Secondary Aluminum and Circular Economy Policies in Europe: A Computable General Equilibrium Approach

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The transition towards a more circular economy has become a central policy priority in Europe, driven by the need to reduce dependence on imported raw materials, strengthen supply chain resilience, improve industrial competitiveness, and lower the environmental pressures associated with primary resource extraction and processing (European Commission 2020, 2023). In this context, circular strategies that increase the recovery, sorting, reuse, and reintegration of secondary materials are gaining importance not only as environmental measures, but also as industrial policy tools. This is particularly relevant for aluminum, a strategic material for a broad range of manufacturing activities, the construction sector, and a key input for the green and digital transitions (Georgitzikis et al., 2021; Albizzati et al., 2025). Strengthening the supply chain of secondary aluminum scrap is also especially important because producing aluminum from recycled scrap requires substantially fewer primary raw materials and much less energy than producing aluminum from virgin sources. In addition, it reduces reliance on imports of bauxite and alumina, lowers exposure to external supply disruptions and price volatility, and decreases the environmental burden associated with mining and primary processing. Improving the recovery and use of scrap therefore offers a way to enhance European material security while supporting the decarbonization and circularity of industrial production.

However, despite the growing policy relevance of circular strategies for aluminum, their broader economic implications remain insufficiently understood. Existing assessments often focus on technical feasibility, engineering aspects, or environmental benefits, while paying less attention to the wider economic adjustments that may result from higher scrap recovery and utilization. Yet policies that promote the use of secondary aluminum are likely to affect beyond the targeted sector alone. By changing production structures, intermediate input requirements, trade flows, and relative prices, they can generate spillovers across interconnected industries and affect households through changes in consumer prices. Assessing these broader effects is thus crucial for understanding the benefits, trade-offs, and distributional consequences of circular economy strategies.

To fill this gap, in this paper we assess the economy-wide impacts of different circularity policies aimed at strengthening the European supply chain for aluminium scrap, assessing its impacts on sectoral production, input use, trade flows, and intersectoral linkages across the regions and sectors. For this, we employ the well-established FIDELIO model developed by the Joint Research Centre of the European Commission (Rocchi et al., 2025). FIDELIO is a multi-country, multi-sector, dynamic general equilibrium model, based on official Eurostatâ€™s statistics from the FIGARO database, covering 64 industries (NACE Rev. 2) and 45 countries (EU-27 Member States, its main 18 non-EU trading partners, and an aggregate region representing the rest of the world (Remond-Tiedrez and Rueda-Cantuche, 2019).

The different scenarios are designed to represent different channels through which circularity in the aluminium value chain can be strengthened, including: a) setting a minimum target for the use of recycled aluminium in construction products within Europe, b) increase requirements for separate collection and segregation of aluminium alloys originated from construction and demolition sector to improve the supply (centred on the recovery of scrap from construction and demolition activities), c) Increase the sorting requirements for aluminium scrap originated from all economic activities accompanied by investments on procedures and machinery to enhance scrap processing and d)

greater domestic uptake of domestic aluminum scrap, representing stronger substitution of secondary aluminum for primary material (bauxite). The scenario narratives are operationalized by modifying a small set parameters or wedge changes in the core production relationships in FIDELIO, translating their assumptions into exogenous changes in one (or a combination) of: intermediate input requirements, capital/labour costs and/or investments on specific technologies.

The simulation results highlight the heterogeneity of the different policy measures considered, generating differentiated impacts on output, prices, trade, and household consumption. This underlines the importance of using an economy-wide framework to identify not only the overall effects of circularity policies, but also the specific channels through which they are transmitted.