17th International Conference on Environmental Science and Technology

Athens, Greece, 1 to 4 September 2021

Is Greece greener than the data shows? Calculation of Green GDP and comparison with neighboring countries

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Abstract Is Greece greener than the current economic indicators show? GDP is used as the leading economic indicator of economic growth and progress. GDP as a measure, among other things, lacks an environmental component. In this paper, we have developed a Green GDP for Greece and neighboring countries and compared them with each other, precisely to compensate for the shortcomings of environmental components in GDP. Green GDP consists of classic GDP minus the costs of pollution, overexploitation of resources, and CO2 emissions into the atmosphere. In this way, or with this calculation method, we have obtained a more detailed and precise presentation of economic growth at the expense of ecology. The paper's main objective is to show whether Greece and neighboring countries, which have the same geographical position, have the same or different environmental policies and how much this policy affects economic development and vice versa. Excessive pollution or exploitation of resources shows a more real economic growth that is sure to pay off in the future for future generations. In this way, we can calculate how much our progress today is a burden for our children or their children in the future, and we can assess whether today's economic growth is worth it in such a way.

Keywords: Green GDP, cost of pollution, CO2 emissions, Greece.

1. Introduction

The main question in this paper is whether Greece is greener than the data will show? This paper will calculate the Green GDP for Greece and neighboring countries and thus try to answer whether, according to the data, the Greek economy is greener than it is shown through the classical GDP. As a comparison due to similar geographical positions, Green GDP will also be calculated for neighboring countries bordering Greece. Why do we ask such a question in the paper? Today's data on the economic variables of a country do not show the real situation we find in practice. GDP as a measure of economic progress and an indicator of development does not contain an environmental component through which to show the damage that this progress brings to nature and the environment. This damage stems from excessive CO2 emissions, overexploitation of national resources, and waste production, which produces directly from increased economic growth. Green GDP is a measure that includes an environmental component and more realistically presents GDP as a measure. In today's time of great and rapid progress at the expense of ecology and nature, we are producing debts that will be paid by the next generations. When we try to include these debts in today's calculations, we get a real situation and a display of progress that does not burden future generations. This issue is gaining more and more importance nowadays, given that after this current viral pandemic, the next catastrophic event that is predicted is related to ecology and potential ecological catastrophe. The calculation of such green variables, i.e., in this case, Green GDP, enabled a more realistic view of the economy and a better idea of the necessary solutions for the future in the direction of avoiding environmental disasters.

2. Literature review

The results of this paper are directly derived from the work of Stjepanović et al. (2017). In this paper, the authors use an alternative method for calculating GDP in which the environmental component is included. Stjepanović et al. (2019) publish a continuation of the above work where they compared Green GDP for developed and underdeveloped countries and further improved it. One of the papers dealing with this topic is the paper of Hongxian (2018), in which the author studies the impact of energy consumption on Green GDP and its growth in China. Increased energy consumption has a positive correlation with an increase in green GDP, but it

is not in itself the only variable that has an impact on green GDP. Vaghefi et al. (2015) calculated green GDP for Malaysia, where they point to the specifics of the Malaysian economy and environmental policy. Wang et al. (2014), in their paper, developed an accounting system as a basis for later derivation of Green GDP. Although there is not a large number of papers on this topic, we can say that Alfsen et al. (2006) dealt with the issue of experience in creating greener GDP. If we look at all the available literature and scientific articles, we can easily conclude that they are the largest number of authors from China who deal with the above issue of greener GDP. In China, due to high economic growth and overexploitation of natural resources, and high pollution, scientists are very concerned about the possibility of a greener view of GDP, which will also be much more realistic. In their work, Li et al. (2010) dealt with China's problems and their experimentation for calculating greener indicators of economic growth and progress. Their work illustrates the need to modernize environmental attitudes and policies in order to avoid the long-term consequences of the current high economic growth. Jiang (2007), who dealt with debates about modernization and the future model of Green GDP development, describes in his paper the same topic. Both Rauch and others (2010) considered China's GDP problems in anticipation of future collection of current environmental costs that remain indebted to younger generations. In China itself, the authors have gone a step further, studying different provinces in China and not just the macroeconomic system of the entire country. Thus Wang et al. (2011) gave a detailed discussion regarding the openness of different provinces in China and their advantages but also the limitations in calculating Green GDP. Popova (2019), in her paper, discussed about the formation and development of a system of economic evaluation of environmental investments. It is established that the methods of economic assessment of environmental investment require adjustment of the main investment parameters. Dinić et al. (2021) informed about the environmental policy of the European Union countries, challenges, problems, and the future in ecology.

3. Data and methodology

Green GDP is calculated based on the previous work of Stjepanović et al. (2017), where it is calculated by subtracting from the standard GDP the cost of waste generated, the cost of CO2 emissions, and the cost of overexploitation of natural resources within the observed year. In this way, we get a more realistic view of the value of GDP that gets the environmental component that is missing from the standard way of calculating economic growth.

In this paper, the data used are obtained from the databases of the World Bank, UN, OECD, and Eurostat. This paper calculates the Green GDP for Greece and the surrounding countries with which it borders for the period from 1970 to 2019, which is shown in Figure 1. What we can see that in certain countries such as Turkey and Bulgaria, there are very few deviations of Green GDP from standard GDP.

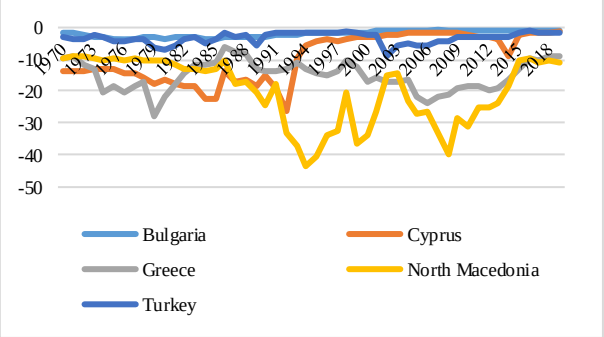

Figure 1. Green GDP 1970 - 2019

In the case of Greece, these deviations are slightly larger, and we can put it in a middle-ranking position in relation to the observed countries. Cyprus also belongs to the middle countries in the period up to 1993, after which the deviation decreases and is almost equal to the Bulgarian and Turkish deviations. Northern Macedonia is the worst of the observed countries where the deviation of Green GDP is the largest, and in some years exceeds 40%, which is a very large deviation from standard GDP. From this, we can see that the ecological component in Northern Macedonia significantly reduces economic growth, i.e., the real economic decline is much larger and more pronounced. These observed countries were chosen precisely because they border Greece and have the same or similar geographical position. However, from the above calculation, we can only conclude that there is a deviation. The next step in this paper is a comparison of environmental policies and investments in ecology in individual countries and the movement of Green GDP. So for this purpose, a graph was made, which is shown under Figure 2, which shows the movement of national spending on environmental protection as a percentage of GDP.

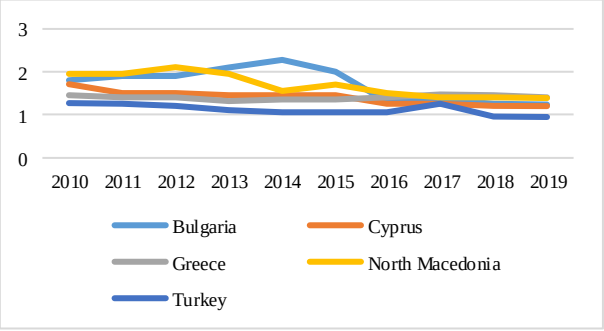

Figure 2. National expenditure on environmental protection percent of GDP

From the above chart, we can see that the countries of Northern Macedonia and Bulgaria invest the most in environmental protection, while Turkey invests the least. In addition, investments in environmental protection by the whole economy were calculated and presented as a percentage of GDP, which is shown in Figure 3. Here we can see that unlike the previous chart we have a very big difference between the countries, where Bulgaria has a

very high rate of investment of the whole economy. All other observed countries, and especially with an emphasis on Northern Macedonia, have a very low investment rate. What this chart tells us is that unlike the government investments from the previous chart, this chart includes investments in the ecology of all participants in the economic system. These investments in Bulgaria have contributed to a very small deviation of Green GDP, while on the other hand, the markedly small level of total investments of the entire economy in Northern Macedonia has contributed to a very large deviation.

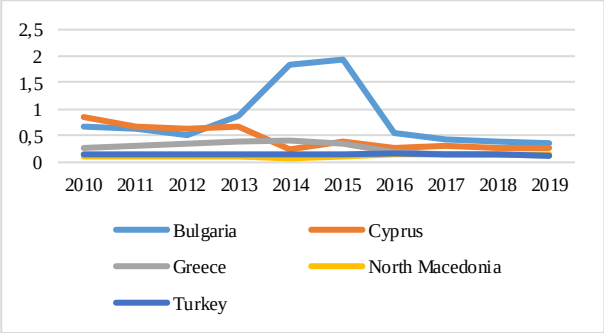

Figure 3. Environmental protection investments of total economy percent of GDP

4. Conclusion

By studying Green GDP for the observed countries, we provided a more realistic picture of economic growth, i.e., the consequences of economic growth and its foundation. Growth only because of growth and statistics does not make sense, and that is exactly the contribution of alternative methodologies for calculating a country's economic progress. If economic growth is based on sound foundations in which future generations are little or not burdened and indebted, then that is justified economic growth. Any other form of growth where as a by-product of growth results in enormous pollution or exploitation of resources that is not adequately renewable is growth that has negative connotations. Green GDP as a measure is conceived as an upgrade of the standard GDP with the addition of environmental components that modify it to more realistically reflect today's economic growth that is not burdened by future deferred costs. In this paper, we can see that there is a very large discrepancy in certain observed countries, such as Northern Macedonia, Greece, and Cyprus, between Green GDP and standard GDP, while the same discrepancy is present but to a much lesser extent in other observed countries. Further, we can see that countries that have a higher degree of investment of the entire economy in environmental protection still, as a result of this investment, achieve much smaller deviations in Green GDP. Also, what we can see in the example of Northern Macedonia is that the state's investment in environmental protection is not so effective if the entire economy does not participate. Bulgaria is the best example of the entire economy investing in environmental protection, which is projected as a very small deviation from Green GDP. Separate environmental policies and investments in environmental protection in the observed countries are completely different, but a comprehensive strategy of environmental management within the economy is needed to have a certain economic and environmental impact. These results show that we need an environmental policy and strategy adopted by the government of a particular country, but it requires a joint effort of all participants in the economy to implement this strategy or to achieve success. What we can say is that, as in any research, there are shortcomings in this as well, such as the number of observed years for investments in environmental protection. Although this time period shows a certain trend, they would certainly get much better results in the case of an increase in the observed years. GDP as a measure of economic progress and growth has many shortcomings, and the environmental component is just one of them. For better monitoring and a more realistic view of the economic situation in the country, it is necessary to add other components that would improve the current measure. However, in this paper, we have referred to the ecological component that we consider very important for the future of civilization and its survival. In addition to these shortcomings, it will be necessary for the future and future work that will continue to address this issue to take a few more important indicators of environmental policies in the observed countries and see their trends and possible impact on Green GDP.

References

Alfsen, K.H.; Hass, J.L.; Tao, H.; and You, W.; 2006. International experiences with 'green GDP'. *Reports 2006/32*, Statistics Norway.

Dinić, J., Bukovala, J., and Ivannikov, N. (2021) Ecological Policy of the European Union. Ecologica, Vol. 28, No 101, p.16-21.

Harnphatananusorn, S., Santipolvut, S. and Sonthi, C. (2019). Concepts and empirical calculation of the green GDP for Thailand. *International Journal of Green Economics*, 13(1), p.68.

Hongxian, X. 2018. Influences Energy Consumption has on Green GDP Growth in China. *IOP Conference Series: Earth and Environmental Science*. 113(1).

Li, V.; Lang, G. 2010. China's 'Green GDP' Experiment and the Struggle for Ecological Modernisation. *Journal of Contemporary Asia*, Vol. 40, No. 1, pp. 44-62.

Jiang, W. 2007. China Debates Green GDP and its Future Development mode. *China Brief*, Vol. 7, No. 16, pp. 4-6.

Popova, O. 2019. Developing the methods for evaluation of economic efficency of ecological investments. Economics: Donjeck national technical university.

Rauch, J.N; Chi, Y.F. 2010. The Plight of Green GDP in China. *Consilience: The Journal of Sustainable Development*, Vol. 3, No. 1, pp. 102-116.

Stjepanović, S., Tomić, D. and Škare, M. (2017). A new approach to measuring Green GDP: A Cross-country analysis. *Entrepreneurship and Sustainability Issues*, 4(4).

Stjepanović, S., Tomić, D. and Škare, M. (2019). Green GDP: an analysis for developing and developed countries. E+M Ekonomie a Management, 22(4), pp.4-17.

Stjepanović, S., Tomić, D. and Škare, M. (2020). Green business cycle: an analysis on China and France. Acta Montanistica Slovaca, Vol. 25., No.4,pp. 563-576.

Vaghefi, N., Siwar, C. and Aziz, S. (2015). Green GDP and Sustainable Development in Malaysia. *Current World Environment*, 10(1), pp.01-08.

Wang, W., He, E. and Zheng, X. (2014). Construction of Green GDP Accounting System. Advanced Materials Research, 971-973, pp.2301-2304.

Wang, X. 2011. Green GDP and Openness: Evidence from Chinese Provincial Comparable Green GDP. *Journal of Cambridge Studies*, Vol. 6, No. 1, pp. 1-16.