The Social Science Journal 52 (2015) 300–310

Contents lists available at ScienceDirect

The Social Science Journal

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

Strategic corporate sustainability performance of Chinese state-owned listed firms: A meta-frontier generalized directional distance function approach

Yanni Yu[a], Yongrok Choi[a,*], Ning Zhang[b,c,**]

[a] Department of International Trade, Inha University, Inharo 100, Nam-gu, Incheon 402-751, Republic of Korea
[b] Institute of Poyang Lake Eco-Economics & Institute of Eco-Civilization and Economics, Jiangxi University of Finance and Economics, Nanchang 330013, China
[c] Sustainability Management Research Institute, Inha University, Inharo 100, Incheon 402-751, Republic of Korea

ARTICLE INFO

Article history:
Received 15 February 2013
Received in revised form 10 July 2013
Accepted 10 July 2013
Available online 1 August 2013

Keywords:
Corporate sustainability performance
Generalized directional distance function
Chinese state-owned listed firms
Data envelopment analysis
Meta-frontier approach

ABSTRACT

Although sustainability recently became a key factor in social science, little progress has been made toward improving the measurement of sustainability performance. This paper proposes composite corporate sustainability performance indicators using a meta-frontier generalized directional distance function. This advanced approach can measure the efficiency of corporate social responsibility activities by benchmarking, while simultaneously considering industrial heterogeneities, using the meta-frontier approach. First, we propose the concept of a meta-frontier generalized directional distance function. Second, several standardized composite indicators related to corporate sustainability performance are developed. The meta-frontier directional distance function is estimated by solving a series of data envelopment analysis models. Chinese state-owned listed enterprises are then empirically examined using the proposed model. We find significant group heterogeneities in terms of corporate sustainability performance. We also derive some policy implications using the empirical results.

1. Introduction

Sustainability has recently become a key factor in social science. The World Commission on Environment and Development first presented the concept of sustainable development in 1987. This Commission suggested the first official definition of sustainable development as those activities that aim "to meet the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987). Since then, there has been increasing concern about corporate sustainability, with efforts toward international standardization in sustainability reporting, such as the Global Reporting Initiative (GRI) and ISO 26000 providing guidelines for social responsibility, both of which are now internationally recognized and widely adopted by corporations. Despite the increased awareness of the conceptual and practical applications of corporate sustainability, however, questions remain about how to measure sustainability performance. Unfortunately, as Briassoulis (2001) indicates, little progress has been made toward improving the measurement of corporate sustainability performance. The present paper bridges this gap in the literature by proposing a new methodology for measuring corporate sustainability performance.

The Chinese government is particularly concerned with the sustainable development of the country. China's 12th Five-Year Plan for 2011–2015 seeks to establish a "green,

* Corresponding author. Tel.: +82 32 8607760; fax: +82 32 8769328.
** Corresponding author at: Institute of Poyang Lake Eco-Economics & Institute of Eco-Civilization and Economics, Jiangxi University of Finance and Economics, Nanchang 330013, China. Tel.: +82 10 20528415.
E-mail addresses: yayabaobei@naver.com (Y. Yu), yrchoi@inha.ac.kr (Y. Choi), zn928@naver.com (N. Zhang).

0362-3319/$ – see front matter © 2013 Western Social Science Association. Published by Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.soscij.2013.07.010

sustainable development concept." In this Plan, the government announced several new targets for sustainable development, such as

- increasing the proportion of nonfossil fuels in energy consumption to 11.4% by 2015,
- reducing energy consumption per unit of gross domestic product (GDP) by 16% from 2010 levels by 2015,
- reducing sulfur dioxide (SO_2) emissions and chemical oxygen demand (COD) by 8% from 2010 levels by 2015, and
- reducing carbon dioxide (CO_2) emissions per unit of GDP by 17% from 2010 levels by 2015.

Clearly, the need to reduce emissions and promote sustainable development poses a challenging task for Chinese state-owned enterprises. This situation is reflected in the dearth of sustainability publications by Chinese enterprises. As recently as 2006, it was almost impossible to examine and/or compare the sustainability performance of Chinese companies, because only 16 local firms published sustainability reports. However, by 2010, almost 600 Chinese companies reported their sustainability practices.

Practicing sustainability through corporate social responsibility (CSR) and environmental management practices is costly for firms in the short run (Walley & Whitehead, 1994). According to Porter and Kramer (2006a, 2006b), however, strategic sustainable activities can become a source of innovation, new business opportunities, and competitive advantage for firms in the long term. Therefore, "doing good" is crucial for companies in the long run. This paper, thus, measures how a firm can perform sustainable activities more efficiently in order to increase profits and improve its market value, or in other words, to improve the firm's strategic sustainability performance.

Simple ratio indicators, such as carbon intensity, such as carbon emissions per product or energy efficiency, energy consumption per product, are widely used for measuring a company's environmental performance. However, such indicators are too simplistic to provide the information necessary for multidimensional decision making. As Zhou and Ang (2009) indicate, composite indicators are increasingly recognized as a useful tool for performance monitoring. Therefore, a composite indicator approach to measure sustainability performance provides insightful information.

In the literature, data envelopment analysis (DEA) of multidimensional production efficiency has been widely used to benchmark energy efficiency (Hu & Wang, 2006; Wei, Ni, & Shen, 2011; Zhang & Choi, 2013; Zhang, Zhou, & Choi, 2013), environmental performance (Lozano & Gutiérrez, 2008; Macpherson, Principe, & Smith, 2010; Picazo-Tadeo & Prior, 2009), and eco-efficiency (Picazo-Tadeo, Beltrán-Esteve, & Gómez-Limón, 2012; Zhang, Bi, Fan, Yuan, & Ge, 2008). Moreover, several studies have used DEA to measure corporate sustainability performance. Tsolas (2008) uses DEA to derive composite environmental sustainability indicators, while Partovi (2011) uses it to select corporate philanthropic projects. Berber, Brockett, Cooper, Golden, and Parker (2011) measure the efficiency of charitable fundraising by social enterprises, and Chang, Kuo, and Chen (2011) use output-oriented DEA to construct a composite corporate sustainability performance indicator to benchmark corporate sustainability performance at the industrial level. Finally, Lee and Saen (2012) propose a DEA model for assessing composite corporate sustainability performance based on cross-efficiency and a dual-role factors model.

An alternative approach for measuring performance from a production efficiency perspective is adopting a directional distance function, which is capable of expanding outputs and reducing inputs. In environmental economics, the directional distance function (DDF) has been employed by Picazo-Tadeo, Reig-Martínez, and Hernández-Sancho (2005) and Färe, Grosskopf, and Pasurka (2007). Although several researchers use DEA for the measurement of corporate sustainability performance, none have applied the DDF to corporate sustainability performance benchmarking. The present study bridges this methodological gap by using a generalized DDF to measure sustainability performance.

As the traditional DDF proposed by Chambers, Chung, and Färe (1996) aims to reduce inputs and expand outputs at the same rate, it can be regarded as a radial efficiency measure. However, this radial measure also has several limitations. Primarily, it does not provide efficiency information for specific factors, such as unequal sustainable performance, because it adjusts all inputs and undesirable outputs by the same proportion to efficient targets. In addition, radial efficiency measures overestimate efficiency when there is slack (Fukuyama & Weber, 2009). Therefore, it has relatively weak discriminating power in ranking the entities being evaluated (Zhou, Ang, & Wang, 2012).

Against this backdrop, recent research has sought to develop alternative non-radial efficiency measures, based on directional distance, that incorporate slack. For instance, Fukuyama and Weber (2009) develop a slack-based inefficiency measure by extending the DDF, while Färe and Grosskopf (2010) propose a generalized non-radial DDF. Fukuyama, Yoshida, and Managi (2011) and Barros, Managi, and Matousek (2012) also develop directional slack-based inefficiency measures and a weighted Russell DDF, respectively. Choi, Zhang, and Zhou (2012) present a slack-based efficiency measure that incorporates CO_2 emissions, and Zhou et al. (2012) define a non-radial DDF following an axiomatic approach to efficiency measurement. Zhang et al. (2013) incorporate the meta-frontier approach into a non-radial DDF. However, most such non-radial approaches are applied to measure environmental performance, and insufficient attention has been paid to multidimensional sustainability measurement using this state-of-the-art approach.

In this study, we extend the generalized DDF proposed by Färe and Grosskopf (2010) to model corporate sustainability performance. Previous research on the efficiency measurement of corporate sustainability focuses on a specific industry, such as electricity firms by Lee and Saen (2012). However, ignoring group heterogeneities of different industries can lead to a biased estimated efficiency score, because heterogeneities among industry groups may