieu or political system; it captures the outturn of the productive factors (Samuelson & Nordhaus, 1995).

Productivity is a measure of effectiveness capturing the ability of one person/company/country to convert inputs into outputs, but why do countries differ so much in their abilities to do it? The main problem in analyzing productivity solely from its economic perspective is that we fail to see the whole picture. Productivity is sensitive not only to the type of inputs that determine the production, but also to other several external factors that are not accounted for when measuring productivity. An important focus in explaining the differences in productivity is given by analyzing the labor force, the importance of the social milieu and the relationship among coworkers (Bandiera, Barankay, and Rasul, 2009), the knowledge and skills of the manager (Bloom and Van Reenen, 2007), the form of organization (Garicano and Heaton, 2007), the motivation or de-motivation from the differentiated pay (Lazear, 2000) or the more striking differences between the quality of human capital from two companies or two countries.

Some of the most well-known methodologies for measuring productivity are the Bennet-Bowley productivity indicator (Bennet, 1920), Fisher productivity index (Fisher, 1922), Törnqvist productivity index (Törnqvist, 1936), Malinvaud productivity index (Caves, Christensen, Diewert, 1982), Hicks-Moorsteen productivity index (Diewert, 1992) and Luensberger productivity indicator (Chambers, 1996). Further discussions on the theory of productivity or the indexes used to capture it can be found in Olley and Pakes (1996), Griliches and Mairesse (1998), Blundell and Bond (2000), Levinsohn and Petrin (2003), Ackerberg et al. (2007) etc. More complex models that deal with heterogeneous-productivity producers have been developed by Jovanovic (1982), Hopenhayn (1992), Ericson and Pakes (1995), Melitz (2003), Asplund and Nocke (2006), Foster, Haltiwanger and Syverson (2008) etc.

Simply put, productivity is efficiency in production: how much output is obtained from a given set of inputs. As such, it is typically expressed as an output–input ratio. Single-factor productivity measures reflect units of output produced per unit of a particular input. Labor productivity is the most common measure of this type, though occasionally capital or even materials productivity measures are used. Of course, single factor productivity levels are affected by the intensity of use of the excluded inputs (Syverson, 2011).

In this paper we approach productivity from a more comprehensive perspective, one that includes the distributional implications, the development perspective and also sustainability. Similar studies have been conducted by Fulginiti and Perrin (2005), Badinger (2008), Rios-Rull and Santaeulalia-Llopis (2010), Aoyama, Yoshikawa, Iyetomi and Fujiwara (2010), Restuccia and Rogerson (2013), Chatzimichael and Tzouvelekis (2013), Becchetti, Castriota and Tortia (2013), Ilmakkunas and Piekkola (2014) etc.

2. Methodology

The paper is based on a methodology developed by the author in a previous study (Mihai, 2014a). The model is built on the following chain of equations:

\[
W = WL + WK, \text{ where } WL = \text{GNI}/\text{EMPC} \text{ and } WK = \text{GNI}/\text{GCF}
\]

\[
W_{\text{GINI}} = (WL + WK) \times (1 - \text{GINI})
\]

\[
W_{\text{GINI-HDI}} = (WL + WK) \times (1 - \text{GINI}) \times \text{HDI}
\]

\[
W_{\text{GINI-HDI_sustainable}} = (WL + WK) \times (1 - \text{GINI}) \times \text{HDI} \times \beta/\text{EFC},
\]

where: GNI – Gross National Income; EMPC – Compensation of employees; GCF – Gross Capital Formation; HDI – Human Development Index; GINI – GINI Index; \(\beta\) - Biocapacity; EFC – Ecological Footprint of Consumption

3. Context for the empirical analysis

The countries chosen for the empirical analysis are the ten countries crossed by the Danube River: Austria, Bulgaria, Germany, Croatia, Hungary, Republic of Moldova, Romania, Serbian Republic, Slovak Republic and Ukraine. Given their common element, being crossed by the Danube, the countries share the same region, respectively, Central and Eastern Europe. Except from Serbia, Moldova and Ukraine, the countries are part of the European Union, Germany since its very beginning, while the others being part of its process of expansion.
Even if they share the same geographical region, the countries are quite different. The countries differ in terms of economic development, social fairness and economic productivity, but these aspects will be discussed in detail in the following sections. The countries differ also in term of cultural background and other several aspects, but these will be disregarded because they don’t fall into the purpose of the present paper.

4. Economic productivity of the Danube countries

Economic development comes from the good management of the available resources. The levels of GDP or GNI reflect the level of economic development of a country. Though there are no significant correlations among GDP or GNI and economic productivity, there must be an indirect relation, mediated by significant lags between the two categories of variables. The chart below presents the levels of GDP and GNI in the selected countries:

![Fig. 1. Levels of GDP and GNI in the selected countries](image)

Germany has the highest levels of both GDP and GNI within the group, both exceeding the 3.3 thousand billion $ threshold. The GDP of Germany is three times higher than the cumulated GDP of the other nine countries. The least developed country in terms of GDP or GNI is the Republic of Moldova, with a GDP of 4.4 billion $ and a GNI of 4.8 billion $.

Economic productivity can be considered an effectiveness score, the higher the score obtained for the output per input ratio, the more productive the person/company/industry/country. For the purpose of this analysis we have computed the effectiveness scores for the ratios of Gross National Income to labor, respectively to capital. By cumulating the two scores, we have obtained the productivity levels for the selected countries.

\[ W = WL + WK, \text{ where } WL = \frac{\text{GNI}}{\text{EMPC}} \text{ and } WK = \frac{\text{GNI}}{\text{GCF}} \]

For the labor input, we have used the compensation of employees, while for the capital input, we have used the gross capital formation. The chart below presents the level of labour productivity (LW), capital productivity (KW) and cumulated productivity (Wtot), all at country level.

![Fig. 2. Levels of Labor productivity (LW), Capital Productivity (KL) and Total Productivity (Wtot)](image)
productivity, the differences between the levels of capital productivity being less significant, all the countries having capital productivity scores between the 2.71-5.28 interval. The smallest capital productivity level has been calculated for Bulgaria, followed closely by the Republic of Moldova (2.87). The similar levels of capital productivity can be explained by the fact that the return one obtains from capital is limited; from a kilo of iron, the maximum you can obtain is a kilo of nails. Some will obtain less, but no one will obtain more without adding something. Labor productivity, on the other hand, is determined by a resource with unlimited potential: the human resource. We observe that the values of labor productivity vary across the 9.77-64.37 spectrum, the differences being far more visible. Labor productivity computed as ratio of the compensation of employees shows how efficient are spent the money for salaries in the selected countries. Germany seems to obtain the most from the salaries it pays for the labor force. Aside from Germany, the second highest labor productivity belongs to the Slovak Republic (23.82), the Republic of Moldova (22.20) and Ukraine (20.67). The results for Moldova are a bit surprising, given the fact that it has the smallest GDP, the smallest gross capital formation and the second smallest capital productivity.

A step further in our analysis is testing for correlations among the two categories of variables, the one that captures the size of the economy on one side and the one that captures the effectiveness of the economic activity. The table below presents the values for Pearson’s r and the respective significance for each relationship.

First we notice that all the relationships have very good significances, ranging from 0.000 to 0.015, which means that all the correlation coefficients can be trusted. GDP and GNI are bounded by a determination relationship, which means that for the effectiveness variables it is enough to analyze the relationship with any of the two (GDP or GNI), the result being transferable to the other one. GDP correlates best with total productivity (r = 0.962, sig. 0.000); among labor productivity and total productivity there is a very strong correlation, almost determination (r = 0.999, sig. 0.000), fact that explains also the high correlation between GDP and labor productivity (r = 0.958, sig. 0.000). Capital productivity, as well, correlates strongly with GDP (r = 0.804, sig. 0.005); the correlation between total productivity and capital productivity is also a strong one (r = 0.757, sig. 0.011). There is also a strong correlation between labor productivity and capital productivity (r = 0.736, sig. 0.015). These relationships can be interpreted as follows: labor and capital productivity develop in the same direction, supporting each other and together resulting into the general productivity of a country. Out of the two types of productivity, labor or capital, total productivity is more sensitive to the fluctuations of labor productivity. GDP and GNI are very similar for the selected countries, their relationship with the productivity variables being almost identical. The high values obtained retrieved for the relationship between GDP or GNI and the productivity variables means that a high productivity will result into a high GDP or GNI and also the higher the GDP or the GNI, the higher the productivity levels.

5. First adjustment. Crossing economic productivity and income distribution

Up to this point in our paper we have confirmed the first part of our hypothesis, respectively that economic productivity reveals the economic result obtained by a country. The strong relationships between the economic result captured by both GDP or GNI and the three forms of economic productivity support our initial supposition. Further in our analysis we will test the second part of the hypothesis, respectively that good economic results don’t necessarily mean improved social conditions for the population.

First we will represent the values for per capita GDPs and GNIs for the selected countries. The chart below captures this picture:

Fig. 3. Levels of per capita GDP and GNI in the selected countries
The chart is dominated by Austria, seconded by Germany. The per capita GDP and GNI of Austria lay around 45000 $, while the per capita values of the GDP and GNI for Germany lay around the 40000 $ threshold. Their per capita values are significantly higher than the values of the other countries. The Republic of Moldova has the lowest values for both the per capita indicators, followed by the values of Ukraine.

If the distribution of the GDP is significantly uneven, the per capita values tell us little about how much money people actually have. In order to have a better image, we will proceed by analyzing the distribution of income, via the GINI index. The table below presents the values of the GINI for the selected countries.

| Country Name | Austria | Bulgaria | Germany | Croatia | Hungary | Rep. of Moldova | Romania | Serbia | Slovak Republic | Ukraine |
|--------------|---------|----------|---------|---------|---------|-----------------|---------|--------|-----------------|---------|
| GINI         | 0.43    | 0.36     | 0.49    | 0.27    | 0.40    | 0.40            | 0.43    | 0.34   | 0.36            | 0.33    |

Table 2. Levels of GINI in the selected countries

We observe that GINI ranges from 0.27 in Croatia to 0.49 in Germany. All the values are contained by the second quarter. To have a more clear understanding of the nature of the interaction between GINI and GDP we have tested whether there are any correlations between the two. We have obtained a 0.418 value for Parsons’ r with a 0.043 significance.

The results tell us that for the selected countries 41.8% of the GDP variation can be explained via GINI variation and reversed, 41.8% of the GINI variation can be explained by the GDP variation. This means that there is a quite strong relationship between the two variables. The values retrieved for the Durbin Watson test show that there is no risk of autocorrelation.

The first correction we apply to productivity takes the following form:

\[ W_{\text{GINI}} = (WL + WK) \times (1 - \text{GINI}) \] or \[ W_{\text{GINI}} = W \times (1 - \text{GINI}) \] (1)

We already know that GINI varies across the (0, 1) interval, 0 representing absolute equality and 1 representing absolute inequality. Given the fact that the absolute values are conventional and ideal, we have chosen to represent the interval as an open one. If GINI were to be 0 then the distributional-adjusted productivity would remain unchanged. Whereas, if its value is higher than 0, reflecting inequality in the distribution of income and wealth, we reduce the value of productivity with the corresponding value. In a previous paper (Mihai, 2014b), we have used the same methodology for computing the economic productivity, but we have divided it to GINI; we have come to the conclusion that multiplying productivity with 1-GINI is a more appropriate form of adjustment because it reduces productivity for all the countries that present inequalities, the higher the inequalities, the larger the share of the reduction, while in the previous study, by dividing productivity to the subunit value of GINI, it rose (Mihai, 2014a). The table below presents the values of the total productivity and the total productivity adjusted according to the (1) equation:

| Country       | \( W_{\text{tot}} \) | Rank | \( W_{\text{GINI}} \) | Country       | Direction |
|---------------|----------------------|------|------------------------|---------------|-----------|
| Serbia        | 13.15                | 10   | 8.67                   | Serbia        | →         |
| Croatia       | 14.45                | 9    | 10.51                  | Croatia       | →         |
| Romania       | 19.28                | 8    | 11.02                  | Romania       | →         |
| Bulgaria      | 19.58                | 7    | 12.01                  | Hungary       | ↓         |
| Hungary       | 20.00                | 6    | 12.58                  | Bulgaria      | ↑         |
| Austria       | 24.20                | 5    | 13.69                  | Austria       | →         |
| Ukraine       | 24.36                | 4    | 15.17                  | Rep. of Moldova | ↓    |
| Rep. of Moldova | 25.07              | 3    | 16.41                  | Ukraine       | ↑         |
| Slovak Republic | 27.30             | 2    | 17.42                  | Slovak Republic | → |
| Germany       | 69.65                | 1    | 35.82                  | Germany       | →         |

Table 4. Comparative layout of productivity and productivity adjusted through model (1)
There already appear some rank mutations among the selected countries. The two most productive countries, the three least productive countries and the median country remain the same, while the other four get repositioned. This repositioning is a first argument in support of our hypothesis affirming that economic productivity hides the social effects. Correcting by GINI, the productivity levels get altered significantly, the largest difference being in the case of Germany.

6. Second adjustment. Incorporating the development perspective

The second correction we apply to productivity incorporates the development perspective captured by the HDI index. The human development index completes the economic perspective by adding 3 subsumed dimensions: long and healthy life, access to education and a steady income. The table below presents the values of the HDI in the selected countries:

| Country Name | Austria | Bulgaria | Germany | Croatia | Hungary | Rep. of Moldova | Romania | Serbia | Slovak Republic | Ukraine |
|--------------|---------|----------|---------|---------|---------|-----------------|---------|--------|-----------------|---------|
| HDI          | 0.88    | 0.77     | 0.91    | 0.80    | 0.83    | 0.64            | 0.77    | 0.76    | 0.83            | 0.73    |

Table 5. HDI levels in the selected countries

We observe that HDI ranges from 0.64 to 0.91, the Republic of Moldova having the lowest level of development while Germany having the highest level. Out of the selected countries, the Republic of Moldova is the only country with a medium human development index. Romania, Bulgaria, Serbia and Ukraine have a high human development index, while the remaining five countries have a high human development index. The differences in the levels of development of the selected countries are stronger than the differences in the distribution of income. This will result into a new significant correction of the productivity.

The correction takes the following form:

\[ W_{\text{GINI_HDI}} = (W_L + W_K) \times (1 - \text{GINI}) \times \text{HDI} \]

or

\[ W_{\text{GINI_HDI}} = W_{\text{GINI}} \times \text{HDI} \]  

(2)

We know that HDI varies across the (0, 1) interval as well, but in this case, the higher the value of HDI, the higher the development level of the selected country. If HDI were 1, respectively, if the development level were absolute, the productivity would remain unchanged, while for the lower development levels, productivity is reduced proportionally (Mihai, 2014a).

The table below presents the levels of the productivity adjusted both by the distribution of income and by the development level.

| Country          | \(W_{\text{tot}}\) | Rank | \(W_{\text{GINI}}\) | Country          | Rank | \(W_{\text{GINI_HDI}}\) | Country |
|------------------|---------------------|------|----------------------|------------------|------|------------------------|---------|
| Serbia           | 13.15               | 10   | 8.67                 | Serbia           | 10   | 6.59                   | Serbia  |
| Croatia          | 14.45               | 9    | 10.51                | Croatia          | 9    | 8.39                   | Croatia |
| Romania          | 19.28               | 8    | 11.02                | Romania          | 8    | 8.52                   | Romania |
| Bulgaria         | 19.58               | 7    | 12.01                | Hungary          | 7    | 9.63                   | Bulgaria|
| Hungary          | 20.00               | 6    | 12.58                | Bulgaria         | 6    | 9.77                   | Rep. of Moldova |
| Austria          | 24.20               | 5    | 13.69                | Austria          | 5    | 9.91                   | Hungary |
| Ukraine          | 24.36               | 4    | 15.17                | Rep. of Moldova  | 4    | 12.01                  | Ukraine |
| Rep. of Moldova  | 25.07               | 3    | 16.41                | Ukraine          | 3    | 12.04                  | Austria |
| Slovak Republic  | 27.30               | 2    | 17.42                | Slovak Republic  | 2    | 14.46                  | Slovak Republic |
| Germany          | 69.65               | 1    | 35.82                | Germany          | 1    | 32.50                  | Germany |

Table 6. Comparative layout of productivity, productivity adjusted through model (1) and productivity adjusted through model (2)
First we observe that even after the second correction, the two leading countries and the three least productive remain the same, the changes taking place among the median countries. Due to a higher HDI than Bulgaria and the Republic of Moldova, Hungary climbs to positions; so does Austria. Ukraine returns to the fourth position while Bulgaria returns to the seventh.

7. Third adjustment. Adding the sustainability perspective

The final adjustment incorporates the sustainability dimension captured through the share of the ecological footprint of consumption that can be supported by a country’s own biocapacity. The table below includes the levels of the biocapacity, ecological footprint of consumption and the share of the ecological footprint of consumption that can be supported by the own biocapacity of the selected countries:

| Country Name            | Austria | Bulgaria | Germany | Croatia | Hungary | Rep. of Moldova | Romania | Serbia | Slovak Republic | Ukraine |
|-------------------------|---------|----------|---------|---------|---------|----------------|---------|--------|-----------------|---------|
| EF of Consumption       | 5.30    | 4.07     | 5.08    | 3.75    | 2.99    | 1.39          | 2.71    | 2.39   | 4.06            | 2.90    |
| Biocapacity             | 3.31    | 2.13     | 1.92    | 2.50    | 2.23    | 1.95          | 1.16    | 2.68   | 1.82            |
| Share                   | 0.63    | 0.52     | 0.38    | 0.67    | 0.75    | 0.48          | 0.72    | 0.49   | 0.66            | 0.63    |

Table 7. Comparative layout of biocapacity, ecological footprint of consumption and the share of consumption that can be supported by the countries’ own biocapacities

The table shows that all the selected countries have ecological footprints of consumption higher than their own biocapacity which results into sub-unitary values of the share. Hungary and Romania have the most sustainable economies in the group, Romania being able to rely on its own biocapacity for 72% of its consumption while Hungary being able to rely on its biocapacity for 75%. Romania has a smaller ecological footprint of consumption than Hungary but also a smaller biocapacity (for further information on the two ecological concepts, please refer to the Global Footprint Network). Germany, on the other hand, appears as the least sustainable economy in the group, being able to rely on its own biocapacity for only 38% of its consumption. Its biocapacity is similar to the one of Romania, but its ecological footprint of consumption is almost twice as high. Austria has the largest ecological footprint of consumption, 5.3 global hectares (gha) per capita, but its deficit is not as high as the one of Germany due to the fact that it has also the highest biocapacity. The deficit of Germany becomes more alarming when multiplying it by the size of the population, resulting into a deficit of 259.9 million hectares. To get a better idea of the size of this deficit, let’s just say that it is more than 10 times larger than the surface of Romania. If all the countries in the world would have behaviours similar to the one of Germany, mankind would need at least 2.5 planets Earth to continue to exist. Even if a country manages to obtain economic performance beyond its own potential, it doesn’t necessarily mean that it will be able to continue to obtain the same performance always. That is why we considered important to adjust the levels of economic productivity so that they capture the perspective of sustainability as well. The correction (3) takes the following form:

\[ W_{GHDN} \_sustainability = (W_L + W_K) \times (1 - GINI) \times HDI \times \beta/EFC \] or

\[ W_{GHDN} \_sustainability = W_{GHDN} \times \beta/EFC \]

The ecological footprint of consumption (EFC) represents the land needed for the countries to obtain and maintain the current productivity levels, while biocapacity (\( \beta \)) represents the land that one country possesses. Between the two, what a country has and what a country uses, there can be large differences. If the difference between the biocapacity and the ecological footprint of consumption, is a positive one, it results into ecological reserve, it means that the country consumes less than it has, which means it has a sustainable production process and consumption. On the other hand, if the difference is a negative one, it results into ecological deficit, and it means that the country uses more than it has and therefore is on an unsustainable path. By computing the share of the biocapacity of the ecological footprint of consumption, we find out the share of the production obtained by valorising the own means. If the biocapacity is higher than the ecological footprint of consumption, the sustainability-adjusted productivity will rise; if the biocapacity and the ecological footprint of consumption are
equal, productivity will remain the same; and, finally, if the biocapacity is smaller than the ecological footprint of consumption, the productivity will be reduced with the corresponding share (Mihai, 2014a). The table below presents all the stages that shaped the economic productivity in order to capture the distribution, life, education, income and sustainability dimensions.

| Country        | \( W_{tot} \) | Country | \( W_{GINI} \) | Country | \( W_{GINI, HDI} \) | Country | \( W_{GINI, HDI, sustainability} \) | Reduced by % |
|---------------|----------------|---------|----------------|---------|---------------------|---------|-----------------------------------|--------------|
| Serbia        | 13.15          | Croatia | 14.45          | Croatia | 10.51               | Serbia  | 8.67                              | 6.59         |
| Romania       | 19.28          | Bulgaria| 19.58          | Hungary | 12.01               | Romania | 11.02                             | 8.52         |
| Bulgaria      | 20.00          | Hungary | 24.20          | Austria | 13.69               | Bulgaria| 12.58                             | 9.77         |
| Hungary       | 24.36          | Moldova | 25.07          | Ukraine | 15.17               | Austria | 12.01                             | 9.91         |
| Moldova       | 27.30          | UKRAINE | 35.82          | Germany | 35.82               | Germany | 32.50                             | 12.31        |
| Germany       | 69.65          | SK Republic | 17.42          | SK Republic | 16.41               | SK Republic | 14.46                         | 7.54        |

Table 8. Comparative layout of productivity, productivity adjusted through models (1), (2) and (3) and the share of the reduction

Productivity is altered significantly in order to incorporate the above mentioned dimensions. The last column of the table tells us how much of the initial level of the productivity is lost after applying all the corrections. The loss varies across 0.65-0.82 for the selected countries, the largest share being lost by Germany, while the smallest penalty being applied to the Slovak Republic. It is worth mentioning that Germany has kept its leading position across all the correctional stages, but so did the Slovak Republic seconding Germany. Serbia, on the other hand, remained constant in being the least productive country in the group no matter what corrections there have been applied.

8. Conclusions

This paper has analyzed economic productivity in relation with its social dimension within the countries crossed by the Danube. The paper has been built on the research hypothesis that measuring economic productivity reveals the economic results, but it hides the social effects. We have started by presenting the context for the empirical analysis highlighting that even if the countries share the same geographical area, they differ in terms of size, population, historical background, cultural values, political systems and, of course, economic performance.

The cumulated population of the selected countries is 196.3 million inhabitants which represents less than 3% of the world population. As far as their GDP is concerned, this amounts to 4377.1 billion $, which is 7.7% of the world GDP. Only by considering these data we can affirm that the selected countries are a powerful group that has at its disposal two and a half times more GDP that the global average. This average is lifted mostly due to the GDP of Germany which represents more than 75% of the group GDP.

After having set the context of the empirical analysis, we have computed the levels of economic productivity in all selected countries. We have measured total productivity of a country by cumulating labor and capital productivity. Labor productivity has been calculated as ratio of Gross National Income (GNI) and Compensation of Employees (EMPC), while capital productivity as ratio of Gross National Income (GNI) and Gross Capital Formation (GCF). The most productive country of the group, both labor and capital productivity, proved to be Germany, while the least productive proved to be Serbia, with the smallest labor productivity.
We have found that the differences in total productivity levels can be mostly explained by the differences in the labor productivity levels of the countries. Labor productivity across the 9.77-64.37 interval, while capital productivity varies across a much smaller interval, 2.71-5.28. This can be explained by the fact that the return on capital is limited; there is a maximum that cannot be exceeded – if it is reached, it means that returned productivity equals expected productivity, which is the optimal situation. Nevertheless, most of the times, there is a difference between expected productivity and obtained/returned productivity, which is influenced by a variety of reasons: the quality of labor that operates with the existing capital, managerial skills, production processes etc. On the other hand, labor productivity comes from the exploitation of resources with unlimited potential: the human resources, and that is why the productivity interval is much broader.

Further in our analysis we have tested whether there are any correlations among the selected variables. Tests revealed very strong and reliable correlations among the selected variables. Total productivity and labor productivity have a correlation coefficient of 0.999 (sig. 0.000) which has confirmed our previous findings, that total productivity can be mostly explained by labor productivity. Capital productivity has also a significant influence upon the total productivity, but less strong, the correlation coefficient between total and capital productivity being 0.757 (sig. 0.011). The tests retrieved the following values for the Pearson’s’ r for the relationships between GDP, on one side, and the three productivity variables, on the other side: LW 0.958 (sig. 0.000), KW 0.804 (sig. 0.005) and Wtot 0.962 (sig. 0.000). This confirms the first part of our research hypothesis, respectively that measuring productivity reveals the economic performance of a country.

In order to test the second part of our hypothesis we have began by representing the per capita levels of the GDP and GNI, which resulted into a significantly different perspective than the one captured by the global levels of the two variables. The lead of the hierarchy has been taken by Austria with per capita levels around the 45000$ threshold. At the other end of the hierarchy lays the Republic of Moldova whose per capita levels of both GDP and GNI lay around the 1200$ value. Per capita values take us a step closer to understanding the potential distribution of the economic result in the selected countries. In order to get even closer to the actual situation we have gathered the GINI indexes for the selected countries. Introducing GINI in our analysis has highlighted the fact that 41.8% of the GDP variations can be explained via GINI variations and reversed, 41.8% of the GINI variations can be explained via GDP variations. The higher the GINI, the greater the deviations from the optimal distribution of the income; this has led us to the first amendment of the productivity measurement (a). All productivity levels have been reduced with a share corresponding to the difference between 1 and GINI. This can be explained by the fact that if there is no inequality in distribution (GINI = 0), productivity remains unchanged, but if there is inequality (GINI > 0), productivity is reduced. All countries have GINI values higher than 0 (0 being the ideal and yet improbable value) which resulted into the diminishing of the productivity values. Having different values for GINI, this has resulted also in the change of the hierarchy of the selected countries, but not significantly because the values of the GINI are not significantly different.

For the second adjustment we have introduced the human development index; its values vary across the 0.64-0.91 interval for the selected countries. This has resulted into a second reduction of the productivity levels and also into shifts within the hierarchy of the countries.

The third and final adjustment meant incorporating the sustainability perspective by using two of the variables developed by the Global Footprint Network: ecological footprint of consumption and biocapacity. All selected countries have ecological footprint of consumption higher than their biocapacities. Hungary and Romania proved to have the most sustainable economies in the group, being able to rely on their own biocapacities for 75%, respectively 72% of their consumption. On the other hand, Germany appears to be the least sustainable country in the group, only 38% of its consumption coming from the exploitation of its own biocapacity. The ecological deficit of Germany is 3.16 gha per capita, which results into a cumulative deficit of 259.9 million hectares. It is definitely a lot, but how much exactly? For a better understanding, we have compared this deficit with the size of Romania: in order to cover the deficit of Germany there would be needed a surface larger than 10 times the surface of Romania. Introducing the sustainability perspective alters the productivity levels even more significantly than the other two adjustments.

More than 65% of the productivity levels of the selected countries comes from social deficits, for Germany it is 82%, for Serbia it is 76%, for Bulgaria 74%. This confirms the second part of our research hypothesis, respectively
that measuring productivity solely from the economy point of view hides the social implications. If this percentage of the difference would be transposed into correcting the GDP of the countries, Europe would probably yield its status of socially and economically developed area.

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