# Source taxes versus end-of-chain taxes in General Equilibrium

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**Abstract**

We propose a general equilibrium model to analyze the taxation of an externality, where only the aggregate amount matters. In this common situation, regulation is traditionally considered at the source of the externality. We rigorously define how efficient regulation can also be implemented at the end-of-chain, through taxation of the embodied externality, that is conserved along the value chain through balance or accounting identities, as in the case of greenhouse gas emissions footprinting. We identify conditions under which source-based and/or end-of-chain taxes can implement the social optimum. We show that implementation via end-of-chain taxes requires the existence of equilibrium price schedules under which goods are traded as bundles of quantities and embedded externalities. Our results characterize the informational and pricing structures required, and provide a unified general equilibrium framework for the analysis of environmental policies.

## 1 Introduction

Externalities violate the independence axiom, hence invalidating the two welfare theorems. Such a market failure calls for government intervention and since Pigou (1936), economists have long advocated externality pricing as an effective and efficient policy to address unintentional spillover effects of economic transactions. However, the price instrument still requires careful selection. For example, there is a broad literature focusing on differences in