

[ENERGY-RELATED CARBON EMISSIONS IN THE ASIA-PACIFIC REGION: TRENDS AND DRIVERS]

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Overview

This study investigates the key drivers of the carbon emissions in the Asia-Pacific region from 1990 to 2010. Most existing studies have covered a small number of specific countries. Even for a regional analysis, most of studies have investigated two effects in different countries separately rather than the whole region. Due to the externality of GHGs, it is necessary to examine the key factors of carbon emissions at the regional level. This study analyses the energy related carbon emissions in the Asia-Pacific region, covering 17 major countries and using a widely consistent database at both industrial and country level. The Asia-Pacific region is divided into four sub-regions (America, ASEAN, ASEAN plus Three, Asia Oceania) based on the geography and economic cooperation.

This study identifies five effects: activity effect, structural effect, intensity effect, energy mix effect, and emission factor effect. The activity effect focuses the impact of economic growth on the carbon emissions while the structural effect quantifies the contribution of economic structure adjustment to the carbon emissions. The intensity effect measures the improvement of energy efficiency while the energy mix effect examines the change of energy structure. The emission factor effect captures the change of carbon emissions during the process of fuel combustion.

Our main contributions are as follows. First, a descriptive analysis gives general trends of energy use and energy-related carbon emissions at the country level and at the regional level. Second, the IDA at the country level is used to identify the energy-related carbon emissions patterns in different countries within the region. Third, the IDA at region level is conducted from the temporal IDA approach and the spatial approach. The temporal IDA method shows the change of carbon emissions over a long time span, while the spatial IDA method explains the differences of the energy-related carbon emissions pattern between a specific country and the average level in the region. The data are obtained from the UN Statistical Yearbooks and the IEA Energy Balances to ensure the comprehensive and consistent datasets. This study sheds light on the regional study of carbon emissions.

The study includes 4 sections. Section 1 introduces the existing literature and our main contribution. The methodology will be presented in section 2. Section 3 shows the descriptive analysis and the empirical results. Section 4 concludes the paper.

Methods

The temporal IDA method is used to analyze the drivers of carbon emissions over a time span at country level and at the regional level. The spatial IDA method is applied to investigate the trend of emissions intensity across countries within a sub-region.

Results

In the temporal analysis, the key driver for the increase of carbon emissions is activity effect in four sub-regions, while it is offset by the intensity effect in America, ASEAN plus Three, and Asia Oceania. The intensity effect is mild in ASEAN, which contributes little to the change of carbon emissions. The structure effect (between country) have a large positive impact on the increase of carbon emissions in the ASEAN plus Three region and Asia Oceania region. It means that the economies in these two sub-regions greatly shift towards the carbon-intensive countries over the twenty years. The structure effect (within country) increases moderately but continuously from 1990 to 2010. It indicates that the economy in each country shifts to the carbon-intensive sectors slowly and continuously.

The mix effect and the emission factor effect is mild, meaning that the changes of energy mix and emission factors influence the carbon emissions moderately.

In the spatial analysis, the study investigates the carbon intensity across different countries in the four sub-regions in 1990, 1995, 2000, 2005, and 2010. The intensity effect and the structure effect show great difference among different countries, while the energy mix effect and the emission factor effect are almost homogeneous in the four sub-regions. It means that the difference of carbon intensity is due to the heterogeneity of the economic structure and energy intensity across different countries. The intensity effect shows a convergent trend in the ASEAN plus Three region and the Asia Oceania region from 1990 to 2010, while the structure effect converges in the America region and ASEAN region over the time span. It indicates that the difference of energy intensity becomes smaller among different countries in the ASEAN plus Three region and Asia Oceania, leading to a smaller difference in the carbon intensity. It also shows that the economic structure tends to be homogeneous in the America region and the ASEAN region, resulting in less difference in the carbon intensity.

Conclusions

This study analyzes the carbon emissions in the Asia-Pacific region using the temporal IDA method and the spatial IDA method. The descriptive data analysis presents the heterogeneity of energy use and carbon emission across different countries from 1990 to 2010. The temporal IDA method shows that the activity effect and the intensity effect are the key drivers for the increase of carbon emissions in the Asia-Pacific region. The structure effect (between country) is significant in the Asia Oceania region and the ASEAN plus Three region. The spatial analysis investigates the difference of carbon intensity across different countries. The heterogeneity is majorly due to the difference of structure effect and intensity effect, while these two effects tend to converge in some specific sub-region over the time span from 1990 to 2010.

References

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