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Decoupling – shifts in ecological footprint intensity of nations in the last decade

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ABSTRACT

The ecological price of economic growth is a heavily debated issue, where ideologies often neglect factual information. In this paper, through the relationship of the ecological footprint and GDP, we examine the tendencies of eco-efficiency in the first decade of the 21st century. We conclude that the average ecological footprint intensity of countries have improved significantly in the given period. In 2009, 50 percent less area was needed to produce a unit of GDP. Many countries could reach the so-called strong decoupling – these countries could increase GDP while decreasing the ecological footprint in absolute terms. We also repeated the analysis of a scientific article published in 2004. We managed to update data and identify ecologically positive tendencies. In ten years, the average of the world's ecological footprint intensity has significantly improved, it halved all in all. We found that 90 percent of the countries started to move to the direction of sustainable development. Among the studied 131 countries, 40 experienced strong decoupling (absolute decrease of resource use), in 77 countries weak decoupling occurred (relative decrease of resource use), and there were only 14 countries, where no decoupling could be observed (relative increase of resource use).

1. Introduction

The crisis of the developed world's financial markets forced the introspection of economics, which has been strongly criticized by the representatives of the alternative and heterodox schools, as well as the media, the general public and economic decision-makers (Bod Péter, 2013). Relations, contradictions or compatibility of economic growth and sustainable development is traditionally seen as the most important questions to which theoretical answers and practical solutions must be found. One of the most well-known analyses on this issue can be found in the report to Club of Rome (The Limits to Growth) outlining a number of questionable scenarios for mankind (Meadows et al., 2005). Krozer (2016) explains how the growth of the income and better environmental qualities go hand in hand, and reviews the drivers and the barriers to sustainable innovation on the basis of real-life cases. Detailed analysis of the interaction of GDP, ecological footprint and happiness is also a "hot topic". Kocsis (2010) for example estimates the effects and highlights the consequences of different development approaches for an individual country, in this three-dimensional field, instead of the old, GDP ruled universe. In our study we investigate the appearance of the Jevons paradox and the compatibility of economic growth as well as the ways of reducing the ecological footprint. We would also like to raise awareness of the dangers of a developing new trap in this field.

2. Literature review

GDP is more often criticized than praised among environmental and ecological economists (Costanza et al., 2009; van den Bergh, 2009). Because of a number of criticisms, corrections have been made in the accounting system; one of the changes affects the enumeration of illegal activities, which were integrated in the 2005 annual calculations. The rest of the changes are related to household activities (KSH, 2010). Giannetti et al. (2015) show that if mankind was concerned with the sustainable development of the planet as a whole, then progress indicators measured only in monetary or social terms are limited and restricted to the weak or the medium sustainability model, and must be complemented by biophysical indicators (2015). As a result of the improvement of additional GDP or substituting alternative indicators,researchers have developed several indicators in the past decades. One of the most completed

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overview of the findings of recent years can be found in the article of Bleys (2012). The author is not willing to determine the exact number of alternative indicators however, Bleys presents almost 200 indicators and its various clustering opportunities. The study of Vačkář (2012) is outstanding; related to the examinations he aims to explore the connections among the indicators in which the correlation matrix of 27 alternative indicators was prepared. In addition to the GDP, among other alternative indicators, ecological footprint index (hereinafter referred to as EF) stands out. A number of researches highlight its applicability, limitations and strategic importance (Csutora and Zsóka, 2011; Kerekes 2013; Wackernagel and Rees, 1996). Between economic development (GDP) and the size of EF, a significant correlation can be found (York et al., 2004). A correlation can be also observed at the micro level; the relationship between the income and the ecological footprint persists at the level of individual consumers; typically consumers with a lower-income have a smaller, while individuals with a higher income have a larger than average ecological footprint (Csutora, 2014).

The relationship between the impact on the environment and economic development can be described by the concept of decoupling. By using it, the quantification of the qualitative relations between the environmental impacts and economic activities would be made possible at national or regional levels, too. Decoupling is the rate of relative change of both environmentally and economically important variables that are in a relation of cause and effect. The phenomenon of decoupling can be examined at various levels and dimensions (Tapio, 2002) and can be used for long-term forecasts (Bassi et al., 2012). The growth of the variable, representing the environmental impact can be compared to the growth rate of GDP at macro or national levels, as well. Separation of environmental deterioration from the economic growth occurs when in a given period, the growth rate of the environmentally important variable is smaller than that of the GDP. Decoupling can be seen as strong (absolute) if GDP grows, while the environmentally important variable does not increase or decreases. Decoupling can be seen as weak (relative), if the environmentally important variable is increasing, but at a lower rate than the growth rate of GDP (Szabó, 2006).

Theoretically, the increase of the size of the economy can be separated from the degree of the conversion of the biosphere. The Environmental Kuznets Curve (EKC) hypothesis postulates an inverted-U-shaped relationship between different pollutants and per capita income, i.e., the environmental pressure goes up to a certain level as income increases; after that, it goes down (Dinda, 2004). However, according to ecological economics, in practice there are no evidences for this so far. In fact, based on the available empirical data, rather the opposite was true (Stern, 2004). In sustainability literature, political and public debates, the perception of the role of innovation and technological change varies on a very wide scale. In some aspects, the principle of technological change makes it possible to move towards sustainability. However, according to others, technological change can be seen as the problem and not part of the solution (Bajmócy and Málovics, 2011).

Jevons (1866) described the most well-known paradox of ecological economics in his book *The coal question*. Jevons observed that although the coal industry had become more efficient – thus it became possible to produce more volume of products per a unit of coal – the total coal consumption increased: "*It is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth.* (. . .) *As a rule, new modes of economy will lead to an increase of consumption*". According to York (2008), the reason for that, is that with a more efficient use of coal the carbon cost of a product decreases; as a result there will be an increasing demand for coal, thereby other energy sources will be replaced, or invested in technologies utilizing coal.

Generally, savings gained by increasing eco-efficiency can almost never be fully realized. This can be particularly true for resources that are widely used, and in case of a strong dependence, by the technologies related to them, the absolute resource consumption of the given resources or even the entire economy will be expected to actually grow. In terms of the rebound effect it can be also expected, that the increase of eco-efficiency alone is not sufficient enough to increase sustainability. In some cases, even an opposite effect will be triggered. Several observations confirmed that the specific increase of efficiency (such as the increase of eco-efficiency) will increase the transformation of the biosphere in absolute terms (Málovics and Bajmócy, 2009). Sebestyénné (2013) demonstrates that the rebound effect is an existing phenomenon. Thus, the measures of energy efficiency will contribute to the savings of the available energy to a lesser extent than expected, in parallel with the increase of energy efficiency, energy savings and a limited use of energy should be pursued. According to Tóth (2003), there are limitations to eco-efficiency (i.e. the laws of thermodynamics), and it can be only increased to its potentials. With a growing population and consumption, they cannot be sufficient alone for the achievement of sustainable development. Figge et al. (2014) developed an 'Eco-efficiency-sufficiency matrix' to logically order eco-efficiency and sufficiency measures to attain lower resource consumption and emissions.

The popularity of this topic is shown by several studies (Alcott, 2005 Missemer, 2012; Schneider, 2010; Sorrell, 2009), and books (Polimeni et al., 2008), describing the manifestations and validity of the Jevons Paradox and the rebound effect, and possible solutions for them. Studies are typically examining the issue from the aspect of energy saving – energy efficiency (Sebestyénné, 2013), but it could be also verified by the example of water consumption (Dumont et al., 2013) or building projects (Teng and Wu, 2014). The Jevons paradox was mentioned by Daly (2013) among the major discrepancies related to economic growth. According to Jaeger (1995), Jevons's theory also shows the different point of views of economists and environmentalists formulated on the issues of sustainability and economic growth. The study of Bunker (1996) reveals that the global economy has been showing a significant improvement in terms of resource efficiency for a long time (natural resources per unit of economic output), the total resource consumption of the global economy, however, continues to grow. Similarly, York et al. (2004) showed that at the levels of nations, financial abundance of economies is associated with both larger ecological footprint per capita (per unit EF GDP release) and higher eco-efficiency per capita. This suggests that the empirical conditions of the Jevons paradox could often be used at higher levels. Similar results were received by examining the eco-efficiency of the USA and six European countries: despite of the increased efficiency in the use of natural resources, the use of these resources continued to increase in most societies (Holm and Englund, 2009).

One of the central issues of sustainability is the harmonization of the dynamics of economic systems with the ecological systems (York, 2008). The improvement of eco-efficiency can be a solution for this, which means that the value added would increase, while the intensity of the use of resources would decrease, i.e. the increase of resource efficiency would be achieved by realizing business benefits at the same time (Szabó, 2006). The experts of sustainability often welcome the improvement of eco-efficiency, however its causes are so complex that without further information it cannot be seen as an improvement under all circumstances (Kocsis, 2012).

According to Kerekes, the improvement of eco-efficiency is partly a result of price competition. Everyone is trying to produce their products more cheaply. This provides a demand for new industries and service providers and in this sense, plays an important role in economic growth. In a sense, it can be also seen as