

Inherited capital and the illusion of decoupling

Topic: Sustainable Inclusive Wellbeing (Beyond GDP) in Input-Output Analysis

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How do decoupling assessments change if we consider capital formation from a truly consumption-based perspective?

As long as our global economic system relies on economic growth, decoupling growth from environmental harm is vital to ensure a safe operating space for humanity (Rockström et al., 2009; Ward et al., 2016; Wiedenhofer et al., 2020). Reports of reduced territorial emissions amid continued GDP growth in some high-income countries (Hubacek et al., 2021; Vogel & Hickel, 2023) have fueled optimism about “œgreen growth,” the idea that innovation can outpace the scale effects of expanding production and consumption. Yet evidence for decoupling depends strongly on how environmental pressures are measured (Wiedenhofer et al., 2020).

Even after accounting for geographical scale (Davis & Caldeira, 2010; Hubacek et al., 2021; Vázquez et al., 2023), environmental scope (Parrique et al., 2019; Rockström et al., 2023; Wiedenhofer et al., 2020), and magnitude (Vogel & Hickel, 2023; Parrique et al., 2019), most decoupling assessments share one overlooked assumption: that much of today’s “œclean” consumption depends on long-lived capital stocks. The creation of these stocks incurred environmental impacts earlier and are invisible in annual flow accounts. Annual flow indicators therefore mix genuine efficiency improvements with legacy benefits from past investment. As such, apparent decoupling may partly be a temporal illusion.

Existing environmental accounting frameworks treat capital goods as a one-off annual flow, recording all associated emissions of “gross fixed capital formation” in the year and country of investment (Akizu-Gardoki et al., 2018; Berrill et al., 2020; Hubacek et al., 2021; Jiang et al., 2022; Vogel & Hickel, 2023; Wood et al., 2018). This approach mismatches the long-term benefits of capital with its front-loaded environmental costs, leading to overestimation of footprints in countries undergoing rapid infrastructure development and underestimation in economies relying on inherited capital (Södersten et al., 2018; Ye et al., 2023). It also fails to take into account that part of the capital stock may primarily enable foreign consumption, leading to an overestimation of footprints in export-oriented countries and underestimation in import-reliant economies. Such biases complicate responsibility attributions between developed and developing economies, as fast-growing countries appear disproportionately responsible for current pressures despite building assets that serve future consumption, including abroad (Ye et al., 2023). Addressing this temporal and spatial mismatch is essential for evaluating whether apparent decoupling reflects genuine efficiency gains or merely the legacy of past investment and outsourcing of capital formation.

Some studies have begun to address the temporal and/or spatial dimension of capital goods by reallocating emissions over asset lifetimes (Södersten et al., 2018; Ye et al., 2023), but none to our knowledge has integrated both temporal and spatial reallocation on a global level and reassessed decoupling. We address this gap by introducing a capital-endogenized consumption-based footprint (CECF), building on the Legacy Environmental Footprint framework (Wang et al., 2023) and using data from EXIOBASE 3, EU KLEMS (2007 release and 2017 release), WORLD KLEMS, and Penn World Table (PWT 10.0) (Feenstra et al., 2015; O’Mahoney et al., 2009; Stadler et al., 2018). The CECF integrates capital stock dynamics by reallocating the environmental impacts of capital formation across time and space, offering a more comprehensive perspective on the relationship

between current consumption and environmental pressures. We evaluate decoupling through the Tapio elasticity model which distinguishes eight different categories including strong and weak decoupling (Tapio, 2005).

We find that capital endogenization substantially alters decoupling outcomes, especially for materials. Under the traditional approach, 13 countries show strong decoupling for material extraction, whereas none do once capital is endogenized. For greenhouse gas emissions, 19 countries exhibit strong decoupling under conventional accounting, compared with only 16 when capital is treated as endogenous. Environmental responsibility shifts across countries and over time in ways conventional methods overlook. Overall, our results challenge prevailing decoupling narratives and suggest that no country is currently achieving genuine green growth.