Impacts of GDP per Capita According to PPS and Health Care Expenditure on Basic Indicators in C5 Countries

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Keywords:
Eurostat; Economies; Indicators; Healthcare expenditure; Correlation analysis

Abstract: The paper focuses on GDP per capita in PPS (standard purchasing power) in C5 countries (Czech Republic, Austria, Slovenia, Slovakia and Hungary). The basic aggregates in the comparison of the indicator include the density of population, employment per thousand persons, and expenditure on pensions. The period for the given comparison is from 2011 to 2021. Other comparisons of indicators that the authors made in this paper were focused in the context of health care expenditure including years of healthy life, proportion of people 65+, occupational accidents, discharge from hospital, and length of stay. For this comparison, the period of 2014-2020 is taken into account. The data sources for the given paper are data from the Eurostat portal. The paper aims to perform a correlation analysis (Pearson correlation coefficient) of the basic indicators related to GDP per capita according to PPS and healthcare expenditure within the C5 countries.

1. INTRODUCTION

Currently, individual economies are facing large expenses, especially after the COVID-19 pandemic. The economies of the world are now trying to get back to the productivity that was before the pandemic. Today, it is evident that individual governments are not solely addressing an energy recession, especially in 2022, but are also actively managing various external events on both national and international scales. The motivation for writing this contribution was primarily to find out the situation of the C5 countries within the above-mentioned period, which is divided into two periods, namely, the period from 2011-2021 and 2014-2020. The paper aims to perform a correlation analysis (Pearson correlation coefficient) of the basic indicators related to GDP per capita according to PPS and healthcare expenditure within the C5 countries. The grouping of countries C5 was chosen by the authors of the paper based on historical context.

Healthcare represents an important part of most households’ budgets. A stylized fact is that older individuals in most countries tend to have greater healthcare needs and, depending on the level of health insurance and other social protections, are likely to have higher healthcare expenditures than households with younger members (de Meijer et al., 2013; Yang et al., 2003; Zweifel et al., 2004). Health care expenditure (HCE) continues to rise worldwide at an alarming rate posing a threat to government budgets. Despite that, the tools used for decision-making in health more than often neglect the role of fiscal sustainability and focus merely on alleged health benefits. Though the importance of improvements in health cannot be overlooked, looking at things from a government’s perspective, requires taking into consideration the fiscal aspect of health

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care. Specifically, for the government to continue spending money on health care in the long
run, a degree of fiscal sustainability must be achieved as it is also important that concrete evi-
dence regarding improvements in health indicators exist (Christopoulos & Eleftheriou, 2020).
Almost all developed countries have universal health insurance: through public insurance pro-
grams or privately provided social insurance, they give access to healthcare services to their en-
tire population. In most European nations, regardless of income, people have nominal access to
the same services, which are typically free at the point of use or come with small co-payments
(Biro & Prinz, 2020).

The article is structured as follows: Introduction is followed by the second chapter Methodo-
logy. The third chapter points to the results found, which the authors of the contribution reached.
At the end, the Conclusion is designed, where the most important findings from the given con-
tribution are evaluated.

2. METHODOLOGY

The second chapter focuses on the methodology of the paper. The paper aims to perform a cor-
relation analysis (Pearson correlation coefficient) of the basic indicators related to GDP per cap-
ita according to PPS and healthcare expenditure within the C5 countries (Czech Republic, Slo-
vakia, Austria, Slovenia and Hungary).

The method of correlation analysis is applied as one of the possible analytical approaches to the
problem. Correlation can be defined as a measure of the relationship between two or more statistical variables. Correlation can be measured in several ways. The choice of measurement method depends on the type of statistical variables. Among the most used correlation coefficients is Pearson’s correlation coefficient. The selection correlation coefficient is given by:

\[ r_{xy} = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2 \sum_{i=1}^{n} (y_i - \bar{y})^2}} \]  

The values of the Pearson correlation coefficient are in the range <-1,1>. Boundary values indi-
cate a perfect linear relationship. The values of the correlation coefficient can be verified by a sta-
tistical test. In the case of the t-test, the null hypothesis is tested, which is the assertion that the selection comes from the two-dimensional normal distribution in which a correlation coef-
ficient of zero (e.g. Hebak et al., 2007; Hendl, 2004). The test statistic is then defined as follows:

\[ t = r_{xy} \frac{n-2}{\sqrt{1-r_{xy}^2}} \]  

where it has a distribution t of n-2 degrees of freedom, where n is the number of pairs \((x_i, y_i)\).

The meaning of the resulting values of the correlation coefficients is as follows:
\[ p(x,y) = 1 \] – there is perfect direct dependence between the quantities x and y;
\[ p(x,y) = 0 \] – quantities x and y are not correlated;
\[ p(x,y) = -1 \] – there is a perfect inverse relation between the quantities x and y;

The authors in the given article focused on the evaluation of certain variables in the context of the issue of the given economy and subsequently the field of healthcare economics.
3. RESULTS PAYING ATTENTION TO THE GIVEN ISSUE

The third chapter pays attention to the empirical results of this article. The figure below (Figure 1) pays attention to GDP per capita according to PPS. Within the framework of the comparison of the GDP macroeconomic indicator, the most acceptable form of using the possibility of comparison is through PPS, which captures the difference in price levels between countries. The period in the case of the given analyzed graph is from 2011 to 2021. Austria (i) achieved the highest values for all analyzed years, followed by Slovenia (ii) and the Czech Republic (iii) in third place. The given order is determined based on the average values of the given indicator in the context of the period and is graphically illustrated in Figure 2.

![Figure 1. GDP per capita according to PPS](source)

*Source: Eurostat (2011-2021); own elaboration (2023)*

The following two figures (Figure 3 and Figure 4) show the results based on the correlation analysis. In the case of Figure 3, the authors focused on comparing two variables, namely GDP per capita indicators according to PPS and population density in the analyzed countries. Based on the above facts, it can be concluded that the strongest positive correlation is in the case of the Czech Republic (i), Hungary (ii) and Austria (iii). Figure 4 shows the results of a correlation analysis based on two parameters, namely GDP per inhabitant according to PPS and employment per thousand persons. Here, a strong dependence (strong positive correlation) was found in the case of Hungary. A strong negative dependence was subsequently found based on the given variables in the case of Slovenia. The period in the performed analysis is from 2011 to 2019.

![Figure 2. Average value of GDP per inhabitant according to PPS](source)

*Source: Eurostat (2011-2021); own elaboration (2023)*
The last figure (Figure 5) of this analysis shows the links between two variables, based on the GDP per capita indicator according to PPS and pension expenditure. Almost all countries showed a negative correlation. The strongest negative influence of both parameters is mainly in the case of Slovenia (i), Austria (ii) and subsequently on the territory of the Czech Republic (iii). Based on this information, it can be concluded that there is a strong negative correlation between the variables.

Another empirical part of the paper is devoted to the issue of healthcare expenditures. The figure below (Figure 6) shows the values of spending on health care according to the standard purchasing power of money (PPS) per inhabitant within the period 2014-2020. It is necessary to point out that a different time range as in the case of (Figure 1) could not be conceived, due to the lack of data (data) from the Eurostat portal. As is obvious, Austria, the Czech Republic, Slovenia and Hungary achieve the highest values based on the given data in all analyzed years. For these countries, it can be stated that there has been a gradual increase in healthcare costs in the analyzed years. This fact is primarily caused by the issue of the COVID-19 pandemic. In the case of Slovakia, the situation is different from other countries, where the fluctuating situation of health care costs in the given years is obvious.

The situation described above for all analyzed years is better presented in Figure 7 below, which focuses on the average values of the given parameter in the case of a period. Below is the ranking of countries based on average values: Austria (i), Slovenia (ii), Czech Republic (iii), Hungary (iv), and Slovakia (v).
As part of the given analysis, a correlation analysis is subsequently performed based on the analyzed region in the case of the GDP parameter and health care expenditures based on PPS. All countries show a positive covariance between the variables. The strongest links between the variables are in the case of Austria, where there is a strong positive dependence (i). Followed by the Czech Republic (ii), Slovakia (iii) and Hungary (iv). For these countries, it can be stated that there is a dependence between the changes. Based on the given parameters, Slovenia shows a weak positive dependence. These facts are presented in Figure 8. The next figure (Figure 9) and the results in that figure are focused on the results of the correlation analysis based on the comparison of two attributes, namely health care costs (PPS) per inhabitant and years of healthy life. All the mentioned countries within the analyzed period (2014-2020) show a positive dependence. The strongest rivalry between the given variables is evident in the case of the Czech Republic, where the correlation coefficient reaches a value of 0.96. The next country is Slovakia (0.77) and Hungary (0.70). The last two countries, namely Austria and Slovenia, show a small positive dependence between the variables in the context of the given region. For these countries, it cannot be stated that a certain strong link between the attributes is proven.

The next two pictures (Figure 10 and Figure 11) deal with other results of the correlation analysis. Figure 10 examines the relationship between health care costs (PPS) per capita and the proportion of people aged 65+. From this point of view, it can be stated that most countries show a strong positive correlation between the given variables, except for Slovenia. Austria, Hungary and the Czech Republic show a strong positive correlation with the values from the given attributes.
Figure 8. GDP and health care expenditure (PPS) per capita
Source: Eurostat (2014-2020); own elaboration (2023)

Figure 9. Health care costs (PPS) per capita and years of healthy life
Source: Eurostat (2014-2020); own elaboration (2023)

Figure 10. Health care costs (PPS) per capita and proportion of people aged 65+
Source: Eurostat (2014-2020); own elaboration (2023)

Figure 11. Health care costs (PPS) per resident and occupational accidents
Source: Eurostat (2014-2020); own elaboration (2023)

Figure 12 focuses on the results of attributes, namely health care costs (PPS) per capita and occupational accidents for the period 2014-2020. The strongest negative correlation dependence is in the territory of Slovenia, where the correlation coefficient between the given variables reaches a value of -0.83. This is a strong negative correlation that is statistically significant. Another country that has a strong negative correlation in the context of the given values is Hungary, where the correlation coefficient is -0.69 and it can be stated that this is a strong statistical value. The other analyzed countries show ties that cannot be considered statistically significant in terms of the given parameters.

Figure 12. Healthcare costs (PPS) per resident and hospital discharge and length of stay
Source: Eurostat (2014-2020); own elaboration (2023)
The last figure (Figure 12) shows the results of the parameters devoted to the problem of health care costs (PPS) per resident and discharge from the hospital and length of stay in hospitals. A strong negative correlation (statistically significant) is found for the analyzed period 2014-2020, evident in the territory of the Czech Republic (i), Hungary (ii) and Slovenia (iii). Austria and Slovenia show a positive correlation between the given variables but are statistically insignificant.

4. CONCLUSION

The paper aimed to perform a correlation analysis (Pearson correlation coefficient) of the basic indicators related to GDP per capita according to PPS and healthcare expenditure within the C5 countries. In the analysis (correlation), certain differences were found between the individual economies examined.

It was found that the largest GDP expenditure per inhabitant according to PPS in the context of the given period was reported by Austria. When examining variables, namely GDP expenditures per capita according to PPS and population density, a strong positive correlation was found in the territory of the Czech Republic. In the other two variables, where the authors included GDP expenditures per inhabitant according to PPS and employment per thousand persons, a strong positive correlation was found in the case of Hungary. A negative correlation value was found in Slovenia. Another finding was that when comparing the variables, namely GDP per capita expenditure according to PPS and pension expenditure, most of the analyzed countries showed a negative correlation, except for Slovenia.

The next part of the paper focused on healthcare expenditures, where it was found that almost all countries showed a rising trend during the analyzed period. Austria had the largest expenditure on health care. Subsequently, the authors of the article performed a correlational comparison of two parameters, namely GDP and healthcare expenditures based on the PPS indicator. All countries showed positive correlation values. It was found subsequently when comparing two attributes, namely healthcare costs (PPS) per inhabitant and years of healthy life, that all analyzed countries show a positive correlation coefficient. Part of the given analysis was the implementation of dependence between variables, namely healthcare costs according to PPS per inhabitant and the proportion of people aged 65+. Most of the countries of the C5 grouping show positive dependence, except for Slovenia. The penultimate analysis of variables focused on the costs of PPS health care per resident and occupational accidents. The strongest negative correlation value was found in Slovenia, followed by Hungary. Other countries show a positive trend, but none so strong that it could be interpreted as statistically significant. The last comparison of attributes focused on the issue of PPS healthcare costs per resident and hospital discharge, and the second attribute was the length of stay in hospitals. A strong negative correlation, which can be considered statistically significant, was found in the Czech Republic, Hungary and Slovenia. The other countries (Austria and Slovenia) showed positive values in the given analysis but were statistically insignificant.

It is clear from the analysis that the individual attributes examined in this paper differ in some ways, but it is clear that healthcare spending is increasing. With the effect that even life expectancy in recent years has a rising trend, individual economies must take this fact into account, as it is obvious that in the years to come, healthcare spending and life expectancy will increase, so it is important to think about how to innovate approaches in the healthcare sector and look for possible effective solutions for the future.
Acknowledgment

This paper was created with the financial support of an Internal Grant agency of The Moravian Business College Olomouc “Challenges of Contemporary Management in Healthcare” 2_2022/23.

This paper was created with financial support from the Development of Capacity for Research and Development of The Moravian Business College Olomouc. Registration number CZ.02.2.6 9/0.0/0.0/18_054/0014592.

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