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Determinants of the changes in the elasticity of CO_2 emissions in Iran

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EXTENDED ABSTRACT

INTRODUCTION

In 2019, Iran is ranked sixth among world countries and fifth among Asian countries (including Russia) in terms of CO_2 emissions. Therefore, studying the CO_2 emission elasticity of the production sectors of this country is significant and important for energy and environmental policymakers. What factors influence changes in CO_2 emission elasticities? Which are the stimulants and which are the inhibators? The answers to these questions are useful in reducing and controlling CO_2 emissions. In the present study, CO_2 emission elasticities of production sectors are calculated, and then, with the aim of identifying CO_2 emission elasticity stimuli, the changes in CO_2 emission elasticities are broken down into different components. The methodology of this research is based on Input-Output analysis and decomposition analysis. The novelty of this paper is to determine and calculate the components of changes in CO_2 emission elasticities using SAD. Guo et al. (2018) have presented a method for calculating CO_2 emission elasticities based on the Input-Output analysis.

METHODOLOGY

Aim of this paper is to investigate the factors affecting CO_2 emission elasticities, CO_2 emission demand elasticity and CO_2 emission production elasticity. In the first step, the elasticities are calculated and in the second step, changes of elasticities are decomposed. In this study, we have used input-output tables published in 2001 and 2011 by the Statistics Center of Iran. Due to the differences in the sector classification of the input-output tables of 2001 and 2011, we match some production sectors and finally take into account the 65 unified sectors. In order to calculate the CO_2 emission of each production

sector, we first obtain the total consumption of each energy for each year from the Iranian energy balance sheet, and then we allocate each energy consumption to production sectors and single household sector, according to input-output tables and the share of production sectors and the share of the household sector.

$$TI_j = \sum_i E_{ij}^{y} = \sum_i \beta_i g_{ij} \frac{y_j}{x_j} = \frac{y_j}{x_j} \sum_{i=1}^{n} \beta_i g_{ij}$$

$$DI_i = \sum_j E_{ij}^{y} = \sum_j \beta_i g_{ij} \frac{y_j}{x_j} = \beta_i \sum_{j=1}^{n} \frac{y_j}{x_j} g_{ij}$$

$$\Delta TI_j = \Delta\left(\frac{y_j}{x_j}\right) \sum_i \beta_i g_{ij} + \Delta\left(\sum_i \beta_i g_{ij}\right) \frac{y_j}{x_j}$$

$$= \Delta\left(\frac{y_j}{x_j}\right) \sum_i \beta_i g_{ij} + \frac{y_j}{x_j} \left(\sum_i \beta_i \Delta g_{ij}\right) + \frac{y_j}{x_j} \left(\sum_i g_{ij} \Delta \beta_i\right)$$

$$\Delta DI_i = \Delta(\beta_i) \sum_j \left(\frac{y_j}{x_j}\right) g_{ij} + \Delta\left(\sum_j \frac{y_j}{x_j} g_{ij}\right) \beta_i$$

$$= \beta_i \left(\sum_j g_{ij} \Delta\left(\frac{y_j}{x_j}\right)\right) + \beta_i \left(\sum_j \frac{y_j}{x_j} \Delta g_{ij}\right) + \Delta\beta_i \sum_j \frac{y_j}{x_j} g_{ij}$$

FINDINGS

Findings show that the "Electricity generation, transmission, and distribution" sector has the most elasticity. The "Ghosh inverse matrix" effect is a strong stimulus to the CO_2 emission elasticity of the sectors. This result indicates that the change in the share of output i, which is sold to sector j as an intermediate input, is a strong stimulus to increase the elasticity of CO_2 emissions. These changes can be due to increased economic activities and the inefficiency of production structure.

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CONCLUSION

"Electricity generation, transmission and distribution" sector should be considered by energy and environmental policy makers due to having the highest amount and changes in CO_2 emission elasticity than other sectors. Increasing the share of renewable energy in the energy consumption basket of production sectors, increasing energy efficiency (reducing energy intensity) by replacing new and advanced equipment with old and worn equipment and improving production structure can help reduce the CO_2 elasticity and CO_2 emission in Iran's production sectors. Finally, due to the high of CO_2 emission elasticities in the "Electricity generation, transmission and distribution" sector, future research can focus on this area and suggest solutions to increase production efficiency and energy efficiency. Also, future research can focus on the production structure of production sectors and provide solutions to improve the production structure of Iran's production sectors.

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