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Measuring the Pollution Terms of Trade with Technique Effects

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Fifteen years ago, Werner Antweiler introduced the concept of the Pollution Terms of Trade (PTT), as the ratio between the average pollution content of exports and the average pollution content of imports. Intuitively, this index is inversely linked with the indirect environmental benefits that a country may derive from trade in goods of different pollution content, by specializing in clean goods and importing dirty goods from the rest of the world. This issue is clearly related with the "pollution-haven" argument according to which countries with lax environmental standards, notably poor countries, may attract dirty industries, and thus tend to exhibit a higher level of PTT than their richer partners.

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···/··· Therefore, it appeared surprising that the initial empirical application performed by Antweiler revealed the opposite pattern, namely that rich countries report relatively higher PTT values than poor countries.

This paper revisits the issue of PTT measurement by extending Antweiler's original calculations in two directions. First, it proposes a novel technique to control for round tripping, i.e. to abstract from those goods which are reexported further by the reporting country. This may be an important source of bias for those countries where the partial PTT index for reexports differs largely from the overall average PTT. Second, and more fundamentally, estimates are based on a new database for SO_2 manufacturing emissions for 62 countries over the 1990-2000 period. This database is consistent with trade and input-output data from the World Bank, and provides emission intensities which are varying not only across sectors, as in the original Antweiler paper, but also across countries and time. In other words, to the original composition effect captured by Antweiler (who had to rely on US 1987 intensities exclusively because of lack of available data), we add technique effects that capture the heterogeneity of emission intensities across countries and over time.

It turns out that the inclusion of these technique effects solves the original paradox, as the estimated relationship between PTT and GDP per capita becomes negative, i.e. richer countries tend to export relatively clean products, as suggested by the pollution-haven argument. When a regression is run across countries and observations are weighted by emission shares, the relationship turns out to be strongly significant whatever the year, with an elasticity above 1 in absolute value. However, the relationship becomes non significant when country fixed effects are included, which suggests that the pollution-haven pattern is not valid in terms of temporal variation. This is confirmed when GDP per capita is replaced by direct proxies for the stringency of environmental protection.

The paper also states a straightforward expression which shows, as a first-order approximation, that the environmental net gains of a given country are a negative function of the product between its PTT index and its export over import ratio. This is intuitive again, as a relatively high PTT level (or relatively clean imports) or a high export over import ratio (few imports relative to exports) has a similar impact on trade-embodied emissions (i.e. more export than import embodied emissions). This opens the way for possible compensations, e.g. a country with a high PTT level (i.e. a potential loser) but with a sufficiently low export to import ratio so that, in the end, it experiences an effective net environmental gain from trade. However, these compensations are rare and limited to small countries so that the general pattern is one in which environmental winners exhibit low values of PTT indices and are basically rich countries, the reverse being true for environmental losers.

Overall, these results on SO_2 emissions and manufacturing goods suggest that the concept of PTT helps to identify robust patterns of trade-embodied emissions and of environmental gains and losses across countries. Given the environmental challenges that these countries are bound to face in the next decades, additional applications of this concept to other periods, products, pollutants or emissions (CO_2 emissions in particular) are highly desirable.

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