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Analysis

Triple win for trade in renewable resource goods by use of export taxes

Ola Flaaten *, Carl Erik Schulz [1]

The Norwegian College of Fishery Science, University of Tromso, N-9037 Tromso, Norway

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ABSTRACT

We challenge the free trade paradigm, in particular for developing countries exporting natural resource goods, by demonstrating positive economic and environmental effects of an *export tax* for renewable resource goods. The two-sector general equilibrium model designed has an open-access renewable resource industry and a manufacturing industry. The economic, environmental and social effects of using an export tax on goods from the open-access renewable resource industry are analysed. It is demonstrated that the gross domestic product, the steady-state resource stock and the domestic consumption of both products increase with the resource export tax compared to free trade with no trade taxes.

1. Introduction

International trade is liberalised and increasing and there has been debate about the welfare and environmental effects of this, in particular for developing countries exporting natural resource goods, whether managed or open access. Some fear that this may harm both welfare and resource stocks in export countries, others are convinced that most, if not all, countries will benefit from increased trade (for discussions, see e.g. OECD, 2003; Bulte and Barbier, 2005; Emran, 2005; Nielsen, 2006). Policy advisers and international economic policy organisations usually favour a reduction in import tariffs and other trade taxes, but governments may be concerned about loss of revenues from such a reduction. This paper challenges the open-trade paradigm by demonstrating positive economic and environmental effects of an *export tax* for nationally confined renewable resource goods, within the framework of a general equilibrium model.

In the 1970s and 1980s the average share of trade tax in total tax revenues was about a third and a quarter in Africa and Asia, respectively, though slowly decreasing (Emran, 2005). Trade tax revenues mainly come from import, but for some countries export taxes amount to an important share of trade tax revenue. 'In 2000, 8 out of 12 countries for which data were available had more than 10% of trade tax revenue from export taxes; 5 of them having more than 20%' (Emran, 2005, p.278).

For a country in transition from autarchy, or nearly autarchy, to open trade, defined by the rules and regulations of the World Trade Organization (WTO), tax revenue is just one concern. Others are related to economic development, the environment and how to finance the government budget. For a thorough and general analysis of such issues, and critical arguments concerning trade liberalisation, see e.g. Daly, 1996, Chs. 10–11, where a main conclusion is that a compensatory tariff may be necessary to mitigate negative impacts of free trade. A compensatory tariff is meant to compensate for the "externalizing of costs" firms in some countries contribute to when abusing inputs, such as labour health, child labour and natural resources and environment. Thus a compensatory tariff is welfare enhancing, which is contrary to a tariff that protects an inefficient industry (Daly, 1996, p.147).

Openings for (more) trade for a small open-economy mean changes in domestic relative prices and changes in the export and import shares of goods and services. Gains from trade for a country exporting a renewable good have been discussed in several papers. One such seminal study concludes 'that trade reduces steady-state utility for a diversified resource exporter' (Brander and Taylor, 1997, p. 526). This conclusion is based on a two-sector general equilibrium model with an open-access renewable resource industry and a manufacturing industry with constant returns to scale. The constant returns assumption for manufacturing, combined with the open-access renewable resource, is decisive for this result. Another article on this issue concluded 'that opening up for trade may result in steady-state gains from trade, even when there is open access to the resource and the country does not specialise fully in resource extraction' when 'the Brander–Taylor small, open-economy model of trade in a renewable resource and other goods is modified to allow

* Corresponding author. Fax: +47 7764 6020.
E-mail address: olaf@nfh.uit.no (O. Flaaten).

[1] Carl Erik was killed in an accident 30th November 2008 at Table Mountain, Cape Town. He was a good friend and colleague, deeply missed.

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for diminishing returns to the other goods sector' (Hannesson, 2000, p.122).

Sustainable development discussions are often concerned about three sub-sets of sustainability; economic, environmental and social development. Even though there may be differing views when it comes to operational definitions of these concepts, we shall use them in this paper within the framework of a two-sector general equilibrium model that combines and develops elements from Chichilnisky (1993), Brander and Taylor (1997), Hannesson (2000) and Emran (2005). We analyse the economic, environmental and social effects of using an export tax on goods from the open-access renewable resource industry. For fish resources the majority of stocks globally are fully exploited or overexploited, that is, at or below their maximum sustainable yield stock-level (FAO, 2007) and it is of interest to find policy instruments to mitigate resource degradation.

Common pool resources, such as the atmosphere, rangeland and fish, are generally difficult to manage to achieve a social optimal outcome and to avoid overuse of the resource (Gordon, 1954; Hardin, 1968). To mitigate such problems several instruments have been proposed, including creation of property rights, user rights, input control, output control and Pigouvian taxes, as well as mixes of these. The economic efficiency of such instruments may vary, both theoretically and in actual cases, require different type and amount of information for the managers, and monitoring, control and enforcement usually depend on resource and industry characteristics. In fisheries economics, for example, it has been demonstrated that within a basic bioeconomic model input control (tradable effort), output control (individual tradable quotas) and Pigouvian taxes are all efficient under full information and costless management (Clark, 1980). However, when models are made more complex and detailed, to better mimic the complexity and reality of real resources and resource industries, results are not that clear-cut with respect to economic efficiency and distribution (see e.g. Clark, 1985, Ch.4; Copes, 1986; Flaaten and Heen, 1995; Wilen, 2000; Hansen et al., 2006). Even though Pigouvian taxes and transferable quotas may be theoretically equivalent regarding efficiency, they differ in some other aspects. First, their distributional effects are different. Taxes transfer the economic rent from the industry to the government budget, whereas quotas, allocated for free, leave the economic rent in the hands of the quota recipients. By combining taxes with the quotas the manager may achieve a balance between efficiency and the desired distribution. Second, in actual fisheries monitoring, control and enforcement may be costly and depend on the type of management system in place and on the structure of the industry (see e.g. Wallis and Flaaten, 2003).

In the case of developing countries fisheries are often very complex with intricate ecosystems, numerous fishermen with small vessels and catches, and numerous of landing places, probably implying costly and incomplete management if based on the Western ideas and principles noted above (see e.g. Raakjaer et al., 2007 for the case of Vietnam, an expansive fishing nation). However, the international trade of such countries are usually concentrated to fewer locations, and international trade reveals quantities and prices. This makes taxation much easier to enforce, and most countries have established institutions for registration and potential regulation of foreign trade. For countries committed to tax collection to fund the public sector this is an obvious and historically early source for taxation.

Throughout our study we focus on domestic *open-access exploitation* of a nationally confined renewable resource (fish or another relatively fast-growing renewable resource). The trade regimes we discuss within a two-sector general equilibrium model are

- *Initially*: autarchy, domestic prices differ from world market prices.
- *Open-trade commences*: world and domestic market prices are equalised. Expected price increase for the resource good may lead to overexploitation and reduced domestic consumption of this good.
- *Export taxes introduced* — to mitigate possible negative effects of open trade.[2]

Table 1
Definitions of symbols and acronyms.

Exogenous	Endogenous	Definition
r		Intrinsic growth rate
	S	Population/resource stock
S_{msy}		Population level at maximum sustainable yield
	S^o	Population level at open-access harvesting
q		Catchability coefficient
	y	Catch per unit of time
l		Total supply of labour
	l_y	Labour in the resource industry
	l_x	Labour in the manufacturing industry
	x	Production of the manufacturing industry
x_{min}		Minimum terminal point, production possibility
x_{max}		Maximum terminal point, production possibility
α		Constant, production function of manufacturing
γ		Elasticity, production function of manufacturing
	π	Profit, manufacturing industry
	VAP_x	Value of average product, manufacturing
	VMP_x	Value of marginal product, manufacturing
	MC_y	Long-run marginal cost of harvesting
	u	Individual utility, Cobb–Douglas function
a		Income, representative consumer
β		Elasticity, resource good in the utility function
b		Constant, domestic demand function
p		World market price, resource good
	p_D	Domestic price, resource good
τ		Unit export tax, resource good
	y_D	Domestic consumption, resource good
	y_E	Export, resource good
	$GDP = R$	Gross domestic product

The main objective of this paper is to analyse and compare the economic, environmental and social results of the taxed export regime with those of free trade with no trade taxes. It will be demonstrated that the former is superior to the latter in the open-access case. The analysis presented should be applicable to any country, developing or developed, where the renewable resource is the natural basis for a more or less open-access industry. Combined systems with export tax and some kind of managed primary industry, including Pigouvian taxes, could also be possible, but are not pursued in this paper.

The paper is organised as follows. The next section presents the model and the modelling results of the export tax. This is followed by a discussion of the results and some policy issues, and the final section concludes the paper.

2. The Model

Following Brander and Taylor (1997) and Hannesson (2000), we assume that growth of the renewable natural resource follows the logistic growth function familiar in fisheries economics literature. Other renewable resources, such as wildlife, forest resources and pollution purification, may also have growth that is a humped shape, if not as simple and well-behaved as in this equation. Trees, however, usually grow much slower than fish.

The symbols and acronyms used are given in Table 1.

Logistic population growth with carrying capacity normalised to unity and with harvest y is

$$\dot{S} = rS(1-S)-y, \tag{1}$$

assuming $0<S<1$ to avoid cases of extinction and no harvest, with r as the intrinsic growth.

[2] Ferreira (2007) demonstrates that a binding quantitative restriction constitutes a second best option in this case.