

# The Impacts of a Unilateral Environmental Policy on Growth with International Trade

Qijie Xu\*, Minoru Nakada\*

## 1. Introduction

The motivation of this topic is based on the question whether a unilateral environmental policy in the North necessarily depress its economic growth. This article analyzes the impacts of a unilateral environmental policy on economic growth under international trade. Our results show that an environmental tax imposed on domestic energy consumption might have no effect on the long-run economic growth. Moreover, the results imply a possibility of not inducing carbon leakage by implementing a unilateral environmental policy in the long run.

## 2. Methods

In this paper, we modify a North-South trade model built by Gancia and Bonfiglioli (2008) to analyze the impacts of a unilateral environmental policy on economic growth. Hémous (2016) examined the possibility of ensuring sustainable growth by implementing unilateral environmental policies in a two-country model. The results are that a combination of a trade tax and a clean research subsidy in the North can prevent an environmental disaster and ensure sustainable growth, while a unilateral carbon tax cannot. However, this research investigates environmental degradation and does not consider the effect of the tax on economic growth, which is the main focus of our study.

We conduct the analysis with a two-country model formed by the North and the South. A final good is produced by aggregating a continuum of polluting intermediates. Each intermediate is produced with machines supplied by monopolistic firms and energy. The productivity of each type of energy is assigned by exogenous index. Technical change occurs when new machines are invented. The government in the North implements a unilateral environmental policy by imposing an ad-valorem tax on energy used in production of intermediates, while the South remains *laissez-faire*. The North can innovate new machines, while the South can only copy the machines invented in the North by paying a fixed cost.

The analysis is divided into two steps. Firstly, we analyze the equilibrium technology and the balanced growth path for the North. Then, we derive the long-run growth rate of the world by using two conditions as follows. The first condition is the “cut-off commodity ( $z$ )”, which defines

---

\* Graduate School of Environmental Studies, Nagoya University, Nagoya city, Japan.

a good in the border between two intervals of the intermediates produced by two countries. This condition implies the relationship between the relative productivity ( $\Phi$ ) and the relative energy price ( $\Psi$ ) in the two countries. The second condition is the trade balance (TB) between two countries where the North imposes an environmental tax ( $\tau$ ). Combining these two conditions gives us the position of the cut-off commodity and the relative energy price in equilibrium.

### 3. Results

As Figure 1 shows, the equilibrium of the world economy can be described by two curves, TB and  $\Phi$  under free trade. There are two equilibria with the tax rate at  $\tau = 0$  and  $\tau > 0$ . In both equilibria, the cut-off commodity  $z$  divides the intermediates into  $[0, z]$  produced by the North and  $[z, 1]$  produced by the South. The implementation of an environmental tax decreases the relative price of energy by shifting the relative productivity downward.

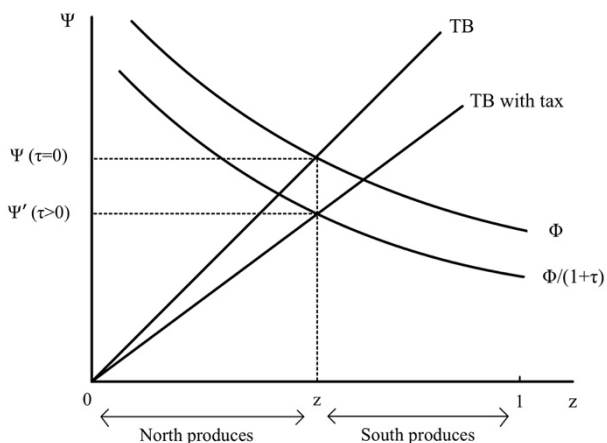


Figure 1: Free-trade equilibrium

However, the tax also shifts the trade balance downward, which offsets the former effect on the cut-off commodity. Consequently, the cut-off commodity remains unchanged. Along the balanced growth path, the long-run growth rate of the world economy can be expressed by a function of total energy consumption in the North and exogenous productivity indexes of the two countries. It implies that the tax may not necessarily bring about a depressive effect on the long-run growth rate.

### 4. Conclusion

In the above setting, implementing a unilateral environmental policy in the North will not change the initial cut-off commodity under free trade. The long-run growth of the global economy is independent of the tax in the North. The results imply that a unilateral environmental policy might neither induce carbon leakage nor depress economic growth in the long run.

### References

- Gancia, G. and Bonfiglioli, A. (2008) North-South trade and directed technical change. *Journal of International Economics* 76 (2), 276-295.
- Hémous, D. (2016) The dynamic impact of unilateral environmental policies. *Journal of International Economics* 103, 80-95.