

HOW CAN THE GLASS CEILING BE BROKEN? PROPOSALS OF THE HUNGARIAN BANKING ASSOCIATION TO SUPPORT AN ECONOMIC TURNAROUND

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Hungary's economic convergence has yielded significant results over recent decades; at the same time, a growing body of domestic and international analysis warns that the growth constraints of the current economic structure are becoming increasingly pronounced. Weaknesses in productivity growth, a loss of ground in the innovation race, and challenges in the investment and regulatory environment may have created a competitiveness "glass ceiling" that will make further economic convergence difficult unless it can be broken through.

Drawing on the domestic and international literature and on the policy work of the Hungarian Banking Association, this study formulates and analyzes proposals in five key areas related to the financial intermediation system that could support economic convergence and a turnaround in competitiveness: strengthening a predictable economic and regulatory environment; further digitalizing mortgage lending processes; implementing a building energy-efficiency strategy that spans electoral cycles; developing SME financing in ways that promote competitiveness while safeguarding fiscal sustainability; and making more effective use of public digital infrastructure. In our view, measures that can be implemented relatively quickly in these areas could make a meaningful contribution to higher productivity and, through it, to improved competitiveness and economic resilience.

JEL codes: G21, G28, O38, O52, R31

Keywords: competitiveness glass ceiling, productivity, financial intermediation system, digital transformation, housing finance, SME financing, building energy-efficiency modernization

**THE BANKING SECTOR'S OWN AI FOOTPRINT
ENERGY AND CARBON IMPACTS OF ARTIFICIAL INTELLIGENCE
APPLICATIONS IN CREDIT INSTITUTION OPERATIONS**

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Over the past decade, the banking sector has become a key actor in the sustainability transition through the measurement of financed emissions (Scope 3) and the decarbonization of portfolios. At the same time, however, artificial intelligence (AI) solutions have been spreading rapidly in credit institutions' own operations—from customer-service chatbots and credit-risk models to agentic systems automating multi-step workflows. Their energy and resource requirements constitute a dynamically growing component of the sector's own environmental footprint that has so far received little attention. The study has three objectives: first, it reviews the international literature and measurement methodologies concerning the life-cycle environmental impacts of AI systems (training, inference, embodied emissions, and water and resource use); second, it examines how current trends in banking AI adoption—especially the rise of generative and agentic AI—affect credit institutions' Scope 2 and Scope 3 emission categories and, through an exploratory document analysis of the 2025 disclosures of nine credit institutions, empirically demonstrates that energy use attributable to AI cannot be identified under current reporting practices; third, it proposes a methodological framework for quantifying the “banking AI footprint” and integrating it into sustainability reporting (CSRD/ESRS). The study argues that, alongside the narrative of “greening by AI,” the sector must also institutionalize the principles of “greening of AI”: without energy-related criteria in AI procurement decisions, model sizing, and contracts with cloud service providers, digital transformation may undermine the credibility of banks' own climate targets.

JEL codes: G21, O33, Q54, Q56, M14

Keywords: artificial intelligence, banking sector, carbon footprint, data centers, ESG, sustainability reporting, CSRD, EU AI Act

**FROM THE SOLOW–SWAN MODEL TO INDUSTRY 5.0
THE INTERRELATIONSHIP BETWEEN AI-DRIVEN KNOWLEDGE
MANAGEMENT AND SUSTAINABLE ECONOMIC GROWTH**

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The evolution of economic growth models has interpreted the role of technological development in different ways. The exogenous Solow–Swan approach treated technological progress as an external given, whereas endogenous growth theories identified knowledge and innovation as internal drivers of growth. Schumpeterian creative destruction further refined this picture by emphasizing the cyclical nature of innovation and the dynamic role of competition.

Building on this trajectory in growth theory, the study examines the economic role of artificial intelligence, with particular emphasis on AI-supported knowledge management. The analysis argues that artificial intelligence is not merely an automation technology, but a platform that transforms the creation, organization, and use of knowledge, thereby affecting the internal drivers of growth. The article shows how AI-based knowledge management influences productivity and the structure of the labor market, and discusses the limitations and risks associated with its application.

The study concludes that the integration of AI and knowledge management offers a new interpretive framework for analyzing economic growth, particularly within the human-centered approach of Industry 5.0, where technological development is based not on replacing labor, but on complementing it.

JEL codes: D80, D83, J24, O33, O47

Keywords: artificial intelligence, knowledge management, economic growth, Industry 5.0

**A CRITICAL ANALYSIS OF THE FEASIBILITY OF THE GREEN DEAL:
AN EMPIRICAL EXAMINATION OF THE MACROECONOMIC
REBOUND EFFECT AND DECOUPLING IN THE EU-27 MEMBER
STATES**

Anita Zombory

Current environmental challenges, especially climate change, biodiversity loss, and resource depletion, make it increasingly clear that growth-based economic models are unsustainable. In light of these challenges, a paradigm shift in economic policy thinking is becoming increasingly urgent. Decoupling—the separation of economic growth from environmental pressures—occupies a central place in the theory of sustainable development; although desirable in theory, it faces numerous empirical limitations. This study examines the constraints on the feasibility of decoupling across the 27 Member States of the European Union in light of the macroeconomic rebound effect. The methodology combines comparative analysis and panel econometrics. Relative decoupling is achievable in some cases, but evidence of absolute decoupling remains limited. A further problem is that technological efficiency gains are often offset by the rebound effect, while economic globalization shifts environmental pressures to developing countries. In light of these findings, reconsidering the current economic model and prioritizing strategies aimed at reducing material and energy use in absolute terms are essential to achieving a fairer and more ecologically sustainable future.

JEL codes: F02, F68, L50, O52, P51

Keywords: European Union, Green Deal, rebound effect, IPAT

GREEN FINANCE AND TRANSITION TOWARDS A CIRCULAR ECONOMY IN HUNGARY IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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This study examines the correlation between green finance, the circular economy transition, and sustainable development in Hungary. Its novelty lies in interpreting the circular economy as a potential theoretical linking mechanism between green finance and sustainable growth. The analysis draws on annual data from the National Bank of Hungary (MNB), Eurostat, and the World Bank. For the longer time series of 2000–2025, it applies descriptive statistics, trend analysis, and Pearson correlation. Developments in green finance indicators over 2020–2026 are presented descriptively, while the short-term correlation analysis between green finance and the circular economy is based on the common observations for 2020–2025. The results show that resource productivity has the strongest and most consistent relationship with economic, energy, and productivity indicators. Favourable co-movements in recycling performance are better interpreted as part of broader technological and institutional modernization, while relationships involving domestic material consumption are weak. Based on the short time series, green finance may support the transition primarily by improving financing conditions for sustainable and resource-efficient investments. However, the correlations do not establish causality or a formal mediating effect; the results are therefore exploratory. The policy implication is that there is a need to coordinate financial, industrial, and environmental policy instruments.

JEL codes: G21, G23, O44, Q01, Q56

Keywords: green finance, circular economy, resource productivity, sustainable development/growth, Hungary

