

## Special Feature A

# Is Free Trade Green?<sup>1</sup>

### Introduction

The literature on the nexus between trade and the environment is vast (Dean, 1992). A number of prominent economists, such as Bhagwati (1988) and Subramanian (1992) fall into the “no linkages” camp arguing that questions of free trade should be de-linked from those of the environment, otherwise, protectionism could easily wreck the global trading system under the guise of environmental concerns. According to this point of view, governments intent on improving the environment would do better to adopt targeted environmental policies instead of trade policies. Dean (1992, p. 22), for example, argues that “trade barriers will be, at best, a second-best means of reducing environmental damage... Any case for more gradual liberalisation of trade should be based on estimates of the costs of maintaining barriers versus the benefits of delayed environmental damage.”

The debate continues because economists have yet to satisfactorily create the frameworks in which to incorporate nature as an input into production or to value the utility of an un-spoilt environment, although there have been increasing attempts to do so. (World Bank, 2005).

This Special Feature explores the simple, but emotive, question – is free trade green? – by introducing environmental issues into a standard microeconomic analysis of an autarchic economy which is then opened up to trade with the rest of the world. The general finding is that although free trade can be compatible with environmental policies designed to reduce negative environmental effects arising from both production and consumption, this is only true under certain assumptions.

### Pollution as an Externality

In the standard microeconomic production model, output of any good involves combining factor inputs, such as labour, capital, and land with given technology. The quality of the environment does not appear in the production function, nor is pollution regarded as an output of production. Yet, pollution is the by-product of several types of production and, *ceteris paribus*, environmental degradation follows. Take the example of a firm that produces a single good X which generates sulphur dioxide as a by-product and when released into the environment, causes acid rain which damages buildings and trees. Unless the firm explicitly takes this pollution effect into account when planning the number of units of X to

produce, the costs of environmental degradation are external to the firm and pollution is an *externality*.

Who bears the cost of this externality? Other firms and households around the site of the pollution will likely be affected and potentially other countries, should the acid rain be transmitted across borders. Since the polluting firm itself only bears the *private cost* of producing X by paying for the factor inputs used, there is a wedge between private costs and social costs. In this particular case, social costs exceed private costs and too much of good X is produced.

<sup>1</sup> This Special Feature has benefited from comments and discussions with Professor Roger Sandilands of Strathclyde University and Professor W. Max Corden, Emeritus Professor of International Economics, Johns Hopkins University.

## Production and Pollution in Autarchy<sup>2</sup>

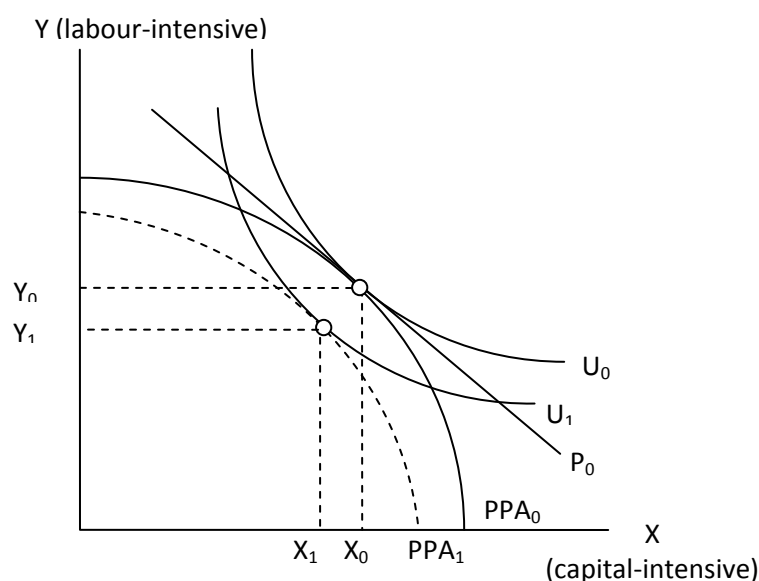
The logical solution to this problem would be for the government to introduce policies to reduce the production of good X by imposing limits on its production or through other means of incentivising firms to reduce output, such as taxing or fining polluting firms under the “polluters pay” principle (Tulkens and Schoumaker, 1975) or imposing environmental standards that firms have to comply with. These policies bring the private cost of production closer to the social cost and reduce the profit-maximising level of output, as firms have to “internalise” the taxes and fines or the costs of investing in pollution abatement technology or “greener” methods of production.

Chart 1 depicts a small, autarchic economy A, producing two kinds of goods: X and Y, which are more capital- and labour-intensive in production, respectively. Suppose initially the production of both goods is polluting. Citizens in country A consume a bundle containing both X and Y and maximise their utility on the highest attainable indifference curve ( $U_0$ ) tangential to the production possibility frontier,  $PPA_0$ . Both

producers and consumers are in simultaneous equilibrium producing and consuming the combination  $X_0$  and  $Y_0$ . Since there is no international trade, consumers are constrained to consume the combination of the two goods in exactly the same proportion as they are produced, with producer and consumer relative price ratios identical at  $P_0$ .

Now, assume that the government is concerned about consumer welfare *and* pollution. Consequently, the government by *diktat* constrains the amount of capital and labour used in production in the economy, while holding constant the technologies used and the relative proportions of X and Y in total output. Firms thus scale down the volume of X and Y they produce in proportion, represented by a lower production possibility frontier,  $PPA_1$ , which represents an inward shift of  $PPA_0$ . This environmentally friendlier outcome comes at a price — there are underutilised resources at the “shadow”  $PPA_1$  and consumers consume less of each good ( $X_1, Y_1$ ) on the lower utility curve  $U_1$ ; hence, their overall utility declines.

**Chart 1**  
**Economy A under Autarchy with Constrained Production**



<sup>2</sup> Some of the assumptions in this section may seem unnecessarily restrictive. These assumptions have been adopted for the purposes of illustrating a simple case of reducing pollution when in autarchy, and will be relaxed in subsequent sections.

## The Free Trade Scenario

### Case 1: Pollution and Production under Free Trade

What happens to production, and thus pollution, when economy A, which is producing along  $PPA_1$ , liberalises trade? Here we utilise the framework developed in Copeland and Taylor (2003), with the plausible simplifying assumption that X and Y vary in their pollution intensity, with X being more polluting in production than Y and Y's pollution is negligible. Additionally, it is assumed that economy A is relatively more abundant in capital than in labour and has a comparative advantage in the capital-intensive good X.

Copeland and Taylor introduce a pollution-production schedule beneath the horizontal axis by mapping the amount of output produced into the volume of pollution discharged, denoted by the line Z.<sup>3</sup> Under autarchy economy A produces a basket of goods  $(X_1, Y_1)$ , generating  $Z_1$  units of pollution in the process. (Chart 2)

The implication is that economy A could ostensibly *trade* its way to a superior basket of goods by opening the economy up to trade with the rest of the world. Given A's comparative advantage in capital-intensive goods, A will specialise in the production of X, the more polluting good. On opening up to trade, the relative price of X is higher than in autarchy, represented by a steeper price line  $P_1$ .

The economy now produces the bundle  $X_2, Y_2$  along its constrained production possibility frontier  $PPA_1$  and can export some of good X to the world market in return for imports of good Y. Consumers will now be able to consume a bundle  $X_3$  and  $Y_3$  and reach a higher utility curve  $U_2$  than in autarchy, depending on the extent to which relative prices change.<sup>4</sup>

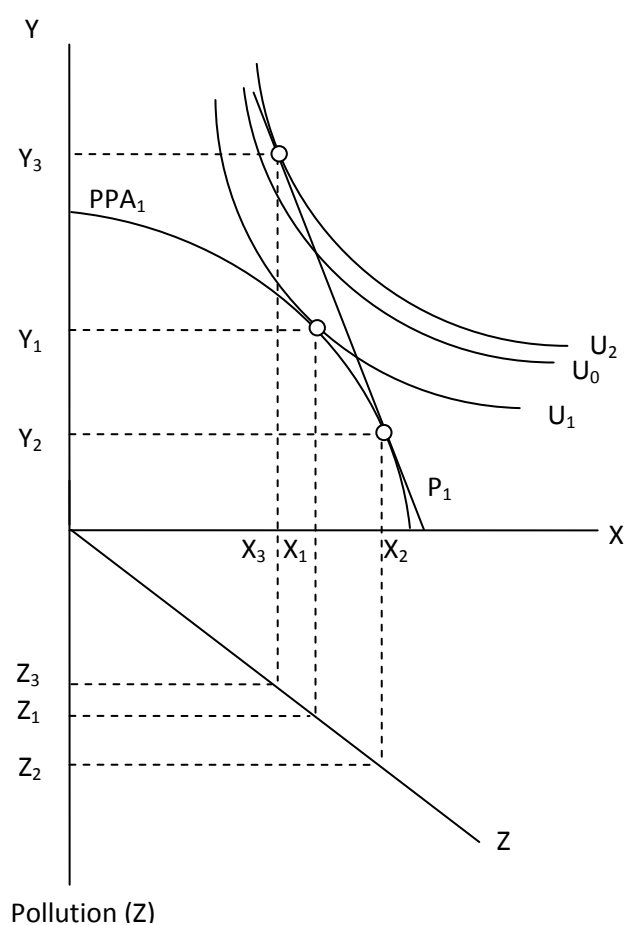
However, the post-trade outcome is not "greener" for economy A, as the composition of production has shifted in favour of the more polluting good. Production of  $X_2$  units generates more pollution as compared to autarchy, while there is no perceptible fall in pollution from importing more of good Y.

The reverse would also be true: were economy A labour-abundant, it would have a comparative advantage in producing the labour-intensive good Y. Not only would consumers enjoy higher welfare after trade but pollution would also be lower in the economy. This brings us to the general conclusion that trade liberalisation *per se* for a particular country is not unambiguously more (or less) environmentally-friendly; much depends on the underlying comparative advantage of the economy, the pollution characteristics of the two goods and their relative capital and labour intensities and the changes in the terms of trade brought about when the economy opens up to international trade. These outcomes are summarised in Table 1.

<sup>3</sup> This assumes a positive monotonic relationship between pollution and production of the polluting good.

<sup>4</sup> The extent to which the slope of the international terms of trade line differs from the pre-trade price ratio will determine the outcome. The greater the difference, the higher the indifference curve attainable. This holds true even if the international price ratio is flatter than in autarchy (rise in the relative price of Y) since the economy would produce more of Y and trade it for greater consumption of X.

**Chart 2**  
**Economy A with Constrained Production but Trading<sup>5</sup>**



**Table 1**  
**The Environmental Impact of Free Trade (Production)**

		Relative Prices with Trade	
		Relative price of X rises (A has comparative advantage in X)	Relative price of Y rises (A has comparative advantage in Y)
Pollution intensity in production	Production of X is more polluting	1. Opening up to trade results in production of more of X and less of Y.  "Less green" outcome	2. Opening up to trade results in production of less of X and more of Y.  "Greener" outcome
	Production of Y is more polluting	3. Opening up to trade results in production of more of X and less of Y.  "Greener" outcome	4. Opening up to trade results in production of less of X and more of Y.  "Less green" outcome

<sup>5</sup> Production and/or consumption of X are polluting but that of Y is negligible.

## Case 2: Pollution and Consumption under Free Trade

The outcomes here are analogous to Case 1. Not all goods are equal in their pollution-intensity in consumption. For example, consuming a transcontinental flight would generate more carbon dioxide emissions than a bicycle ride. If there is no pollution in production, the same Copeland and Taylor framework in Chart 2 can be adapted to ascertain the outcomes when the consumption of X is assumed to be polluting but the consumption of Y is not. Additionally, it is assumed that the shape of consumers' indifference curves remains unchanged, and consumers do not take the impact of pollution into account in the utility derived from consumption.

Under autarchy,  $Z_1$  units of pollution are produced when  $X_1$  is consumed. Assume that trade liberalisation results in a rise in the relative price of good X. (Chart 2) With free trade, the "greener" outcome ( $Z_3$ ) is realised in economy A if consumers end up consuming the basket of goods denoted by  $(X_3, Y_3)$ . However, *this would only occur if the change in relative consumer prices as a result of opening economy A up to trade induces consumers to purchase less of X and more of Y*. Should relative prices move differently, the "greener" consumption outcome may not materialise. Table 2 summarises the circumstances under which free trade would be better for the environment.

The picture becomes more complicated if consumption and production is assumed to be polluting simultaneously. The impact of free trade on pollution is ambiguous in all circumstances, as the impact of comparative advantage and production on pollution pulls in an opposite direction from the consumption effect. For example, a rise in the relative price of X results in more production but less consumption of X in economy A. Thus, a "green" outcome would depend on the relative pollution intensity of consumption and production.

Finally, even if economy A is able to attain the "greener" outcomes under free trade in Tables 1 and 2, the situation must run in the opposite direction for its trade partner country B in a two-country world. It may be the case, for instance, that technological differences or ecological endowments between the two economies differ so vastly that firms and consumers in economy B are able to undertake greater production or consumption of the more polluting good without degrading the environment. Otherwise, it would be difficult to avoid accusations that economy A's "greening" attempts have resulted in an environmental "beggar-thy-neighbour" effect that redistributes pollution across borders. What is best for one country may not be best for the world as a whole — this seems to be as true for pollution as it is for monetary policy and tariffs on traded goods.

**Table 2**  
**The Environmental Impact of Free Trade (Consumption)**

		Relative Prices with Trade	
		Relative price of X rises	Relative price of Y rises
Pollution intensity in consumption	Consumption of X is more polluting	Opening up to trade results in consumption of less of X and more of Y.  "Greener" outcome	Opening up to trade results in consumption of more of X and less of Y.  "Less green" outcome
	Consumption of Y is more polluting	Opening up to trade results in consumption of less of X and more of Y.  "Less green" outcome	Opening up to trade results in consumption of more of X and less of Y.  "Greener" outcome

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## Conclusion

Free trade can be compatible with environmental concerns, but this is only true under certain assumptions. Environmental effects stemming from changes in production and/or consumption when engaging in international trade may complement the standard gains from trade, but equally, a sufficiently large negative environmental

impact could offset these gains for an individual country. In the face of such externalities, countries concerned about environmental damage would be better off dealing with pollution directly via, for example, an optimal tax, while retaining free trade to maximise the welfare gains from international exchange.

## References

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