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The relationship between economic and carbon footprint changes in EU: The achievements of the EU sustainable consumption and production policy implementation

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ABSTRACT

The Sustainable Consumption and Production policy is a key objective in the renewed European Union (EU) Sustainable Development Strategy (SDS). EU countries implement the targets of Sustainable Consumption and Production policy at different a level. Nevertheless, SDS targets are concerned more with production than consumption side. In addition, analysis of the carbon footprint data, which was supplied by the Global Footprint Network, showed that in all EU countries consumption-based carbon footprint caught-up and exceeded the level of production-based carbon (except Denmark and Estonia) during 1993–2010 period. The significant absolute decoupling in terms of carbon footprint from production-based perspective was observed in Belgium, Denmark, Sweden, Slovakia, Poland, United Kingdom and Germany, meanwhile from consumption-based perspective only in Denmark, Estonia and Germany. Moreover in Spain, Portugal, Italy and Croatia the consumption-based carbon footprint grew faster than economy in general. Results imply that EU should put more focus on consumption side in terms of Sustainable Consumption and Production policy and measures taken. A commitment to reduce the environmental impact from consumption-based perspective should be more addressed covering values and lifestyles.

1. Introduction

Sustainable Consumption and Production (SCP) is one of the main objectives in the renewed European Union (EU) Sustainable development strategy (Nash, 2009; Scholl et al., 2010). According to the renewed Sustainable development strategy and in line with the Marrakech Process, in 2008 European Commission published the European Action Plan on SCP and on Sustainable Industrial Policy (European Commission, 2008). This document highlighted three main aspects: smarter consumption, better products, as well as global markets for sustainable products (Lorek and Fuchs, 2013). Thus generally the SCP policy contributes to worldwide sustainability by creating market conditions conducive to low carbon and sustainable technologies, products and services and encouraging changes in consumer behaviour, which in turn contributes to reduction of environmental pressure.

In terms of the SCP policy implementation two main categories are considered: consumption and production. The production perspective takes into account the responsibility of country-producer considering direct environmental impact in a particular country due to domestic production processes that generate pressures and impacts within that country (Peters, 2008; Bagliani et al., 2008; Wood, 2009; Marin et al., 2012; Lu et al., 2013). Thus a government has direct authority to implement policies over emissions which is generated by certain industries (Peters, 2008). However the production-based inventory can give misleading insights on the mitigation effort and raises the question of environmental impact leakage[1] (Reinaud, 2008; Honkasalo, 2011; Aichele and Felbermayr, 2012; Radu et al., 2013; Tian et al., 2014). Meanwhile from the consumption based perspective the direct and indirect environmental impact associated with the production of goods and services allocated to the final users excluding export and including import level is evaluated (Tian et al., 2014). Moreover it is

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[1] Environmental impact leakage is defined as "the increase in environmental pressure outside a region as a direct result of the policy to cap emission in this region" (Reinaud, 2008).

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well known that increase in consumption is the main factor behind the serious environmental deterioration across the globe (Lenzen and Shauna, 2001; Garnaut, 2008; Schroeder, 2014). However, other authors remarked that consumption and production sides are overlapped. Tian et al. (2014) state that environmental impact occurs in production processes and it is ultimately driven by the consumption of final goods and services. In contrast to the diversified responsible bodies for the consumption pattern variations, changes in production pattern, both intensity improvement and production structure optimization, are highly related to the producers (Sinden et al., 2011; Barrett et al., 2013). Therefore implementing the SCP policy it is important to consider both production and consumption categories. However considering the SCP policy in the EU countries much attention has been focused on the direct environmental impact, but relatively little attention has been paid to the impact (for ex. emissions) associated with the consumption of goods and services (Davis and Caldeira, 2010).

Regarding research on SCP policy implementation, Vergragt et al. (2014) highlight that the studies in SCP field are not very well structured yet and still fluid. Authors analysing the SCP policy in the EU countries look at different angles of SCP policy. Tukker et al. (2008) recommend a framework for action to change SCP including key domains as food, mobility, housing, and using a systematic perspective on SCP challenge. Nash (2009) reviews the European Commission's communication on the SCP and examines the priority areas identified for the action, the means adopted to improve energy and environmental performance of products as well us uptake by consumption side. Scholl et al. (2010) overviews the EU efforts promoting sustainable consumption. Vergragt et al. (2014) discuss how research over the last 20 years has revealed variety of the mechanisms and lock-ins of unsustainable consumerist lifestyles and production patterns, and the barriers to systemic change. Honkasalo (2011) analyses the perspectives of SCP policy in Finland. Brizga et al. (2014) analyse various sustainable consumption and production indicators as CO_2 emissions, energy consumption, household final consumption and ecological footprint, policy developments, progress achieved, and the main challenges behind sustainable consumption and production governance in post-Soviet republics including Baltic States.

One of the main indicators suitable to evaluate the SCP policy implementation is the carbon footprint. The carbon footprint together with ecological and water footprint is one of the main footprint family indicators (Roelich et al., 2014). The carbon footprint term was developed in the 90's (Ercin and Hoekstra, 2012; Radu et al., 2013) and in the past few years this indicator has become one of the most important environmental protection indicators (Wiedmann and Minx, 2008; Lam et al., 2010; Galli et al., 2012; Čuček et al., 2012). A country's carbon footprint accounts for all carbon dioxide (CO_2) emissions caused by production activities (carbon footprint production-based) and by country's residents consumption level (carbon footprint consumption-based) when estimating the total CO_2 emissions caused by direct emission of energy, petrol and gas and indirect emissions embedded in the products it uses or consumes (Garnaut, 2008; Steen-Olsen et al., 2012; Fan et al., 2012; Tian et al., 2014; Schroeder, 2014; Zhao and Zhong, 2015). Moreover this indicator provides the information about implementation of climate policy (Laurent et al., 2012; Radu et al., 2013). Taking into account that it is very important to integrate SCP with climate policies (Barrett et al., 2013), the usage of carbon footprint provides the insight of implementation of both SCP and climate policy (Gomi et al., 2010; Zhao and Zhong, 2015).

Reviewing the studies on carbon footprint in the EU, Aichele and Felbermayr (2012) employ the carbon footprint and analyse the implementation of Kyoto protocol including some EU countries concluding that the Kyoto Protocol has had at best no effect on world-wide emissions. Radu et al. (2013) present a methodology for the development of a model for carbon footprint calculation to assess the reduction of CO_2 emissions generated by European funds financed projects. Steen-Olsen et al. (2012) quantify the total environmental pressures (greenhouse gas emissions: carbon footprint; appropriation of biologically productive land and water area: land footprint; and freshwater consumption: water footprint) caused by consumption in the EU. Barrett et al. (2013) analyse the consumption-based CO_2 emissions accounting in the United Kingdom. However, there is a lack of research in terms of economic impact on changes in consumption and production-based carbon footprint in all EU countries. Moreover, none analysis in terms of carbon footprint analyse the implementation of SCP policy in the EU. Therefore, considering that the aim of SCP policy is to pursue than in line with economic growth the environmental impact would increase at slower rate or decrease, the aim of this study is to analyse the impact of economic changes on alteration of carbon footprint in the EU countries and to evaluate the SCP policy implementation referring to best practices and suggesting the tools for better SCP policy implementation.

Thus the rest of the paper proceeds as follows. Section 2 presents methods used in the study: catch-up approach and elasticity coefficient. The results are presented in Section 3. The discussion and policy implications are to be found in Section 4. Section 5 produces the main conclusions.

2. Methods and data

Referring to the data of carbon footprint, which was provided by the Global Footprint Network, the changes in carbon footprint from consumption and production perspective in the EU countries in the 1993–2010 period are analysed. The study covers all EU countries: Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland(FL), France (FR), Germany (GE), Greece (GR), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Slovenia (SL), Spain (ES), Sweden (SE), United Kingdom (UK). Due to the lack of the data, Luxemburg, Malta and Cyprus are excluded from this study. In order to reveal the economic impact on changes in carbon footprint indicators, GDP per capita PPP (constant 2005 international $) instead of market exchange rate is used.

2.1. Elasticity coefficient

Considering that the aim of SCP policy is that while pursuing economic growth the environmental impact should increase at slower rate or decrease, an elasticity coefficient, which reveals the impact of economic changes on consumption and production based carbon footprint changes is applied. The elasticity coefficient is defined as ratio of percentage change in carbon footprint to percentage change in GDP in a separate country. The elasticity coefficient is calculated using a regression model. The coefficient b from this regression model could be directly read as the elasticity coefficient (Vehmas et al., 2003, 2007). Thus, the equation is specified as follows:

$$\ln(CF) = a + b^{*}(\ln GDP) \quad (1)$$

in which: CF is the amount of consumption or production based carbon footprint per capita, GDP—per capita PPP (constant 2005 prices, international $).

The elasticity coefficient shows the scale of changes in carbon footprint occurred in relation to economy growth by 1%. In our case, it reveals the process of decoupling occurred during the period of 1993–2010. With economic growth, a negative coefficient