



# Reply to Lopez et al.: Consumption-based accounting helps mitigate global air pollution

In their letter (1), López et al. propose “control-based” accounting of air pollution that assigns pollution to countries according to the nationality of corporations producing the pollution. For example, pollution produced in China by US corporations would be assigned to the United States regardless of where the related goods are sold. Such a control-based approach is a variation of the dominant production-based accounting that assigns pollution to the parties producing related goods. Control-based accounting could encourage leadership by multinational corporations to invest in cleaner production technologies and help these technologies diffuse, although influences by multinationals are likely to decrease as the number of production layers of their supply chains increases (2). This is because each additional production layer further down the supply chain would reach more suppliers who may be constrained with their own business interests, culture differences, and local environmental regulations (2).

In contrast, our consumption-based accounting (3) attributes pollution to final consumers of goods. This approach provides fundamentally different information to policymakers who may believe that a strict “polluter pays” principle is less equitable than a broader “beneficiary pays” principle (4). Few people would disagree that the countries and firms producing pollution are not the only parties benefiting from the associated production of goods, and many argue that consumption in fact drives production and associated pollution. A claim that control-based accounting is “more comprehensive” than consumption-based accounting is unjustified.

The letter (1) shows that control-based accounting would imply stronger emission transfer from the United States to China with enhanced atmospheric pollution transport to the western United States. The resulting increases (decreases) in pollution physically

produced in China (the United States) would still mean an overall beneficial effect for US public health at the expense of air quality in the western United States and particularly China, supporting our findings (3).

The letter (1) argues that an international environmental policy that accounts for the effect of trade should consider the possibility of production relocating from China to other countries. Consumption-based accounting assigns pollution associated with one country’s consumption of goods to that country, wherever the production occurs, by analyzing the global production chain. Our paper (3) analyzes the pollution embodied in China’s trade as a pilot study of such work.

It is worth pointing out that moving production away from China might not reduce global pollution, especially in the short term. Such a shift requires a new round of pollution-intensive construction of manufacturing hubs. Construction has triggered more than 40% of annual particulate emission in China during 1997–2010 (5). Also, newly emerging producing countries might have a steep learning curve (with economic and environmental consequences) to master what technology achievements China has accumulated over the last decades.

Different accounting practices offer different perspectives to assist environmental policymaking. To the extent that increasing per capita incomes and consumption are key drivers of global pollution, consumption-based accounts are necessary to support international policies that distribute the burden of mitigation among all beneficiaries and according to their ability and willingness to pay.

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- 4 Davis SJ, Caldeira K (2010) Consumption-based accounting of CO<sub>2</sub> emissions. *Proc Natl Acad Sci USA* 107(12):5687–5692.
- 5 Guan D, et al. (2014) The socioeconomic drivers of China’s primary PM 2.5 emissions. *Environ Res Lett* 9(2):024010.

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The authors declare no conflict of interest.

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