ENERGY CONSUMPTION AND GREENHOUSEGAS EMISSIONS TRENDS IN MEXICO

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Overview

This paper presents trends of energy consumption and CO_2 emissions in Mexico from 1990 to 2006. End use sectors are included, as well as power generation and energy consumption in the energy industries, that in Mexico correspond to the state owned company, Pemex. Decomposition analysis based on both Laspeyres and Divisa index are used, and results compared.

CO_2 emissions grew in a very similar number than energy consumption between 1990 and 2006 at around 35% because increase in gasoline, diesel, coal and coke and decrease in renewable energy, reduced the importance of the substitution of fuel oil by natural gas in the power sector.

The activity and structure effect drove up, energy and emissions, while intensity drove down both of them, and energy intensity and carbon intensity effects provoke a decrease in emissions. However the carbon intensity effect is very low compared to the other effects. In order for Mexico to reduce emissions further efforts on energy intensity and reductions in carbon intensity have to be implemented

Methods

To analyze the Mexican energy and emission trends, a decomposition analysis method based on both Laspeyres and Divisa index are used. The approach implemented in this study is a top-down analysis. Indicators are calculated at the economy or macroeconomic level. The decomposition method accounts for activity changes based on Gross Domestic Product (GDP), structural changes that account for the modifications of the GDP structure, energy and emission intensity changes and carbon intensity changes defined as the division between CO_2 emissions and primary energy consumption.

The analysis is conducted for seven index methodologies: Simple Laspeyres multiplicative and additive indexes, Refined Laspeyres index as defined by Ang and Zhang (2000), mean Divisa indexes multiplicative and additive, and Log mean Divisa indexes multiplicative and additive.

Results

The activity effect represents the energy or emission consumption that would have occurred over the period 1990-2006, if the other explanatory variables had remain constant at the 1990 value. The activity effect drove up energy and emissions by 58.5%, instead of the real 35.5 and 35.3% respectively.

Structural effect shows the changes that would have taken place in energy demand and emissions if other explanatory variables would have remained constant at its 1990 value. Although results are different depending on the methodology used, in all cases the effect is positive (in the additive index methods) or superior to one (in the multiplicative index methods). The structure effect show that energy demand would have increased 11 to 16.5%, and emissions between 18 to 20% with other changes constant, depending of the methodology used.

Energy intensity effect shows changes of energy demand and emissions with other explanatory variables constant at its 1990 value. It is clear that energy demand would have decreased around 25% if GDP and GDP structure would not have stay constant at its 1990 value, and emissions would have decreased by 24.7 to 35.8% (depending of the index method used) if activity, structure and carbon intensity effects would have remained constant.

The carbon intensity effect would have drove down CO_2 emissions by only 1% with other changes constant.

For the indexes that consider a residual term, the approximation is similar in the multiplicative indexes. For energy demand, the residual terms are -1.6% for the Laspeyres multiplicative and 2.2% for the mean Divisa multiplicative index. For emission changes the residual terms are 1.6% and 0.1% respectively. In this last case the residual term result more significant because the carbon intensity have a small value.

Conclusions

The activity and structure effect drove up both, energy and emissions, while intensity drove down primary energy demand, and energy intensity and carbon intensity effects provoke a decrease in emissions. However the carbon intensity effect is very low compared to the other effects, which explain the similarity between total changes in energy and emissions. In general, he increment in the use of coal, oil coke, gasoline and diesel minimized the substitution of natural gas by fuel oil. In order for Mexico to reduce emissions further efforts on energy intensity and reductions in carbon intensity have to be implemented.

For the purpose of this paper, the refined Laspeyres index or Log Divisa indexes result a good explanation of the explanatory variables that drove energy and emissions in Mexico. However log mean multiplicative method seems to present a better picture because it balances in a better form the explanatory variables.

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