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Forecasting Gross Domestic Product Per Capita Using Artificial Neural Networks with Non-Economical Parameters

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ABSTRACT
Gross Domestic Product per capita is one of the most important indicators of social welfare. All countries try to increase their Gross Domestic Product per capita to contribute to their population's happiness and well-being, as well as strengthen their nation's standing in international relations. Economic growth is affected by economic parameters such as trade, import, and export. However, Gross Domestic Product may also be affected by non-economic factors. Therefore, for a country to increase its Gross Domestic Product per capita, it's important to employ the correct strategy. The aim of this study is to investigate the predictability of Gross Domestic Product per capita based on non-economic data by using artificial neural network with feed forward back-propagation learning algorithm. For this purpose, neural network models have been developed with different architectures. Education level, number of published academic paper per capita, number of researchers per employed, percentage of Research and Development expenditure in the Gross Domestic Product and number of patents per capita are used as input data in the models. The input data has been collected from variety of resources such as Organisation for Economic Co-operation and Development.
A comparison between the model results and actual data give a high correlation coefficient (R^2= 0.96) and show that the model is able to predict the Gross Domestic Product per capita from non-economic parameters.

Keywords: Forecasting, Artificial Neural Networks, GDP per capita, Models, Economic

1. Introduction

Gross Domestic Product (GDP) per capita is one of the most important indicator to compare the level of development within countries. It is widely considered that human welfare and GDP per capita is highly correlated. It is found in the literature that GDP per capita measures happiness of people better than the human capital index [1]. GDP per capita effect in Human Development Index was studied on low and high human development countries. It was found that low human development countries are much more sensitive to changes in GDP per capita [2]. GDP per capita is also used as socioeconomic indicator of health. Correlation between GDP per capita and health has been widely studied in literature [3]. High correlation between GDP per capita and health has been demonstrated with further economic and demographic research [4-10]

Although it is one of the most important indicators for social welfare, GDP per capita estimation was not widely investigated by researchers in economics Instead, much emphasis has been given to GDP Growth estimation [11-13] since GDP is considered as the most important indicator of a country's overall performance. GDP growth rate estimation has been investigated by using machine learning algorithms such as ANN in many studies [14-16].

Another remarkable point is that economic forecasting studies have almost always used economic parameters.

For example, the authors in [14] estimated gross domestic product and Hirschman–Herfindahl Index with four different inputs data. For this purpose, they applied artificial neural network with extreme learning machine and back propagation algorithm. These are gross fixed