

Analysis of economic impacts including poverty under global CO2
emissions reduction targets

Takashi Homma^a,

^a Systems Analysis Group, Research Institute of Innovative Technology for the Earth
(RITE), 9-2 Kizugawadai, Kizugawa-shi, Kyoto 619-0292, Japan

* Corresponding author. Tel.: +81-774-75-2304; fax: +81-774-75-2317.

E-mail address: homma@rite.or.jp (T. Homma)

Global climate change and poverty are two of the most serious issues facing the world today. The two issues are closely linked. This paper presents the quantitative analysis on economic impacts by region and by sector up to 2050 for global GHG emission reduction targets on the consideration of international industrial relationships using DEARS (Dynamic Energy-economic Analysis model with multi-Regions and multi-Sectors)[1]. We also evaluate living people in poverty in the developing regions, which is consistent with the evaluations of economic analysis by DEARS. DEARS is a dynamic optimization model, which maximizes global discounted consumption utilities and evaluates the impacts of CO₂ emissions reduction policies on energy and economic systems. DEARS has the two modules. One is the economic module which represents explicitly industrial structures of production, consumption and trade by region and by sector, which are required for sectoral analysis on climate policies. The other is the simplified energy systems module which represents explicitly energy flows. The model includes 18 regions and 18 non-energy sectors. The model also includes eleven energy sources with seven types of primary energy (coal, crude oil, natural gas, biomass, hydro power, wind power, and nuclear power) and four types of secondary powers (solid, liquid, and gaseous fuels and electricity), where energy supply technology and CCS (carbon dioxide capture and storage) technology are considered. The main datasets of DEARS are based on GTAP database for economic systems and IEA statistics and other sources for energy systems. The baseline of socio-economic scenario without any climate change policy intervention is based on the socio-economic factors analyses from various historical statistics. The model baseline of population, exogenous variables in the model, is based on the UN2008 medium estimations. The model baseline of GDP and final energy consumptions, calculated endogenously in the model, are harmonized with the scenarios based on the socio-economic factors analyses; The analyses reveal that high economic growth induces consequences of low population and energy intensities such as energy consumptions per GDP decreases along with economic developments according to many historical evidences. The method of living people in poverty for the future is based on the conventional approach using income distributions and international poverty lines. The region's average per-capita incomes for the five cases are obtained from DEARS's results. Income distributions are expressed by log-normal distributions whose standard deviations are formulated by GINI coefficients. We assumed that GINI coefficients are constant in all countries up to 2050 in this preliminary study. Two types of poverty lines are assumed: 1) the constant line of 1.25 \$ per day for the future, and 2) variant poverty line, which is determined by using future oil price with elasticities. The sensitivity analyses on GINI coefficients scenarios and variant poverty lines using oil price elasticities are conducted in this study. We compare the sectoral economic impacts at the cases of global GHG emission reduction levels: 1) Baseline, 2) CP6.0 (around 750 ppm-CO₂eq. in 2100), 3) CP4.5 (stabilization at around 650 ppm-CO₂eq.), 4) CP3.7 (stabilization at around 550 ppm-CO₂eq.), and 5) CP3.0 (around 450 ppm-CO₂eq. in 2150). Our results of poverty indicate that

poverty will reduce greatly under both poverty lines in accordance with economic growth up to 2050. People living in poverty in 2000 were about 1.6 billion people in the world. In the baseline, the people in poverty in 2030 will be expected to be around 0.5 billion under the constant poverty line of 1.25 \$/day. On the other hand, if the increased poverty line is assumed to be changed in accordance with increased oil price, people living in poverty in 2030 will be expected to be around 1.0 billion people. Under this threshold for the poverty, people living in poverty in Sub-Sahara Africa increase by 2050 compared with those in 2000. On the other hand, those in other developing regions greatly decrease. The differences of living people in poverty between emission reduction targets are small compared to the historical trends before 2000.

Keywords: poverty, intertemporal optimization, global warming

References

- [1] T. Homma, K. Akimoto, T. Tomoda, S. Mori, Y. Murota, Sectoral economic impacts of CO₂ mitigation policies under different levels of stabilization targets: A study with the hybrid model DEARS, GTAP Conference 2007