

## Global emissions chains and multinational enterprises: measuring responsibilities following the control criterion

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The Kyoto Protocol framework establishes the Production-based (PR) criterion (IEA, 2001) as the emissions responsibility allocation method. Greenhouse Gases emissions (GHG) are assigned depending on the country where they occur, regardless of the country where the consumption is done. This approach has generated controversy and is the point at which many emerging and large exporting countries base their refusal to sign the emissions reduction international agreements. Emerging countries argue that they are adversely affected in a context where production and consumption decisions are increasingly separated in different parts of the world. Moreover, carbon leakage through international trade threatens national reductions achievements at global level. One of the most popular scientific literature on alternative approaches proposes to shift responsibility to the consumer (Peters and Hertwich, 2008 or Davis et al., 2012). A country would be responsible for the emissions generated in the production of goods that are consumed within its borders, independently where the goods or services are produced. However, the consumer responsibility criterion (CR) has not managed to become part of international environmental legislation yet, although it has the advantages of allocating higher emissions to outsourcing "rich countries", which import highly polluting goods, and reducing the burden for the big-exporting countries, which are usually referred as "developing countries factories".

The global nature of climate change requires the establishment of allocation responsibility criteria that allow to involve more participant agents of different countries in the process: governments, consumers, suppliers, workers, investors (Hoekstra and Wiedmann 2014). Taking into account the presented context, in this paper a control-based criterion is proposed, previously presented in López et al. (2014), in order to allocate the responsibility to the firms that take decisions, in many cases, of locating thousands of kilometres away in countries with weaker environmental policies. This criterion assign to those firms all the emissions embodied in linkage effects along the production chain. Taking into account the control criterion, the limits of enterprises' responsibility is not determined by the country's borders, this limit is given by the control that the parent companies has on its subsidiaries firms and suppliers too, regardless of geographical location and where are citizens of the world that are consuming the goods produced by these enterprises. Therefore it is necessary to find new frameworks that encourage more countries to sign emissions reduction international agreements and also that allow the responsibility transfer to companies and citizens as main actors in the mitigation of climate change. To shift the focus to the role of companies, instead of nation-states, has some advantages as, for instance, not to deal with the problem of restricting responsibility to territory (PR) or of the ability of governments to act beyond their frontiers (CR). Moreover, recent research states that nearly two-thirds of historic emissions can be attributed to 90 companies (Heede 2014). Companies, and thus consumers, do not become knowledgeable about the environmental impacts of their production networks (O'Rourke, 2014); these firms do not take responsibility for the external costs associated to these impacts. The quantification of these emissions under the control criterion and the allocation of responsibility to firms would help to provide positive incentives for the more efficient management in environmental terms of the global value chains by the companies.

The aim of this paper is to calculate a control-based criterion for China in a multiregional input-output context (MRIO), which allows the assessing of the impact of international trade considering all the emissions associated with the entire global value chains. The Chinese choice is

due to foreign enterprises operating and exporting in China account for 54% (Feenstra et al., 2013) and have a strong potential influence over the global production chains with respect to technology and emission intensities (Skelton, 2013). Estimations will be done using the World Input-Output Database (WIOD) that provides information about 41 regions with a sectorial disaggregation of 35 industries. These data will be combined with information about multinationals operating in China for the year 2009.

Previous results of the application of the control criterion was presented in LÃ³pez et al. (2014), which compares the results presented in Lin et al. (2014) using a consumption-based assumption with a control-based approach show that, according to a control-based criterion, the United States is responsible for 65% more CO<sub>2</sub>, 68% more NO<sub>x</sub> oxides and 66% more SO<sub>x</sub> emissions than the results of consumer responsibility estimations held by Lin et al. (2014).