

An Input-Output Model of Extended Producer Responsibility: A study of the used tire management system in Portugal

Topic: Waste Input-Output Analysis

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Under an Extended Producer Responsibility (EPR) system, when a producer delivers a product to the market it must also pay a fee, which is used to cover the costs of end-of-life disposal. EPR systems exist for many countries and types of products. In this work we develop an Input-Output (IO) model of an EPR system and study the environmental, economic and social impacts of the used tire management system in Portugal. The EPRIO model is based on the Waste Input-Output (WIO) model of Nakamura and Kondo (2001), but exhibits several new features.

The EPRIO is an hybrid model, which combines a top-down description of the economy in make-use format, and a bottom-up description of the waste management sector in which the waste flows are in physical units and the waste management technologies are in monetary units. The rest of the economy is divided in 125 sectors and 431 products, whereas the used tire management system is divided in 6 management waste management sectors including 3 waste management technologies (retreading, recycling and energy recovery) and 14 types of tires. The Producer Responsibility Organization (PRO) finances the used tire management system with the producer fee paid by the respective sectors of the rest of the economy.

Besides accounting for direct and indirect impacts, the EPRIO also accounts for several types of avoided impacts, i.e., the impacts that do not take place because of the EPR system. Avoided impacts are subdivided in substitution, alternative treatment and opportunity effects. Substitution effects arise from the replacement of goods and services by recycled products and recovered energy and are modelled in the same manner as in the WIO model.

The alternative treatment effects are the impacts in the counterfactual scenario in which the EPR system does not exist, but waste is still generated and must be disposed of. In the case of the used tire management system, the counterfactual scenario is a mix of incineration and landfill.

Finally, the opportunity effects are those which would result from additional spending if the financing of the EPR system had not taken place. Because the opportunity effects have a high uncertainty we perform a sensitivity analysis on the allocation of cost savings among producers and consumers. We consider three situations: the savings are fully captured by producers and consumer prices remain unchanged; the savings are fully captured by consumers and result in increased consumption of the EPR good or service; the savings are fully captured by consumers and result in an increase of general consumption.

We find that the net impact of the current EPR policy is positive in all dimensions considered, if compared to the alternative scenario of used tire disposal as unsorted municipal solid waste. Indirect impacts are around 50% lower than direct impacts and avoided impacts are of the same order of magnitude of indirect impacts. In terms of GDP and employment, the EPR system is beneficial because new tires are imported while the production chain of the EPR management system is mostly domestic. Concerning the treatment technologies, retreading is the most beneficial option, followed by recycling and energy recovery.