Natural Resources, Technological Change, and Economic Growth: Incentive mechanism and effects on market

Shunsuke Managi
Tohoku University, Japan

Abstract

This summary provides analyses on global data asking questions such as 1) is there EKC cuvees for different emissions?, and 2) what factors improve emission damage/increase technological progress including trade openness and energy price increase?. Then, I focus our analysis on country level. This report intends to provide solutions to country and industry specific questions, such as 1) Is there an increasing return to pollution abatement?, 2) Does higher price at emission trading encourage technological change?, 3) Do stringent environmental regulations improve productivity?, 4) Is trade good for environment at sector level?, and 5) What are the policy factors reduce pollutions?.

1. Introduction

The debate over the role economic growth plays in determining environmental quality has been rapidly gaining importance. There are three effects that are key in determining the level of environmental pollution and resource use. First, increases in output require more inputs and, as a by-product, imply more emissions. Economic growth therefore exhibits a scale effect that has a negative impact on the environment. Second, economic growth also has positive or negative impacts on the environment through a technique effect. Changes in income or preferences may induce changes in policy that in turn lead to changes in production methods and hence emission per unit of output. This suggests that the relationship between income and pollution should vary across pollutants because their perceived damage is different. Third, economic growth has positive or negative impacts on the environment through a composition effect. As income grows, the structure of the economy might change; consequently, there might be an increase in cleaner or dirtier activities. In the case of general industrial pollutants, environmental degradation tends to increase during the structural transformation of an economy from the agricultural to the industrial phase and subsequently starts to fall with the structural change from an energy-intensive economy to a technology-intensive economy, based on services and knowledge.

2. Summary

From the past, economic growth has been a central issue in modern economics. However, less attention has been given to the relationship between economic growth and the environment until

recent decades. Rapid economic growth tends to be harmful to the environment due to a greater use of natural resources and higher levels of emissions. Therefore, potential conflict between economic policies and environmental qualities arises.

Researchers are interested in technology and people' preferences as basics to analyze long-run economic growth. Recently, environment's ability to reduce emissions has been added to the analysis of economic growth and the environment (Akao and Managi, 2006, 2007). Akao and Managi (2007) shows that sustainable growth is impossible without technological progress or assimilation ability of nature. Theoretical arguments provided show that an inverted-U-shaped relationship of Environmental Kuznets Curve (EKC) might be possible. This study finds significant results supporting EKC for many of the local pollutions. On the other hand, the results show deteriorating environment and natural resource while increasing income level for global environmental indicators and solid waste.

We suggest that the nations in the world have not reached income levels sufficient to generate the turning points for some of the local and global pollutions and natural resources. Further interpretations regarding decomposed effects of EKC are analyzed in detail. In case of CO2, my result implies that, unless we reduce coal share, we will obtain pollution-income relationship. If we cannot reduce coal share, we need to pour more efforts into development of less carbon-intensive technology and diffusion of technology even though there are some studies that indicate that induced innovation is likely to be a less powerful factor in implementing climate-change policies than substitution. This does not reject the importance of policy induced innovations. This is because my results show trade and price induced innovations (globally and industry level in US), and policy induced technological progress in US industry to be crucial for environmental preservations and productivity gains even though trade has not been mainly focused on environment and energy prices has been low in the past decades.

Trade has additional effects on environment. Trade openness to international trade is expected to have both positive and negative effects. We find that whether trade has a beneficial effect on the environment on average or not varies depending on the pollutant and the country. Increase in trade openness causes an increase SO2 and CO2 emissions and a decrease in BOD emissions in non-OECD countries in the long term. On the other hand, the long-term effects for OECD countries are encouraging for SO2, CO2 and BOD. The results also show that there is a sharp contrast between OECD and non-OECD countries with regard to SO2 and CO2. This contrast also exists for environmental productivity. This summary did not find CO2 emissions convergence. We must be careful to suggest any developed countries' technological and management assistances to developing countries and may need further efforts to increase their environmental efficiency level apart from those associated with economic development.

In a country level analysis, using example of US, this summary further provide more decomposition of technique effects into environmental technique (improvement of environmental

technologies) and environmental scale effects (damage abatement effort). Furthermore, this summary analyzes the potential gain of increasing return to pollution abatement. All of these studies suggest importance of further evidence of technology effects on greener environment. More specific studies including incentives to innovate, how policies affects economy among others are discussed in the following studies listed in the reference.

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