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# Trade liberalization and pollution: a general equilibrium analysis of carbon dioxide emissions in Taiwan

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## Abstract

This paper examines the environmental effects associated with Taiwan's application for membership at the World Trade Organization. The objective is to provide quantitative assessment of carbon dioxide emissions from changes in the level and structure of production activity in Taiwan following a liberalization of trade. The estimates are derived from a five-household, 18-sector computable general equilibrium model calibrated to a 1996 social accounting matrix. Our empirical results show that total carbon dioxide emissions increase as a result of trade liberalization, there is also a shift in the structure of production towards those sectors that are the most carbon-intensive. © 2001 Elsevier Science B.V. All rights reserved.

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## 1. Introduction

Will the realization of comparative advantages induce a risk of specialization in dirty activities? For most countries, the issues involved have important implications for design of development strategies.

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Recently, several studies on trade and the environment have argued that international trade is a primary contributor to environmental degradation. The argument advanced is that environmental emissions affect the pattern of comparative advantage: countries with comparatively higher levels of environmental assimilative capacity, or with comparatively lower valuation of environmental quality have a comparative advantage in the production of pollution-intensive goods (see Blackhurst, 1977; Siebert, 1977; Shrybman, 1990; Beghin et al., 1994, 1995; Perroni and Wigle, 1994; Dessus and Bussolo, 1998, for surveys). Most empirical researches tend to confirm that developing economies specialize in dirty industries (Hettige et al., 1992; Lee and Roland-Holst, 1994, 1997; Copeland and Taylor, 1995; Gale and Lewis, 1995; Dessus and Bussolo, 1998). This implies that the new patterns of resource allocation and output composition under free trade are more pollution-intensive for these countries. Although previous studies have been a detailed evaluation of trade and the environment, little attention has been devoted to inquiring about these relationships in the Asian newly industrialized countries (the so-called NICs).<sup>1</sup>

The objective of this paper is to examine the effects of trade liberalization on carbon dioxide emissions in the Taiwan economy. The Taiwan case is interesting for a number of reasons. For the past three decades, the Taiwan economy has enjoyed a remarkable growth rate of approximately 8% per annum. Like many other NICs, Taiwan has followed a trade-led growth strategy since the early 1960s. The high ratio of export/GDP and import/GDP both averaging 45% make its economy is very sensitive to the trade policy. The rapid economic growth has created substantial changes in production structure for the nation's economic sectors. This makes a rapid increase in energy consumption and carbon dioxide emissions. In 1990, Taiwan imports more than 90% of its energy resources and ranks 25 in global carbon dioxide emissions (Yi, 1994). Accordingly, Taiwan's economic growth following a trade-led strategy should rely upon the production of pollution-intensive goods. This study will test whether this assertion can be confirmed by empirical results. In practice, Taiwan is applying for membership at the World Trade Organization. If admitted, Taiwan will have to abide by the terms of the agreement reached in Uruguay at the end of 1994, plus those reached in bilateral negotiations between Taiwan and the existing member countries (see Chu, 1996, for discussions). Will the Uruguay Round agreement lead to the creation of a pollution haven south of the border and to further environmental degradation in Taiwan? Whether or not such a question is examined by data is therefore an interesting empirical question. This paper aims at offering a quantitative analysis of environmental effects associated with Taiwan's application for membership at the

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<sup>1</sup>The newly industrializing economies of Asia (Hong-Kong, South Korea, Singapore and Taiwan) have become increasingly important in the world economy because of their high economic growth rate and the associated expansion in trade with other countries. Since the mid-1960s, average economic growth in these countries, and their share of world trade increased from approximately 2% in the early 1960s to more than 7% in the late 1980s (General Agreement on Tariffs and Trade, 1990).

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