Technologyâ€‘Augmented Endogenous Growth in a Multisector IOâ€‘CGE Framework

Topic: Input-Output Modelling: Innovation and R&D policies
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Research question
This paper addresses the following central question: how can technology be formally integrated as an endogenous efficiency mechanism within a multisector Input-Output (IO) consistent Computable General Equilibrium (CGE) framework, in such a way that Artificial Intelligence (AI) becomes a particular case of a broader class of General Purpose Technologies (GPTs)? More specifically, we ask which endogenous growth paradigm is theoretically and computationally most suitable for embedding technology-driven productivity dynamics into an IO-Social Accounting Matrix (SAM) structure without violating accounting consistency, and how such a formulation modifies impulse, transmission, propagation and persistence mechanisms across sectors.

Method
The contribution aims to be twofold, the first part is conceptual and methodological and the second is an applied CGE model. First, we conduct a structured theoretical synthesis of major endogenous growth approaches, R&D-based models (Romer, 1990), creative destruction (Aghion & Howitt, 1992), increasing returns and path dependence (Arthur, 1994; Katz & Shapiro, 1985), and task-based technological change (Acemoglu & Restrepo, 2018), identifying their respective impulse, transmission and persistence channels. Second, we reformulate the sectoral production function in a multisector dynamic CGE model by introducing technology as an endogenous efficiency parameter.

For each sector j, value added at time t is defined as a Cobbâ€“Douglas production function in which capital and labor are combined with an efficiency parameter. Specifically, value added equals a sector-specific efficiency term multiplied by capital raised to the elasticity parameter theta_j and labor raised to one minus theta_j. The efficiency term evolves over time according to a logistic diffusion function. This logistic specification captures S-shaped adoption dynamics, threshold effects and self-reinforcing feedback between profitability, investment and technological accumulation. Technology does not appear as an independent factor or SAM account; instead, it modifies total factor productivity while preserving the square SAM structure and IO consistency. The dynamic model is implemented in GAMS and designed to allow scenario simulations under alternative technology investment paths.

Data
The empirical backbone of the model, to develp the second part, is a square Social Accounting Matrix calibrated from the 2022 Spanish Input-Output table and complementary national accounts data. The SAM ensures full consistency between production, income generation, institutional accounts and external transactions. Sectoral capital and labor shares are derived from national accounts aggregates, while the technological efficiency path is parameterised to reflect diffusion dynamics rather than exogenous shocks. Although the present contribution focuses on the

conceptual and modelling stage, the structure is fully prepared for numerical simulation using the calibrated Spanish SAM as baseline equilibrium.

Novelty

The novelty of the paper lies in three dimensions. First, it proposes a general and technology-neutral integration mechanism, allowing AI, digitalisation, automation, robotisation or intangible capital deepening to be treated as specific instances of a unified endogenous efficiency function. Second, it bridges endogenous growth theory and IO-based CGE modelling through a logistic productivity formulation that captures impulse (technology investment), transmission (intersectoral IO linkages), propagation (income-demand multipliers) and persistence (cumulative diffusion and increasing returns) within a coherent accounting framework. Third, it provides a policy-oriented architecture aligned with the conference theme â€œAdvancing policy resilience through input-output economicsâ€•, enabling the simulation of impacts on economic growth, household income, tax revenues, external balance and savings under alternative technology diffusion scenarios.

By embedding endogenous technological dynamics into a multisector IO-CGE structure, the paper contributes to the methodological frontier of Input-Output modelling and offers a replicable protocol for analysing structural transformation in digitally evolving economies.