Journal of Cleaner Production 123 (2016) 180–193

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Decarbonization under green growth strategies? The case of South Korea

Jonas Sonnenschein*, Luis Mundaca

International Institute for Industrial Environmental Economics, Lund University, P.O. Box 196, 22100 Lund, Sweden

ARTICLE INFO

Article history:
Received 20 February 2015
Received in revised form
29 June 2015
Accepted 13 August 2015
Available online 21 August 2015

Keywords:
Climate change
Decomposition analysis
Energy
Green growth
Policy evaluation
South Korea

ABSTRACT

The win–win opportunities connected to green growth are appealing to academics and policy makers alike, but empirical evaluations about the effectiveness of green growth policies are still scattered. Taking South Korea as case study, which set up a highly ambitious green growth program in 2009, our research casts light on the extent to which the Korean Green Growth Strategy has been effective in decarbonizing the economy. Our methodology combines decomposition analysis and econometrics with a review of energy and climate policies, including related structural changes. On the short term (2008–2012), most of the drivers displayed an enhancing effect on CO_2 emissions from fuel combustion, with GDP per capita being the strongest driver. From a historical perspective (1971–2012), findings reveal that important drivers, such as energy and CO_2 intensity even worsened their effects during the first years under the Green Growth Strategy. Regression statistics revealed that GDP per capita was in fact the driver with the most explanatory power for CO_2 emissions, followed by energy intensity. The Korean policy mix of modest government support to low-carbon energy technologies and a lack of complementary pricing policies did not deliver the targeted emissions reduction, at least in the short-term. Despite recent policy developments, i.e. the introduction of a renewable portfolio standard in 2012 and an emissions trading system in 2015, several key policy challenges for decarbonization remain.

© 2015 Elsevier Ltd. All rights reserved.

1. Introduction

The 2008–2009 global financial crisis triggered fiscal stimulus packages around the world. While the main purpose of the stimulus was to get economies back on the economic growth path, several environmental organizations, environmental economists, and policy makers saw this crisis as an opportunity to achieve economic recovery with low environmental impact. UNEP pointed out the "unique opportunity presented by the multiple crises and the ensuing global recession" (UNEP, 2009, p. 4). Moreover, it was argued that "a Global Green New Deal, if implemented effectively and swiftly, has the potential to revive the world economy and reduce its vulnerability to repeated fuel and food crises as well as climate-induced risks." (Barbier, 2010, p. 20). Within this framework, economic stimulus packages were portrayed as a golden opportunity and entry point into a new green economy, with the low-carbon energy technology sector playing a critical role (IEA, 2009). In many countries (e.g. USA, China, South Korea) clean energy was heavily targeted (UNEP and GEI, 2009). While the opportunities connected to green growth strategies are appealing, there are few studies about their actual success in delivering the aspired win–win outcome. The literature regarding the effectiveness of green growth strategies and supportive policies is scattered. This case study of decarbonization in South Korea in a Green Economy context finds that, mainly due to a lack of ambitious supplementary reforms, public spending under a green growth strategy seems insufficient to offset economic growth effects on CO_2 emissions.

The case of South Korea (hereafter Korea) is sticking out in the green growth debate as, together with China, it became the world leader in green growth spending. With 80% the share of green investments in Korea's 2009 economic recovery package of USD 45 billion[1] (representing 3% of GDP) was the largest worldwide (UNEP, 2010). The green stimulus package was already under the impression of President Lee Myung-bak's 2008 announcement of "Low

* Corresponding author. Tel.: +46 46 222 0215.
E-mail address: jonas.sonnenschein@iiiee.lu.se (J. Sonnenschein).

[1] When we refer to GDP in the text, we assume an exchange rate of 1100 KRW per USD, which reflects the rate at the time of writing (January 2015) and is close to the average exchange rate over the last five years.

http://dx.doi.org/10.1016/j.jclepro.2015.08.060
0959-6526/© 2015 Elsevier Ltd. All rights reserved.

carbon, green growth" as the new development vision for the country. This vision inspired the "National Green Growth Strategy", which was published in 2009. The strategy had "Mitigation of climate change & energy independence" as the first of three objectives. The other two objectives were "Securing new growth engines" and "Improving living standards and enhancing national status", which included only the improvement of water and flood management and the construction of railways as further actions with direct relation to environmental goals (Presidential Commission on Green Growth, 2009). The Green Growth Strategy and its primary focus on climate change mitigation are reflected in several policies, above all the Five Year Plan for Green Growth (2009–2013), which emerged from and overlapped with above mentioned stimulus package, and had a total volume of USD 98.8 billion (OECD, 2012).

There were several reasons for Korea to give a strong push towards the decarbonization of its energy economy. First, Korea is 97% dependent on imports for its primary energy supply (U.S. Energy Information Administration, 2014), which means that energy security and reduced import costs are important co-benefits of climate change mitigation. Second, Korea is an OECD country with consistent and rapid economic growth over several decades (OECD, 2012), but it is one of only three OECD countries that do not have any emissions reduction obligations under the Kyoto Protocol. Third, Korea is a heavily industrialized country with a high share of energy intensive industry, in which a significant part of Korea's economic capacity and welfare is rooted (Jeong and Kim, 2013). Fourth, renewable energy has only a marginal share in both primary energy supply and power generation, which also means that there is no strong domestic market for renewable energy technology, yet (Park et al., 2013). Finally, and most importantly, Korea's CO_2 emissions from fuel combustion increased by 125% from 229 Mt in 1990 to 516 Mt in 2009 (IEA, 2014b).

The Korean commitment towards decarbonization has not only been expressed in the National Green Growth Strategy but also in quantitative targets: Korea committed itself to reducing GHG emissions by 30% till 2020 as compared to a business as usual (BAU) scenario, representing a decrease of 4% compared to 2005 levels. This is the most demanding pledge of any non-Annex I country under the Kyoto Protocol. Furthermore, the First Energy Basic Plan contained targets for the energy intensity of the economy (46% reduction by 2030 as compared to 2006) and renewable energy (increase from 2.4% of total primary energy supply in 2006 to 11% in 2030) (Chung, 2014).

Despite all these relevant drivers and policy commitments, there is a lack of assessment regarding the actual performance of Korea's Green Growth Strategy, in particular from the empirical point of view. Earlier quantitative studies in the context of decarbonizing the Korean energy system have researched: the drivers of CO_2 emission from industry between 1990 and 2009 (Jeong and Kim, 2013), the energy and GHG emissions intensity of 96 economic sectors between 1990 and 2004 (Chung et al., 2009), the role of eco-industrial parks in reducing CO_2 emissions in Korea (Jung et al., 2012), the sector-specific drivers of CO_2 emissions in Korea between 1990 and 2005 (Oh et al., 2010), and the drivers of power sector CO_2 emissions in a scenario analysis for the period 2008–2050 (Park et al., 2013). While these analyses provide valuable quantitative insights about some drivers of energy-related CO_2 emissions, they do not relate their findings to green growth policy programs. On the other hand, recent research on Korean climate and energy policy is scattered. Duffield (2014) provides a qualitative analysis of Korea's first National Energy Plan without putting much stress on its environmental effectiveness. The only explicit attempt we found in the literature is the report "Korea's Green Growth based on OECD Green Growth Indicators" by Statistics Korea. The report provides an interesting summary of several green growth statistics, but neither analyzes these statistics nor assesses the impact of green growth policy on the included indicators (Statistics Korea, 2012). The lack of evaluations of green growth policy programs is likely to explain why there is a discrepancy between the political optimism about the win–win potential of green growth policies on one side, and academic skepticism about the environmental effectiveness of green growth policies on the other side (cf. Antal and Van Den Bergh, 2014; Brahmbhatt, 2014).

Given the lack of knowledge, our research aims to cast light on the extent to which the Korean Green Growth Strategy has been a suitable policy tool for short to mid-term decarbonization of the economy. Our analysis quantitatively unravels key drivers and identifies the extent to which policy efforts have, or not, facilitated decarbonization. The paper combines decomposition analysis and econometrics with a review of energy and climate change mitigation policies; including related structural changes.

The analysis is undertaken in two steps. We first take the Korean National Green Growth Strategy (2009–2013) as a point of departure to analyze recent (2008 onwards) policy efforts to reduce CO_2 emissions. We do this by carrying out an additive decomposition analysis that attributes CO_2 emissions to various drivers, since the indicator CO_2 emissions alone does not have enough resolution to unveil the dynamics that were potentially triggered by policy intervention (methodological details in the next section). Second, and building upon the decomposition approach, we take a longer-term perspective by analyzing Korea's CO_2 emissions using an econometric model with time series data from 1971 to 2012. Questions that guided our analysis included: What have been the most significant drivers of CO_2 emission levels in the short and long term? Which policies (if any) have facilitated the decarbonization of the economy? What can be said about the environmental effectiveness of Korea's Green Growth Strategy? Is Korea on track to reach its 2020 emissions reduction target? And finally, are economic growth and decarbonization compatible? As a whole, our research aims to learn from Korea's experience with using green growth policies to encourage a low-carbon energy system.

The paper is structured as follows. Section 2 outlines the methodology of this study. The results from the short-term decomposition analysis are presented and analyzed in Section 3.1. These findings are put into the context of the long-term development of CO_2 emissions drivers, which were analyzed with econometric tools (Section 3.2). The findings from both parts of the analysis are discussed in the context of structural changes of the Korean economy and its energy system in Section 3.3. Key policy aspects are further analyzed in Section 3.4. Section 4 summarizes implications of our analysis for short to mid-term decarbonization policies. Conclusions are drawn in Section 5.

2. Methodology

The methodology is based on a top-down empirical approach. Building upon the Kaya Identity (Kaya, 1990), our research deploys two complementary analytical tools, namely additive decomposition analysis and an econometric assessment. This study gives emphasis on *environmental effectiveness*, which is primarily assessed by analyzing CO_2 emissions from fuel combustion.

2.1. Decomposition analysis

Decomposition analysis is a useful tool to further the understanding of interactions between CO_2 emissions and socio–economic activities. This understanding can be used as the basis for policies that address the most relevant drivers of CO_2 emissions (IEA, 2014a). The Kaya Identity is a macroeconomic decomposition

Download English Version:

https://daneshyari.com/en/article/1744229

Download Persian Version:

https://daneshyari.com/article/1744229

Daneshyari.com