Newsletter
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INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Welcome from the Editor

Dear **IIOA** member,

I am delighted to release the latest issue of the *International Input-Output Association Newsletter*. My heartfelt thanks go to everyone who has contributed to this and previous editions.

In this issue, you will find information about the Change in Leadership of the IO (Historical) Archive Project, update of the IO databases, details on some recent conferences, job opportunity, the latest ESR articles, and some highlights in journals.

I welcome your feedback, comments and suggestions, and encourage you to continue sharing your activities for inclusion in future issues. Thank you for your ongoing support and contributions.

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In this issue

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Change in Leadership of the IO (Historical) Archive Project

The IIOA is pleased to announce an important transition in the leadership of the IO (Historical) Archive project. After more than four years of dedicated work, Bert Steenge and Josef Richter are stepping down as coordinators of the project, and Kurt Kratena will take over as the new responsible person for the next phase of development.

About the IO (Historical) Archive

Launched in 2021, the IO (Historical) Archive was conceived to safeguard the scientific heritage of input–output (IO) analysis and to make valuable materials in this field accessible to IIOA members and researchers worldwide. The project aims to preserve documents and resources that would otherwise risk being lost—such as early IO tables, conference proceedings, reports, and personal archives of IO pioneers—by digitizing and organizing them in a searchable web-based database.

Thanks to the tireless efforts of Bert and Josef, the project has already achieved several important milestones. More than 1,000 historical documents have been digitized and integrated into the Archive, including contributions to IO Conferences between 1971 and 1995, closing a major gap in the documentation of the discipline's development. The project has also established a solid technical and organizational infrastructure, creating a functional and efficient web database for member access.

An important milestone was reached with the formal agreement signed with the University of Oviedo, which now hosts the IO (Historical) Archive Repository—the physical home for printed IO materials. A considerable number of historical documents have already been received by the University, marking a crucial step toward ensuring their long-term preservation and accessibility for future generations of scholars.

The IIOA expresses its deep gratitude to Bert and Josef for their vision, leadership, and dedication in bringing the Archive to this important stage. Their work has laid a strong foundation for the next steps of the project.

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IO Archive Leadership Change

Welcoming Kurt Kratena!

Researcher, Austrian Institute of Economic Research (WIFO, 1993–present)

Developer of the FIDELIO dynamic interregional econometric IO model for the European Commission, JRC/IPTS (2008–2011)

Visiting Scholar at MIT and FEEM, Italy (2006); Harvard University (2011); University of Illinois, REAL (2013); and European Commission, JRC/IPTS (2015)

The IIOA is delighted to announce that Kurt Kratena will now lead the IO (Historical) Archive project. Kurt brings extensive experience in input–output and macroeconomic modelling, as well as a long-standing commitment to the IIOA community. He is a research economist with a distinguished career at the Austrian Institute of Economic Research (WIFO), as well as being a co-founder of the WIIW and GINFORS/EUROGREEN models. His expertise in building and maintaining large-scale economic databases and models makes him ideally suited to guide the Archive into its next phase — expanding its content, strengthening collaboration with institutions, and enhancing accessibility for future generations of IO scholars.

The IIOA warmly thanks Bert and Josef once again for their exceptional contribution and welcomes Kurt in his new role, confident that the IO (Historical) Archive will continue to grow as a living repository of our shared scientific heritage.

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Databases

ADB launched the environmentally extended input output tables (EE MRIOTs), which integrates GHG emissions data for the period 2017 to 2023 with relevant IO statistics

Since 2008 the Asian Development Bank (ADB) has been supporting its developing member economies to compile supply and use tables (SUTs) and input-output tables (IOTs) and to apply input-output analysis in policy work. To serve the emerging need to study globalized production processes, in particular to discern developing Asia's role in global value chains, since 2015 ADB has been producing multi-regional input output tables (MRIOTs) which integrate the IOTs of 74 economies. To date the ADB MRIOTs remain the most current analytical framework of its kind.

On 26th August 2025, ADB launched the environmentally extended input output tables (EE MRIOTs) as a component of its Key Indicators for Asia and the Pacific knowledge initiative. The EE MRIOTs integrate GHG emissions data for the period 2017 to 2023 with relevant IO statistics and provide a comprehensive framework for environmental economic analysis.

The launch of the EE MRIOT by ADB was marked by a global webinar attended by over 250 participants. Joseph Mariasingham, Nomundari Baatar and Shambhavi Sawhney of the ADB EE MRIOT project team presented the salient features of the framework. The discussion panel including Albert Park (ADB), Pradeep Tharakan (ADB), Jing Meng (UCL), and Sabah Abdulla (ADB) highlighted its analytical utilities and practical relevance.

https://www.adb.org/publications/key-indicators-asia-and-pacific-2025
https://kidb.adb.org/globalization

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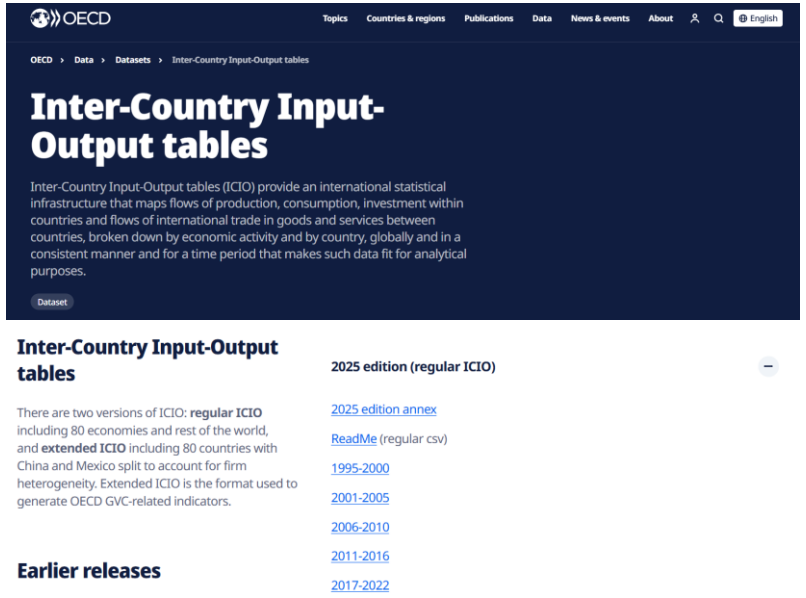
Databases

The OECD has published new updated Inter-Country Input-Output (ICIO) tables covering the period 1995 to 2022 and with increased geographical coverage, from 76 to 80 economies.

Another key feature of the 2025 edition of the ICIO database, compared to the previous version, is an increase in the number of economic activities. Notably:
i) the expansion of the agriculture and mining sectors to their 2-digit ISIC Divisions;
ii) splitting *Manufacture of basic metals* to separate iron and steel from non-ferrous metals;
iii) including *Building of ships and boats* separately from other transport equipment.

OECD's collection of Trade in value-added (TiVA) indicators has been updated accordingly, reflecting the expanded coverage of the ICIO tables.

https://www.oecd.org/en/data/datasets/inter-country-input-output-tables.html
https://www.oecd.org/en/topics/sub-issues/trade-in-value-added.html



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Conferences

Cornerstone Initiative: Sustaining Access to High-Quality Data for Corporate Sustainability

Photo: Kickoff meeting at Stanford (August 19-21, 2025)

The Cornerstone initiative, launched August 8, 2025, is a joint effort led by Stanford University, ERG and Watershed. Its purpose is to preserve and expand access to top-tier, open-access sustainability data—particularly after the U.S. EPA decided to discontinue updates of its USEEIO model.

Cornerstone will serve as a central hub for the two most widely used scope 3 (value-chain) carbon-accounting models—USEEIO, originally developed by the EPA, and Open CEDA from Watershed. Together, they underpin approximately 65 % of corporate scope 3 carbon measurements globally, according to CDP data.

Over the coming months, these two models will be merged into a single global multi-regional input-output (MRIO) model under the management of Cornerstone, enhancing scope 3 measurement consistency.

Dr. Wesley Ingwersen—former EPA lead and architect of USEEIO—will serve as Technical Director, with Dr. Sangwon Suh (developer of CEDA) and Dr. Steve Davis (Stanford) as Technical Advisors.

The launch of Cornerstone has garnered wide media attention—including coverage in The New York Times.

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Job Positions

Prof. Daniel Moran and Assoc. Prof. Keiichiro Kanemoto at Tohoku University are seeking a dedicated researcher to be co-supervised by both professors, who will explore how spatial land use and its economic dimensions connect with supply chains and environmental challenges. We will employ geospatial data to analyze inter-industry connections at both national and global levels. This position offers an excellent opportunity to contribute to advancing research on economic and environmental challenges.

Required Skills and Knowledge

Candidates should have high-level numerical programming (MATLAB, Python, R, Julia etc.) experience and one or more of the following:

- Spatial data analysis or GIS
- Understanding of machine learning and statistics
- Environmental impact analysis and/or environmental accounting methods such as MRIO analysis and environmental footprinting

Qualifications

- Ph.D. degree or equivalent in computer science, economics, environmental science, engineering, agriculture or similar field
- Programming skills in Julia, MATLAB, Python, and/or R are highly desirable
- Good level of spoken and written English

This position offers a unique opportunity to contribute to cutting-edge research with significant real-world impact on urban decarbonization and sustainable development. We particularly encourage applications from candidates who can foster interdisciplinary collaboration and contribute to a vibrant research environment. The inherent complexity of challenges in urban renewable energy integration, such as spatial constraints, grid limitations, regulatory hurdles, social acceptance, and aesthetic concerns, necessitates concerted efforts across technological, economic, policy, and social dimensions.

We look forward to receiving applications from highly qualified candidates who share our commitment to accelerating sustainable urban energy transitions. You can apply now and the closing date for applications is October 31.

https://www.kankyo.tohoku.ac.jp/en/general_public/employ.html#20250829

東北大学大学院
環境科学研究科

Department of Environmental Studies for Advanced Society,
Division of Environmental Policies,
Industrial Ecology Laboratory
Call for Applicants: 1 specially Appointed Research Fellow

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Job Positions

Research Fellow in Carbon Accounting

This role involves undertaking research on carbon accounting, using multi-regional input-output (MRIO) analysis and related techniques, for a jointly funded project by UK Research and Innovation (UKRI) and the Department of Energy Security and Net Zero (DESNZ). The research centre entitled, "Production and Consumption Transformations" Centre will explore the alignment of the UK's industrial strategy, and resource consumption policies with both short term and long-term climate targets. With DESNZ funding 35% of the project, you will work directly with senior policy makers delivering actionable insights that can lead to real policy change.

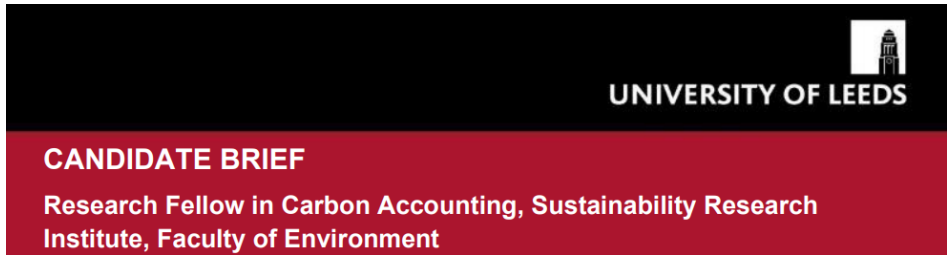
You will join a team with a strong history of applied research in the field of carbon accounting. The University of Leeds has developed a UK specific MRIO (UK MRIO) that is used in producing the UK's consumption emissions accounts for the UK Government . You will be required to use quantitative research methods, (including writing and maintaining python code) in developing the UK MRIO for a range of applications, whilst working alongside the wider research team in an inter-disciplinary environment. You will display a strong commitment to applied interdisciplinary research, work effectively in a team environment, show commitment to addressing the climate crisis while also demonstrating a strong background in communicating evidence and insights to multiple stakeholders.

To explore the post further or for any queries you may have, please contact:

Dr. Anne Owen

Email: A.Owen@leeds.ac.uk

You can apply now and the closing date for applications is October 13.
https://jobs.leeds.ac.uk/Vacancy.aspx?id=50265&forced=2



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Published papers and books in Input-Output Analysis and related methods

Economic Systems Research
Journal of the IIOA
Volume 37, Issue 1, 2025

Guomei Zhao, Rui Xie, Bin Su & Qunwei Wang

CO2 terms of trade and its determinants based on input–output models with technical differences

This paper constructs a comparative analysis framework on how the input-output (IO) model with technical differences affects the calculation of the pollution terms of trade (PTT) and the tests of the pollution haven hypothesis. Specifically, the CO2 terms of trade (CTT) of the world's major economies are calculated based on five IO models, and chain additive structure decomposition analysis (SDA) is conducted to examine the roles of different factors in the changes in CTT. The economic phenomena reflected by the CTT measured by these IO models are found to be different, and a comparative analysis shows that different IO models are suitable for studying different economic problems. Suggestions are provided on the application of different IO models in the calculation of economic indicators and the study of economic issues. Policy makers need to be cautious about policy recommendations based on the results obtained from different IO models.

Fátima Cardoso & António Rua

Gone with the wind: a structural decomposition of carbon emissions in Portugal

Understanding the driving forces underlying greenhouse gas emissions is vital for the design of climate and environmental policies aimed at promoting sustainable development and human well-being. In particular, we focus on Portugal where a striking reduction of carbon emissions has been observed in just a few years. We perform a structural decomposition analysis over the last two decades allowing to unveil the main drivers underlying the evolution of carbon emissions. We find that the investment on renewable energy sources, namely wind, has been key for a successful transition to a cleaner economy. The impact has been felt both on the reduction of carbon intensity as well as on the increase of energy efficiency in power generation. We also find that such benign evolution was partly counterbalanced by the increase of the contribution of final demand to carbon emissions despite being attenuated with the COVID-19 pandemic.

Cristian Mardones & Matías Correa

Methodological proposal to approximate the sectoral impacts of a carbon tax at the regional level – the case of Chile

This study proposes a methodological approach to approximate the sectoral impacts of carbon taxes in the different regions of Chile through the environmental extension of intraregional input – output models. These models are calibrated by regionalizing technical coefficients using an indirect method called Industry-Specific Flegg Location Quotient. Carbon dioxide emissions at the regional and sectoral levels are obtained mainly from regional inventories of greenhouse gases, although in some sectors, they are calculated indirectly from fuel consumption. Then, tax scenarios are proposed that allow simulation of the effects on sectoral prices, levels of production, and emissions at the regional level. The results show that implementing an identical tax rate at the national level has a very heterogeneous impact on the country's regions, with the regions of Atacama, Antofagasta, Valparaíso, and Biobío being the most affected economies in relative terms since most of the large thermoelectric power plants are located there.

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Kehan He, D'Maris Coffman, Xingzhe Hou, Jinkai Li & Zhifu Mi

An electricity big data application to reveal the chronological linkages between industries

Effective integration and compromise between theories and empirical data are essential for an operational economic model. However, existing economic models often neglect the intricate fluctuations and transitions that occur in weeks and days. This research proposes an Input–Output-based algorithm to introduce the time domain into economic modelling. Using daily electricity consumption big data in Chongqing as a proxy for economic activities, we quantitatively analyse the chronological interactions among industrial sectors and reveal that a longer duration is required by the heavy industry sector to signal an intermediate production in the service sector than any other sectors in this municipality. With the proposed model, we forecast the economic impact induced by demand changes for consumer goods under three growth scenarios. The model not only serves as a methodological bridge between theoretical and data-driven approaches but also offers new insights into the dynamic interplay of sectoral activities over time.

Cheng Yongwei

Spread efficiency of energy demand in the industrial chain: a perspective from economic distance

This paper investigates the spread efficiency of energy demand in the industrial chain based on the input-output method. The concept of intersectoral economic distance and spread efficiency was introduced to formulate the energy demand spread functions. Then, an empirical study was conducted based on China's 2017 input-output data and nearly 3,500 companies were listed in the Chinese A-share market. The results show that the sectoral average spread time is 32.75 days. Manufacturing plays a central role in the spread of energy demand. In the short term, the logistics sector has the greatest pulling effect on energy demand, while the electric power sector has the greatest impact on energy demand in the long term. Energy demand caused by exports is greater than consumption and investment. Finally, sectoral economic distances and actual spread functions for 9 main energy sources are provided to help us better predict energy demand.

Federico Riccio, Giovanni Dosi & Maria Enrica Virgillito

Functional specialisation and income distribution along global value chains

This paper addresses two questions: first, the extent to which the participation in Global Value Chains (GVCs) has penalised labour as a globally insourced production input, and second, what happened to between-occupation functional inequality. We combine input–output (I–O) tables and labour income along the production stages of global value chains. We focus on foreign labour requirements in manufacturing industries and distinguish across four production stages, namely fabrication, marketing, R&D, and managerial functions, to map the relative specialisation patterns of different production sub-systems. Our results show that GVCs are hierarchically structured, with advanced countries specialising in upstream functions along global production networks. Fabrication workers are the largest losers in this process, accounting for most of the drop in labour share in advanced and developing countries. Considering that production workers make up more than 50% of the workforce in both advanced and developing countries, the loss of the labour share of blue-collar workers has contributed to increasing wage inequality globally.

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Prithu Sharma & Aparna Sawhney
Understanding export-generated employment in India

International trade can play a catalytic role in economic development and employment enhancement. To understand the employment impact of India's pattern of trade, we use a structural decomposition analysis utilising the World Input – Output Database. Distinguishing between final and intermediate exports from India, we quantify the domestic employment effect during 2000–14. We show that a shift in final exports' composition towards sectors and sub-sectors with lower employment generation potential led to a negative employment effect. However, changes in international production sharing have largely had a positive impact on employment in India. Our structural decomposition analysis is complemented with a panel regression that tracks the employment effect of exports through backward linkages. We find significant differential impacts in India's bilateral trade with middle-income versus high-income countries. While bilateral backward linkages from exports to middle-income countries enhanced employment in India, exports to high-income countries did not yield a positive employment effect.

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Economic Systems Research

Journal of the IIOA

Volume 37, Issue 2, 2025

María T. Álvarez Martínez, María Gesualdo & Jonathan Pycroft

Storm in the Cloud: A Study on the Macroeconomic Impact of the UK's Digital Service Tax

The nature of the digital economy puts pressure on traditional tax practices, as it is frequently characterised by high returns from intangibles. In this paper, we assess the macroeconomic impact of the digital services tax introduced in the UK in 2020. We employ the CORTAX model, which is a macroeconomic model elaborated for the Member States of the European Union, the UK, the US, and Japan. The model strongly focuses on corporate taxation and multinational firms. To be able to represent the digital sector, a major extension of the model has been introduced to expand the model from one sector to two, allowing the digital sector to be modelled separately from the rest of the productive economy. The results suggest a negative impact on GDP from the introduction of the tax but a gain in welfare and consumption for the UK and small positive spillovers for close trading partners.

George Philippidis & Ana I. Sanjuán-López

An ex-ante study on the impacts of reduced EU sugar consumption: a sweet mix of health and environmental benefits

This paper estimates the health and environmental benefits from reducing sugar intake in EU households. A CGE model is modified by linking probability density functions of body mass index for EU populations to a complete demand system with nutrition accounting. Following the WHO recommendation, sugar intake is reduced to 10% of total dietary energy intake, whilst two further scenarios explore more ambitious targets of 7.5% and 5%. This dietary transition leads to a relative reduction in overweight and obese EU adults of between 8 and 15 million by 2050, with potentially significant health gains in Scandinavia. Environmental 'footprints' reveal relative land and emissions savings of up to 56m2 and 20 kgCO_2e per capita per year by 2050. With scientific evidence supporting a virtuous circle of improved health, higher wages and increased macroeconomic performance, the reported negative impacts on economic indicators in this study could be reversed through targeted redistributive policies.

Gerardo A. Perez-Valdes, Kirsten S. Wiebe & Adrian T. Werner

Uncertainty in dynamic econometric input-output models: a Norwegian case study

Input-output models used for macroeconomic impact and policy analysis are often characterised by large data sets and resource-heavy computing. However, the types of results they provide are sensitive to uncertainty in their core assumptions. Various approaches have been proposed to account for the uncertainty in one or more parts of the analysis assumptions. Although it is standard practice to include varied cases in policy analysis, the notion of stochasticity of parameters across periods of time is less widespread. Costly numerical computing and difficulty in interpreting the results complicate this approach. In this work, we adapt an environmentally-extended dynamic econometric input-output model to account for uncertainty of various kinds. We demonstrate the methodology in the case of building renovation. The results provide insight into situations where explicitly considering uncertainty as part of the analysis is useful, as well as others in which no additional information was gained from such treatment.

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Manuel Alejandro Cardenete, M. Carmen Lima & Ferran Sancho

A methodology to study price-quantity interactions in input–output modeling: an application to NextGenerationEU funds

The standard input–output (IO) model consists of two distinct and self-contained modules that describe the underlying factors governing quantities and prices. However, these modules operate independently, existing in separated spheres where prices do not influence quantities and quantities do not affect prices. This limitation restricts the standard model's ability to evaluate market dynamics that involve simultaneous changes in both quantities and prices. To overcome this limitation, we introduce an extended version of the traditional IO price and quantity models, combining them into a unified 'price-quantity' model that establishes connections between the two IO modules. We apply this integrated IO model to evaluate the impact of *NextGenerationEU* funds on the Spanish economy utilizing input–output and national accounts data for 2016.

José Daniel Buendía-Azorín, Rubén Martínez-Alpañez & María del Mar Sánchez-de-la-Vega

Estimating inter-regional trade: the radiation model versus the gravity model

The estimation of interregional trade flows within a country is confined to the context of multi-regional input–output models. Despite the remarkable relevance of these trade flows for regional incomes, most countries have almost no official data, with Korea being an exception used here. In addition to survey-based estimation methods, there are non-survey methods, some based on gravity models, which can be used to estimate inter-regional trade flows. This paper compares the gravity model with the novel radiation model. Preliminary results show that the accuracy of the radiation model's estimation is superior to that of the gravity model, with the invaluable benefit of not needing to estimate regression coefficients, unlike the gravity model. This finding provides a generalisation of the radiation model for estimating interregional trade in contexts where there is no prior multi-regional input–output table without restrictions derived from coefficient estimation as in the gravity model.

Maximilian Koslowski, Edgar Hertwich & Richard Wood

From single to joint-production under rectangular technology choice

Unlike conventional input–output impact analyses based on matrix inversion, the optimisation-based rectangular-choice-of-technology model (RCOT) by Duchin & Levine [(2011). *Economic Systems Research*. https://doi.org/10.1080/09535314.2011.571238] allows for choice among multiple technologies along a sustainable development narrative. However, their model, as first proposed, does not utilise a supply-use framework in order to properly capture the issues of joint-production. That is unfortunate for two reasons: Joint-production is the general case and is, moreover, interesting from an efficiency perspective. Using single-production data instead requires re-allocating by-products, involving a range of assumptions. This concerns, by design, the utilisation of by-products as well as reuse and recycling. Here, we explore the role of these assumptions and the possibility of using production data as-is, where technologies typically produce multiple co-products. Despite fewer assumptions, the joint-production model may not always align with the study goals.

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Min Jiang & Euijune Kim

Measuring impacts of retirement age extension on economic growth and labor market in China using a recursively dynamic CGE model

This paper estimates the effects of retirement age extension on China's economic growth and employment from 2020 to 2050 using a dynamic computable general equilibrium model. This paper focuses on the interaction between retirement and youth employment, particularly the substitution between young and older workers and the trade-off between male and female workers. According to the reform speed of the retirement system, nine policy scenarios are designed, which are divided into three policy options: slow, gradual, and fast reform. The simulations indicated the extension of the retirement age will indeed have a positive impact on China's GDP growth and the optimal policy is to gradually delay the female retirement age from 50 to 60. Meanwhile, the share of women in their 30s and 50s in total labor demand is intended to increase by 2.01–2.05%, while the employment share of young and middle-aged men will decline by 1.32–1.68%.

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Economic Systems Research
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Aoi Tsukioka & Shigemi Kagawa
Identifying critical supply chain sources of imported inflation: evidence from Japan

This study develops a new forward-type unit structure model that utilizes a cost-push input – output price model to identify the most vulnerable industries and supply chains in Japan affected by the recent energy price shock during 2015–2022. We observe that several commodities, including basic petrochemicals and paving materials, play a crucial role as hub sectors with large cost pass-through in the supply chain paths. Additionally, midstream industries in crucial supply chains bear cost burdens without receiving financial support. Consequently, the Japanese government should implement policies to provide financial assistance and increase investments in greener technology for the most vulnerable supply chains identified in this study, including petroleum products → petrochemicals, petroleum products → road paving, coal products → cement, coal products → iron and steel, and gas production and distribution → domestic electric power generation.

Hyoungmin Han & Sunhyung Lee
Global value chains and disasters

We assess the disruptive potential of disasters on global value chains (GVCs) using comprehensive data on GVC trade and disasters. Analyzing 62 countries from 2007 to 2020, we find that a typical disaster reduces forward and backward linkages by at least 27% on average. Our analysis uncovers that more prolonged and intense disasters further weaken GVC linkages, with climate-related disasters being the most disruptive due to their severity and frequency. We also reveal how the positions of developing countries in GVC linkages and inadequate responses amplify these effects. Finally, we discuss policy implications for building a more resilient global production network.

Lucas Leão, Eduardo Gonçalves & Fernando Salgueiro Perobelli
Economic complexity, international trade, and environmental pollution

This study analyzes the impact of production and international trade between developed and emerging regions, which have distinct levels of economic complexity, on pollution levels (measured by CO_2 emissions). To do so, we calculate the regional Miyazawa trade multipliers with data from the input—output and CO_2 emissions matrices from the Eora Global Supply Chain Database (Eora) and the Economic Complexity Index (ECI) from the Observatory of Economic Complexity (OEC) for groupings of 87 countries over the period 2000–2016. The results reveal, among other things, that less complex regions pollute more than regions with a higher degree of complexity, regardless of income level. Furthermore, this suggests that more complex regions tend to seek out less complex regions as 'pollution refuges'.

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Harry C. Wilting & Daan in 't Veld

An overview of accounting approaches for national greenhouse gas emissions; comparing consumption and production footprints in the European Union

Environmentally extended multi-regional input–output (EEMRIO) analysis enables emission accounting over supply chains starting from production-based emissions reported by countries. In addition to well-known approaches that base the accounting on a country's final demand, this article proposes a production footprint that includes all direct and upstream emissions from a country's production activities. We applied various accounting approaches to greenhouse gas (GHG) emissions related to consumption and production in all 27 EU Member States. Our results showed that production footprints exceeded consumption footprints in all Member States, except France, Italy and Croatia. Consumption and production footprints identified different sectors as main contributors to total emissions per country. An analysis that focuses only on consumption footprints, disregarding production footprints, misses up to 69% of a country's total import-related GHG emissions. We recommend that policymakers consider both consumption and production footprints together with production-based emissions, as this may lead to different reduction opportunities.

Kerstin Hötte

Mapping the disaggregated economy in real-time: using granular payment network data to complement national accounts

In an era of rapid change, timely and disaggregated economic insights are crucial for effective policymaking. This study explores the potential of real-time payment data to complement traditional economic measurement. Using anonymised UK business payments from 2015 to 2023, we analysed inter-industry financial flows at a granular 5-digit SIC level and systematically compared them with established economic indicators, such as GDP and input-output tables (IOTs). Our findings show strong correlations with GDP and qualitative consistency with official IOTs, highlighting the value of the novel high-frequency data for real-time economic monitoring. We benchmarked network statistics at the 5-digit level, showing how industry-specific payment structures align with stylised facts from the empirical economic network literature. While outlining methodological and interpretative challenges, we discuss the integration of such bottom-up data into national accounts. This work contributes to ongoing efforts to advance economic measurement and offers tools for tracking economic dynamics in real time.

Ilaria Fusacchia, Enrico Marvasi, Silvia Nenci, Federico Sallusti & Luca Salvatici

From micro to macro: integrating firm-level data to enhance global production systems analysis

This paper introduces a novel methodology to improve the accuracy of trade data for analyzing supply chain structures. Integration of micro-level information into Inter-Country Input-Output tables reveals previously overlooked variations in firms' sourcing patterns and the allocation of imported inputs across sectors. Applying this methodology to the Global Trade Analysis Project Data Base and leveraging Italian micro-level data, we identify the significance of within-sector variations in the role of trading partners. For instance, in the transport equipment sector, conventional models overestimate inputs from the United States and underestimate those from China, with discrepancies reaching up to 15 percentage points. These refinements improve the representation of trade patterns and the accuracy of policy-oriented economic models. Furthermore, the methodology's adaptability facilitates its application to other countries, fostering international research collaboration. Overall, this approach strengthens the reliability of supply chain research and offers valuable insights for industrial and trade policy design.

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Xiang Gao, Geoffrey J.D. Hewings & Cuihong Yang

Measuring the industry relocation at the macro-level

The paper introduces a new method for quantifying the magnitude of industry relocation at the macro-level, mitigating the limitations in existing measures and providing a clearer depiction of production location dynamics. We employ this novel approach to measure global and China's domestic industry relocation. The findings reveal that during 2002–2007, production activities displayed a dual trend of dispersion globally alongside an agglomeration within China. However, during the periods 2007–2012 and 2012–2017, following the outbreak of the global financial crisis in 2008, the global dispersion pattern attenuated, while China's domestic industry relocation transitioned from a slight agglomeration to a more dispersed pattern.

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Latest ESR articles

Economic Systems Research

Journal of the IIOA

Latest articles (up to 06 Oct)

Ludovica Almonti, Stefano Deriu, Rosita Pretaroli, Francesca Severini, Irfan Ahmed & Claudio Socci

The disaggregated effects of policies for food security: the Pakistani case

The UN Sustainable Development Goals prioritize food security as one of their cornerstones. The Government of Pakistan has made food security a top priority in its 2022–2026 national defence policy, thus adding balanced dietary requirements to economic goals. This study aims to provide decision-makers with purpose-specific tools to evaluate the effects of fiscal policies from different perspectives, including food security. Using the SAM-based CGE model specifically developed for Pakistan, the study analyses three scenarios and evaluates the changes in GDP and its components, income distribution and food access in both aggregated and disaggregated terms. The database includes calories consumed by food item and households' groups, differentiated by location and source of income. Then the model formalizes the main relations among consumption and calories and gives back signals on the potential shifts occurring in the consumption and nutritional patterns within the economy resulting from policy actions.

Annabelle Mourougane, Polina Knutsson, Rodrigo Pazos, Julia Schmidt & Francesco Palermo

Tracking developments in global supply chains in real time

Trade in Value-Added (TiVA) indicators are essential tools for understanding how countries are integrated into global supply chains. However, these indicators are published with considerable lags, limiting their usefulness for policymakers who need to respond to rapidly changing economic conditions. This paper aims to nowcast four TiVA indicators across a panel of 41 economies, both at the aggregate (economy-wide) level and for 24 industry sectors. The analysis relies on gradient boosted trees and other machine-learning techniques in a panel-data setting. The resulting nowcasting algorithms improve forecasts compared to an autoregressive benchmark model and yield relatively low prediction errors at a one- and two-year horizons, although model performance varies across countries and sectors.

Stefano D'Angelo, Claudio Di Berardino & Giuseppe Pernagallo

Do reshoring and nearshoring drive reindustrialization? The case of Germany

This study investigates the evolution of the German manufacturing sector in response to recent global disruptions, such as COVID-19. Using a new multi-country input–output framework, we analyze whether reshoring (bringing production back to Germany) and nearshoring (relocating it to neighboring European countries) have contributed to a process of reindustrialization. Our results indicate a clear shift in manufacturing value chains, particularly in medium-high-tech sectors, toward domestic and regional production. These sectors have increased employment within Germany and the EU while reducing dependence on distant (non-EU) production, suggesting a growing preference for resilient and regionally integrated supply chains. Concomitantly, the integration of services, particularly knowledge-intensive business services, has reinforced this transformation by supporting innovation and operational efficiency, reflecting the ongoing transformation to a knowledge-based economy. This study provides new insights into the changing geography of manufacturing and highlights the importance of reshoring and nearshoring as strategic responses to global uncertainty.

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Hong Chen, Abdul Rais Abdul Latiff, Soo Y. Chua & Xiu Wei Yeap

Who benefits from carbon emissions? Redefining production benefits in the benefit principle

Existing methods for allocating carbon emissions rely on production volumes and consumption, often misaligning emissions with production benefits. This study redefines production benefits as the gains received by factor providers (e.g. wages and profits) rather than those received by producers. We propose a benefit principle that attributes carbon emissions based on both production and consumption benefits. Our findings show that this approach allocates more emissions to developed countries and fewer to developing ones, reveals higher emissions embodied in trade, and highlights distinct national patterns: in India and Iran, emissions attributed to profits exceed those from wages, while China shows higher emissions linked to capital depreciation. These results suggest that climate policies should prioritize developed economies and better address trade-related emissions. Additionally, India and Iran should focus on profit-driven emissions, while China should address capital-related emissions. This method helps reduce allocation disputes and offers broader applicability for allocating other pollutants.

Luca Tausch & Guilherme Magacho

Challenges in the transition to a low-carbon economy for developing countries: estimating capital-use matrices and imported needs

The low-carbon transition in developing countries requires large investments in new technologies, which will generate a high demand for imported machinery and equipment. To account for the important role of investment in the transition, we endogenize fixed capital in the input-output (IO) framework, estimating capital-use matrices for six developing countries in Latin America and the Caribbean within the Gloria sectoral framework from 1990 to 2020. Our findings suggest that the inclusion of capital in the IO framework reveals a substantial deepening of the external constraint for developing countries. For every dollar invested, on average more than 45% leaks directly and indirectly to foreign producers through imports. Some socio-economic benefits of green investment, such as employment generation, are absorbed by the rest of the world, rather than fostering domestic job creation. Thus, as developing countries embark on their low-carbon trajectory, they will face an increased external constraint and substantial socio-economic imbalances.

Stefano Deriu, Ludovica Almonti, Francesca Severini, Rosita Pretaroli & Claudio Socci

Key sectors for gender pay gap reduction: a multiplier effects analysis for Chilean economy

Recently, the Chilean government embarked on a phase of redefining fiscal policies with the aim of addressing gender pay equity (*Equidad Salarial*). In this context, this paper emphasises the crucial role that a disaggregated and general equilibrium approach can play in supporting the Chilean policymakers, particularly in the formulation of policies for the reduction of gender pay gap in specific sectors and the integration of female employment. The analysis is carried out using a gender Computable General Equilibrium model based on the gender Social Accounting Matrix for Chile. The simulations reproduce an expansion of final demand for investment by commodity under different assumptions on the elasticity of substitution between male and female labour. The results suggest that some productive sectors, more than others, have aptitudes to reduce the gender pay gap and stimulate employment and economic growth, if stimulated by fiscal policies.

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Chen Xu, Max Munday & Calvin Jones

Can an information and communication technology (ICT) satellite account help us to understand digital sovereignty?

The concept of 'digital sovereignty,' relating to a nation or region's ability to assert control over its digital infrastructure, data, and capabilities, is increasingly embedded in strategic policy towards key parts of the information and communication technology (ICT) industry. However, there are few tools available that enable us to better understand the interconnections and interdependencies between supply and use of ICT products and services in an economy, as well as dependence on externally produced ICT goods and services. This paper investigates how an ICT satellite account can provide valuable insights across various industries and products. We employ satellite accounting methods to identify key elements of the significance of the ICT industry and show that such an accounting framework might inform debates over digital sovereignty.

Krisztián Koppány

Two problems with the use of the cost-push input–output price model

This paper identifies two problems related to the use of the cost-push input–output (IO) price model that have not been previously discussed in the literature. These problems and their proposed solutions are presented with numerical examples and illustrative applications. The first issue relates to the variation of export exchange rates, which cannot be modelled within the framework, yet affects the output-price index. Without addressing this problem separately, the model yields an incorrect result. The second issue concerns the available data compatible with IO tables and IO price analyses, specifically the output price deflators or implicit price indices. Being of the Paasche-type, these indices are better suited for retrospective studies than for forecasting. This paper proposes a basic decomposition framework for analysing output price inflation both before (ex-ante) and after (ex-post) it occurs. For the ex-post analysis, a simplified empirical application for Hungary illustrates the practical potential of the model.

Gilang Hardadi & Stefan Pauliuk

The impact of sectoral aggregation on the elasticities of substitution in modeling translog cost functions

The appropriate level of sector aggregation should adequately capture sectoral variations in elasticities while adhering to the regularity conditions of the aggregate production function. This study uses EU-KLEMS panel data on production inputs and price indices, along with EXIOBASE v3.6 time-series data (1995–2016), to investigate the impact of sector aggregation on modeling translog cost function and to determine the optimum resolution level. The cost function is modelled using dynamic translog in the Generalized Method of Moments (GMM) estimation method, which better addresses concavity violations compared to pooled or fixed-effect models. Selecting a higher resolution level improves model fittings, although it occasionally leads to increased concavity violations. The optimized level of sector aggregation obtained is at 86 sectors, capturing the different elasticities of substitution in manufacturing sectors of basic materials and electricity production. Addressing this elasticity variation is crucial, especially in modeling energy policies.

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Haiyan Zhang, Yu Hua, Yue Xu & Michael L. Lahr
Tracking China's household carbon footprint (1997–2017): insights from drives and supply chain analyses

Rising household consumption has significantly increased China's carbon footprint, posing challenges to its '2060 carbon neutral' target. Herein we examine the evolution of household emissions from 1997 to 2017 by combining structural decomposition analysis (SDA) with structural path analysis (SPA). Results show that indirect emissions attributed to Chinese households have been stabilizing, while their direct emissions – particularly in rural areas – continue to grow. Improved energy efficiency, a cleaner energy mix, greener production, and greener household consumption have lowered indirect CO2 emissions since 2007. SPA further identifies that a few sectors, like electric power generation and transportation services, have developed longer and more fragmented supply chains, countering upstream efficiency gains. Thus, our combined SDA and SPA approach enables new insight into what drives changes in CO2 emissions. We consequently recommend access to cleaner energy resources, targeted mitigation policies, and government support of low-carbon lifestyles.

Eduardo Rodrigues Sanguinet, Patricia Batistella, Fernanda Castilhos França de Vasconcellos, Adelar Fochezatto & Augusto Mussi Alvim
The gendered content of trade: regional impacts in a constrained economic scenario for Brazil and Chile

Input–output constrained disturbances significantly impacted the gender gap in the labour market. In Brazil and Chile, women experienced greater relative job and income losses during economic shocks, such as the COVID-19 pandemic, due to structural factors like gender and regional inequality, as well as the high concentration of women in the services sector, which was particularly affected by input–output linkages between core and peripheral economic areas. This paper examines the direct and indirect impacts of economic constraints on regional production systems, focusing on gendered labour footprints, income-based multipliers, and industry-level analysis. It estimates the gender-based labour content of trade in interregional and export markets, considering the economic challenges brought about by the COVID-19 pandemic. The findings suggest that value-added generated by female workers were more affected in areas specialising in natural resources and services industries, with economic constraints likely propagating the gender gap along supply chains.

Eva Alonso-Epelde, María Victoría Román de Lara, María Moyano-Reina, Xaquín García-Muros, Manuel Tomás, Mikel González-Eguino & Iñaki Arto
Balancing the scales: gendered impacts and policy responses to oil price shocks in Spain

This paper analyses Spanish households' vulnerability to oil price shocks from a gender perspective and explores different compensatory policies to reduce it. The methodological approach combines an input–output price model and a microsimulation model based on the Household Budget Survey. The paper studies the impacts of the recent surge in oil prices using four scenarios based on different alleviation measures (discounts on fuels, subsidies for public transport, and a combination of the two). Gender implications are analyzed considering the gender of the household reference person and the household feminization degree. The results show that oil price shocks have a more significant impact on those households with greater mobility needs, dependence on private transport, and less accessibility to public transport. Among the policy responses, subsidizing public transport would be the most effective policy from an economic point of view and the fairest from a gender and social justice perspective.

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Highlights in journals

Yuli Shan, Kailan Tian, Ruoqi Li, Yuru Guan, Jiamin Ou, Dabo Guan, Klaus Hubacek

Global methane footprints growth and drivers 1990-2023

Nature Communications

Methane is the second-largest contributor to climate change, responsible for about 30% of global warming. While countries have set reduction targets, knowledge of methane trends and drivers—especially from a consumption perspective—remains limited. This study examines methane emissions across 120 sectors in 164 countries from both production and consumption viewpoints (1990–2023), and assesses their decoupling from economic growth. We find no global slowdown in methane emissions; only a few developed economies achieved strong decoupling. Trade contributes ~30% of emissions, with flows shifting from North-North and North-South to South-South, reflecting developing countries' rising role in supply chains. From 1998 to 2023, reductions in emission intensity through efficiency gains and cleaner technologies partly offset demand-driven increases, while structural changes in demand have fulled growth since 2008. These findings improve understanding of methane dynamics and provide insights for integrating methane into climate mitigation strategies.

L. Dary Beltran, Manuel Alejandro Cardenete & Ferran Sancho

Designing an ecotax on carbon emissions to meet EU targets: a proposal for the Spanish economy

Journal of Cleaner Production

We examine the implementation of a carbon emissions tax in Spain as a strategy to help meet the European Union's climate targets. The study highlights the controversial nature of environmental taxes, which, despite ongoing debate, can effectively reduce emissions and promote environmental sustainability. The objective is twofold: first, to analyse the economic implications of introducing a bespoke environmental tax in Spain, where such taxation is rarely used; and second, to evaluate two approaches to recycling tax revenues to maximise overall benefits, tailored to the economic context. A novel methodology is employed to capture market interactions and assess the potential environmental and economic outcomes of the proposed ecotax. In addition to offering an updated analysis for Spain, this study contributes to the literature by applying a methodology that incorporates feedback between prices and quantities. This approach overcomes the limitations of standard input-output models without relying on a computable general equilibrium model, which may involve untested assumptions. One key finding is the identification of the tax rate required to meet the 2030 emissions reduction targets. Another is that recycling revenues through labour tax reductions lead to a smaller economic contraction and greater emissions reductions. Additionally, maintaining the public deficit results in better emissions outcomes and has a positive effect on employment, despite a more pronounced decline in Gross Domestic Product. These findings underscore the importance of designing environmental policies that are carefully tailored to a country's specific circumstances.

Su B., Ang B.W.

Semi-closed Input-Output and Structural Decomposition Analysis of Embodied Emissions and Intensities

Energy Economics

Input-output (I-O) analysis has been widely used in energy and emission studies, including in embodiment and intensity analyses. Most previous studies use the open I-O model (IOM) which does not account for household expenditure patterns within the system. When endogenizing the household sector, the semi-closed IOM provides feedback effects where the incomes generated by production are spent by households on goods and services. This will influence further production. Very few studies have compared the embodiment and aggregate embodied intensity (AEI) results obtained using the two different approaches, i.e., semi-closed IOM versus open IOM. None has dealt with the differences between the two IOM approaches in quantifying the drivers of embodiment and AEI changes. This paper proposes a systematic framework to study and compare their differences. An empirical study using China's latest datasets (2017 and 2020) is presented to reveal the scale of the differences at the final demand and sectoral levels. Implications of the findings and future research are discussed.

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Chengqi Xia, Can Wang, Ying Fan & Heran Zheng
Heterogeneity in carbon footprint trends and trade-induced emissions in China's urban agglomerations
Communications earth & environment

Mitigation at the city level is vital for climate goals, yet most strategies overlook intercity interactions. This study examines carbon footprint changes in 16 Chinese urban agglomerations from 2012 to 2017 using city-level input-output models. Five agglomerations reduced emissions, six increased, and five plateaued. Drivers of reductions include consumption decline (Harbin-Changchun, 97.7%), low-carbon consumption (Beijing-Tianjin-Hebei, 701.4%), and technological advancement (Shandong Peninsula, 124.3%). Increases stem from rising per capita consumption, while plateaus reflect a balance of production and consumption factors. Although local emissions fell by 351.9 Mt, intercity trade raised external emissions by 801.7 Mt. A no-trade scenario shows trade-induced reductions declined from 1562.7 Mt in 2012 to 1374.5 Mt in 2017, indicating weakening trade mitigation. By 2017, 11 agglomerations still achieved net trade reductions, while others saw increases, underscoring regional heterogeneity. The findings stress the need for region-specific strategies integrating production, consumption, and trade to reduce urban carbon footprints effectively.

López, L. A., Ortiz, M., García-Alaminos, Á: Cardarso, M. Á.
Consequences of legislation-based reshoring for EU carbon emissions in global value chains
Journal of International Business Policy

The increased vulnerability of global value chains (GVCs) to events such as pandemics and wars has put reshoring trends—i.e., returning some previously delocalised activities back to the home country or nearby regions and like-minded countries—in the spotlight. The GVC reconfiguration resulting from potential backshoring, nearshoring or friendshoring processes may have crucial consequences for the fight against climate change that need to be assessed. Using an environmentally extended multiregional input–output model, combined with the source-shifting technique and international trade data, we evaluate the impact of reshoring five strategic products according to the European Union (EU) industrial policy orientation on the EU carbon footprint. In all the simulated scenarios, there is a net saving in the EU's carbon footprint, which depends on the sector considered. In relative terms, reshoring scenarios allows for diversification and a reduction in the transitional climate change risks of the sectors involved. We find synergies between resilience and climate change goals and show how supplier selection through GVCs helps firms to achieve evidence-based mitigation goals.

Tobarra, M. Á.; López, L. A.; García-Alaminos, Á. and María-Ángeles Cadarso
Identifying critical EU carbon emissions risk through global value chains
Structural Change and Economic Dynamics

Global value chains (GVC) are a key element in discussions about trade dependencies/bottlenecks and recent EU policy proposals. Similarly, carbon-emissions reduction measures feature predominantly in the design of EU strategies and require sector-detailed knowledge about where emissions are generated along GVC. We use input-output techniques to identify carbon upstream and downstream sectoral hotspots within EU's GVC and classify industries according to their exposure to changes in carbon-related and trade policy. We introduce a novel (climate-reshoring, CRI) index to measure carbon dependency and apply it to sectors currently targeted by EU policy for potential backshoring. Our results show that sectors demanding and supplying high-carbon-emissions goods are different, implying that EU countries' differences in exposure depend on their industrial structure and trade patterns. Top downstream-imported emissions come from Russian refined petroleum products, while upstream-emissions EU hotspots include Electricity & gas, Basic metals from China and Russia, and Chinese Chemical and Other non-metallic products. Regarding CRI, the sectors most at risk by carbon dependencies and trade disruptions are Computer, electronic and optical equipment; Pharmaceutical; and Electrical equipment, all identified as critical by EU's Open Strategic Autonomy. Core-EU economies and large Southern countries show the highest levels of CRI, mainly due to their dependence on critical foreign sectors rather than a high imported emissions risk index.

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Su Y.F., Su B., Yu S.W.
How Coopetition between Domestic and Multinational Firms Shapes Carbon Emissions Performance in Global Supply Chain?
Structural Change and Economic Dynamics

The importance of climate action, as outlined in the sustainable development goals (SDGs), has promoted firms worldwide to pursue low-carbon transitions. However, the impact of coopetition between domestic and multinational firms within supply chains on global carbon emissions performance remains unexplored. Thus, this study addresses this issue using an inter-country inter-industry Input-Output database (2000–2019) that distinguishes heterogenous firm ownership. The results show that: (1) the competition mechanism between domestic and multinational firms within global supply chains is more effective in improving global carbon emissions performance than the cooperation mechanism; (2) although the competition mechanism can enhance carbon emissions performance in developing countries, supply chains of purely multinational firms under this mechanism exacerbate the widening gap between developed and developing countries in balancing carbon emissions and value added; (3) key regions that determine the carbon emissions performance of global supply chains are significantly affected by coopetition mechanisms, whereas key economic sectors and final demands are not; and (4) coopetition mechanisms reshape the driving role of carbon intensity effect and demand structure effect on carbon emissions performance of various global supply chains, but the production structure effect remains largely unaffected.