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Analysis

Drivers of greenhouse gas emissions in the Baltic States: A structural decomposition analysis

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ABSTRACT

Since the mid-1990s three Baltic States have significantly increased their per capita gross domestic product (GDP) and at the same time have managed to keep the CO_2 equivalent (CO_{2e}) emissions low. We used structural decomposition analysis to identify the drivers of change for CO_{2e} emissions in these countries between 1995 and 2009, a period that includes the collapse of the Soviet Union, restructuring and economic growth and the great recession. The results show that final demand has been the main driving force for increasing emissions in the Baltic States and would have caused an 80%, 64% and 143% emission increase in Estonia, Latvia and Lithuania, respectively, all other factors kept constant. This increase has been partly offset by a declining emission intensity of the economy, especially in Latvia and Lithuania; whereas in Estonia, which has one of the highest emission intensities in Europe, a shift in consumption patterns towards low carbon consumption items and a decarbonizing economic structure were the main balancing factors. It is likely that the Baltic States will experience a continuation of economic growth given their relatively low per capita GDP, which is less than half of the European Union average thus adequate carbon policies are paramount.

1. Introduction

The Baltic States—Estonia, Latvia and Lithuania (see Fig. 1)—were some of the first in the mid-1990s to show signs of recovery from the collapse of the Soviet Union. In 2004 they become members of the European Union (EU), which was accompanied by increasing foreign direct investment and inflows from the EU structural fund as well as easy access to bank lending. Around 2005 the Baltic economies started to show signs of economically unsustainable consumption-led growth based on overheating domestic demand, in particular private consumption and capital formation, and growth in service sectors (trade, finance, commercial services, hotels and restaurants) and construction (Criste et al., 2011; Koyama, 2010) led to increasing inflation and a widening current account deficit.

In 2008 the Baltic States were hit hard by the global financial crisis, suffering both a severe fall in output and deterioration of the labor market (Verick and Islam, 2010). Between 2008 and 2010, GDP in Estonia, Latvia and Lithuania decreased by 15%, 22%, and 10.5%, respectively (Eurostat, 2013b). In response governments applied tough austerity measures (several state budget cuts were performed in 2008 and 2009 (Purfield and Rosenberg, 2010)), and Estonia also launched the second phase of an ecological tax reform, generating additional revenues to compensate the final demand shortfall caused by cutting the state budget and declining income (GreenBudgetEurope, 2013). The three Baltic States have been successful in overcoming the 2008 economic crises and in 2011 recorded the highest economic growth rates in the EU: Estonia (8.3%), Lithuania (5.9%) and Latvia (5.5%) (Eurostat, 2013b).

At the same time, the Baltic States have managed to significantly reduce their CO_2 emissions since the early 1990s. Data from the National Greenhouse Gas Inventories show that in Estonia, Latvian and Lithuania total emissions (from all the sectors) between 1990 and 2010 decreased by 49%, 57% and 60%, respectively (Konstantinavičiūtė et al., 2013; MoE, 2013a; Slanke et al., 2013). Therefore the Baltic States, as Kyoto protocol Annex I parties, had no problems meeting their targets for the Kyoto Protocol commitment period of 2008 to 2012.

There are not many studies investigating the driving forces behind the changes in these emissions. Gavrilova and Vilu (2012) looked at differences between production and consumption based carbon emissions of Estonia for 2005 and concluded that consumption-based emissions are 18% higher than production-based emissions, primarily due to the net import of embodied emissions from countries outside of the EU. Roos et al. (2012) estimated the likelihood of the Baltic States on meeting the EU climate commitments and concluded that the three countries will have no problem reaching these targets.

In global studies, the Baltic States have been included as part of the former Soviet Union (e.g. Kojima and Bacon, 2009; Raupach et al., 2007; Syri et al., 2008), or other studies subsume them as part of the EU (e.g. EEA, 2013; Moll et al., 2008; Saikku et al., 2008; Tukker et al., 2006; Vehmas, 2009) and thus not providing any insights into the performance of the Baltic States.

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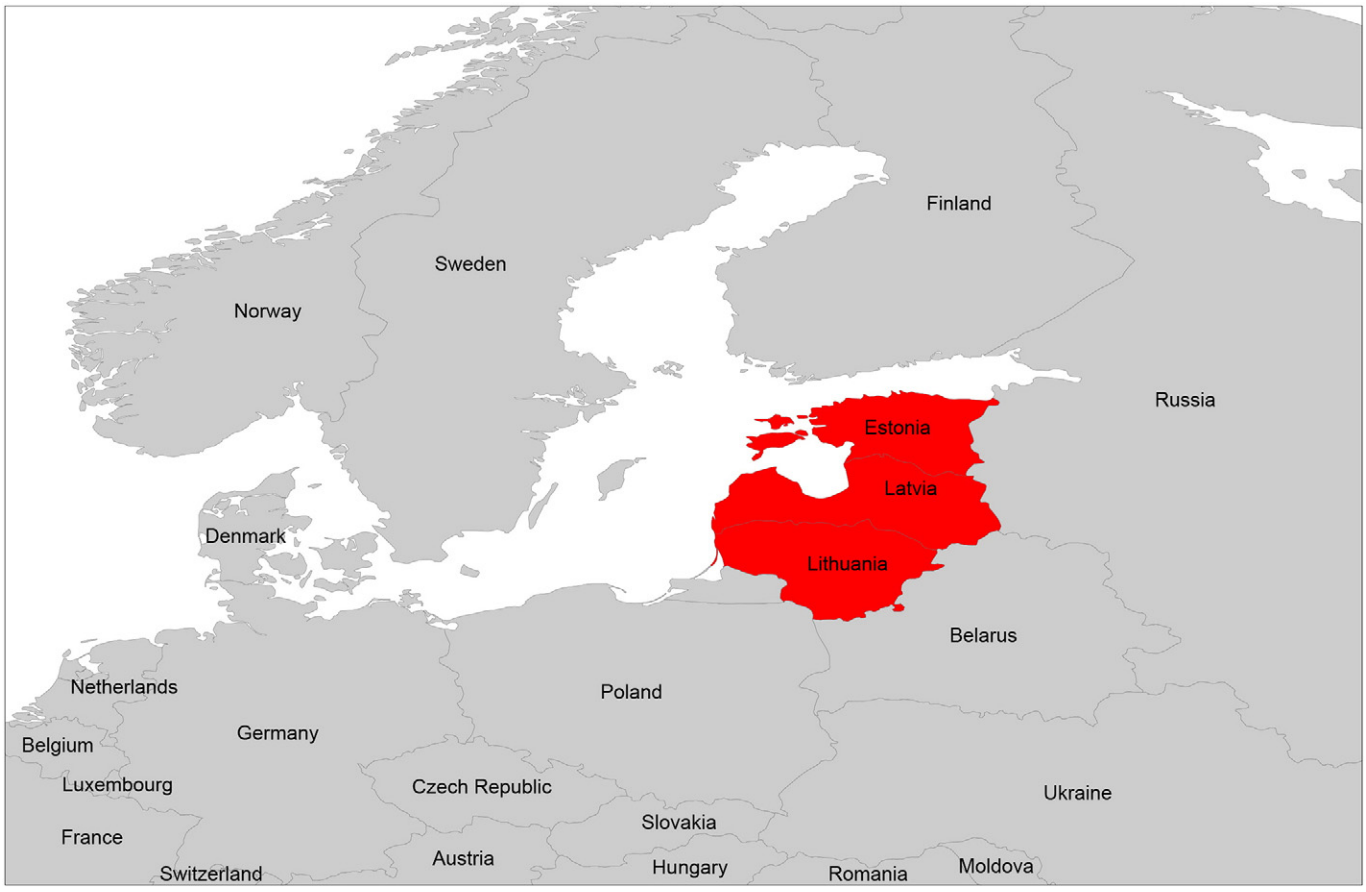

Fig. 1. Map of the Baltic States.

To better understand what has happened during those significant political and economic changes between 1995 and 2009 in the Baltic States in terms of carbon emissions we investigate the driving forces behind the changes in emissions for each of the Baltic States. One of the tools having potential in detecting these forces is Structural Decomposition Analysis (SDA) based on environmentally extended input–output analysis. This method is well established and frequently used to analyze changes in energy consumption, CO_2 emissions and resource flows and identify the key drivers behind changes over time.

SDA has been used in many studies around the world (for a review see Tukker and Dietzenbacher, 2013; Wiedmann, 2009). For example, Vehmas (2009) used SDA to analyze factors contributing to changes in CO_2 emissions from fuel combustion for the years 1990–2003 for the USA, Japan, China, India, Brazil and the EU-25 as a whole and for each Member State. Other studies on the EU include Tukker et al. (2006), who studied environmental impacts of final consumption in the EU-25; and the European Environmental Agency has conducted two studies on consumption and production related CO_2 emissions and resource flows in the EU-27 (EEA, 2013; Moll and Watson, 2009). However, many of these studies excluded the Baltic States from their analysis because of insufficient data (e.g. Kortelainen, 2008); others have been substituting data of the Baltic States with data for seemingly similar countries such as Poland (e.g. Giljum et al., 2007).

Only a handful of decomposition analyses have been done looking at countries in transition or new EU Member States. Weinzettel and Kovanda (2011) applied SDA to study the changes in raw material consumption of the Czech Republic between 2000 and 2007. Baležentis et al. (2011) used index decomposition analyses to analyze energy intensity in Lithuania between 1995 and 2009.

To bridge the apparent gap, in this study we use SDA to identify the main drivers of production based CO_{2e} emissions in the Baltic States.

2. Description of the Region

The economic structures of the three countries are similar on a very aggregate level (see Table 1). About 4% of GDP is produced by agriculture, forestry and fishery. Estonia has a much higher share for service related activities whereas Lithuania has the highest share in manufacturing.

The Baltic States had de-industrialized their economies at the beginning of the 1990s after the collapse of the Soviet Union and are now mainly service-based economies with high imports of industrial goods from the rest of the world. The economies of the Baltic States are strongly interlinked with each other and the EU as well as the Former Soviet Union. The main exports are electrical and electronic equipment, wood and mineral products, metals, agricultural and food industry products, transport equipment, raw materials and textiles. The main imports are electric & electronic equipment, machinery, vehicles, mineral fuels, iron and steel.

Government gross debt remains relatively low in the Baltic States: in 2012 in Estonia it was 10.1% (3.7% in 2007), in Latvia 40.7% (9% in 2007)

Table 1
Main economic sectors as percent of GDP (2009).
Source: (UN, 2012).

	Estonia	Latvia	Lithuania
Agriculture, hunting, forestry, fishing	4	4	4
Mining, utilities	5	4	4
Manufacturing	16	12	21
Construction	7	5	7
Wholesale, retail trade, restaurants and hotels	12	20	18
Transport, storage and communication	13	17	16
Other activities	43	38	30