Newsletter
Number 63, Feb 2026

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 Update of the IO databases, details on some recent conferences, 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.

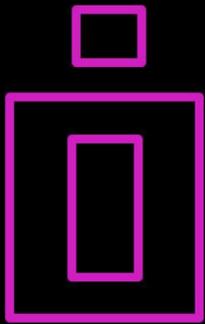*Jing Meng*
IIOA Newsletter Editor
University College London
Newsletter E-mail: newsletter@iioa.org
Personal E-mail: jing.j.meng@ucl.ac.uk

Would you like to contribute to the IIOA newsletter?
Send us your news at newsletter@iioa.org

In this issue

A message from IIOA President: Dr. Kuishuang Feng

Professor, University of Hong Kong, Hong Kong
President of the International Input-Output Association (2025 – 2027)
Council Member of the International Input-Output Association (2021-2027)
Member of the International Input-Output Association since 2007
Leontief Memorial Prize Winner (2013)
Editor-in-Chief, Sustainable Production and Consumption
Editor, Ecological Economics
Highly Cited Researcher (top 1%) by Clarivate

Dear IIOA Members,

Please join me in welcoming our newly elected Council members—Norihiko Yamano, Sanjiv Mahajan, and Umed Temursho. Your commitment to serving the IIOA is greatly appreciated, and I look forward to working closely with you. I also extend warm congratulations to Kirsten Wiebe and Norihiko Yamano on their election as Vice Presidents of the IIOA, and to Sofía Jiménez Calvo on her appointment as Director of the International School of Input-Output Analysis (ISIOA). Your leadership and expertise will undoubtedly strengthen our association.

The current ISIOA directorate also includes Deputy Director Francesca Severini, Management and Admission Coordinator Mattia Cai, and Certificate Coordinator Luis Pedauga. Congratulations to the entire ISIOA leadership team.
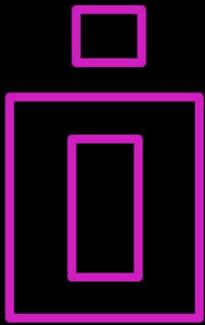
I am pleased to announce that the 32nd International Input-Output Association Conference, the 11th SHAIO Conference on Input-Output Analysis, and the 14th Edition of the International School of Input-Output Analysis (ISIOA), together with the 5th Spanish School of Input-Output Analysis (ESAIO), will be held in Seville, Spain. This marks the first joint conference between the IIOA and a regional IO association—an important milestone that brings regional and international IO communities together to exchange knowledge, strengthen networks, and build collective capacity. My sincere thanks go to Dr. María Teresa Álvarez Martínez, Chair of the Local Organizing Committee, and to Dr. José Manuel Rueda Cantuche and Dr. Alfredo Mainar Causapé, Scientific Committee Co-Chairs, for their dedicated efforts.

I encourage all members to participate and look forward to an engaging and successful conference this summer. Let us continue working together to advance input-output research and further strengthen our global community. I look forward to connecting with many of you in the months ahead.

Best regards,

Kuishuang Feng

Databases

CEADs launched China's Provincial Multi-Regional Input-Output Database for 2018 and 2020

The U.S.-China trade friction in 2018 and the COVID-19 pandemic in 2020 have significantly influenced China's domestic supply chains, with their impacts varying considerably across regions and sectors. Multi-regional input-output (MRIO) models are widely used to track supply chains and analyze cross-regional spillover effects, playing a key role in understanding economic linkages and environmental impacts. However, due to data unavailability, existing MRIO tables fail to capture the impact of the U.S.-China trade friction and the COVID-19 pandemic on China's regional supply chains.
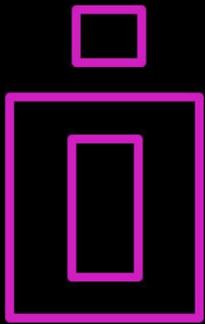
To address this data gap, we employ hybrid methods to construct Chinese MRIO tables for 2018 and 2020, covering 31 regions and 42 sectors. This dataset is consistent with our previous work on the China provincial MRIO model for the years 2012, 2015, and 2017, offering insights into how regional supply chains and economic structures adapted to the combined impacts of the trade war and the COVID-19 pandemic.

The MRIO tables are publicly available via the China Emission Accounts and Datasets (https://www.ceads.net/data/input_output_tables/) and Figshare (https://doi.org/10.6084/m9.figshare.29927291).

The Methodology Paper is available in:
https://www.nature.com/articles/s41597-025-06543-y

CEADs **Carbon Emission Accounts and Datasets**

Databases

GLORIA MRIO database Release 060: Version 060 of the global multi-region input-output database GLORIA has been released! This update includes the most recent Global MRIO tables, satellite accounts, uncertainty information, and diagnostics.

This database has been created in the Global MRIO Lab by a collaboration between the University of Sydney and NIES Tsukuba, and is distributed by UNSW Sydney. The dataset is available through the following link: https://ielab.info/resources/gloria. Full details on the dataset and changes from previous versions are provided in the Release Notes and ReadMe files.

GLORIA is made available under a Creative Commons Attribution Non-Commercial license (https://creativecommons.org/licenses/by-nc/3.0/au/). Commercial applications are managed by FootprintLab (https://www.footprintlab.io). The symbiotic relationship between FootprintLab and the universities involved allows for financial security for research and improvement of the data, which are increasingly used for strategic decision making in business.

The creators hope GLORIA v060 will be a valuable resource for the IIOA and Industrial Ecology communities as well as business partners. Feedback or comments are welcome via the IELab Forum: https://ielab.info/forum

Any use of this database must be acknowledged by citing:

- Lenzen, M., A. Geschke, M.D. Abd Rahman, Y. Xiao, J. Fry, R. Reyes, E. Dietzenbacher, S. Inomata, K. Kanemoto, B. Los, D. Moran, H. Schulte in den Bäumen, A. Tukker, T. Walmsley, T. Wiedmann, R. Wood and N. Yamano (2017) The Global MRIO Lab - charting the world economy. Economic Systems Research 29, 158-186.

- Lenzen, M., A. Geschke, J. West, J. Fry, A. Malik, S. Giljum, L.M.i. Canals, P. Piñero, S. Lutter, T. Wiedmann, M. Li, M. Sevenster, J. Potočnik, I. Teixeira, M.V. Voore, K. Nansai and H. Schandl (2021) Implementing the Material Footprint to measure progress towards SDGs 8 and 12. Nature Sustainability, https://doi.org/10.1038/s41893-021-00811-6.

Suggested wording: We used Release 060 of the GLORIA global environmentally-extended multi-region input-output (MRIO) database (Lenzen et al. 2021), constructed in the Global MRIO Lab (Lenzen et al. 2017).
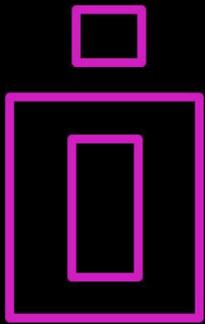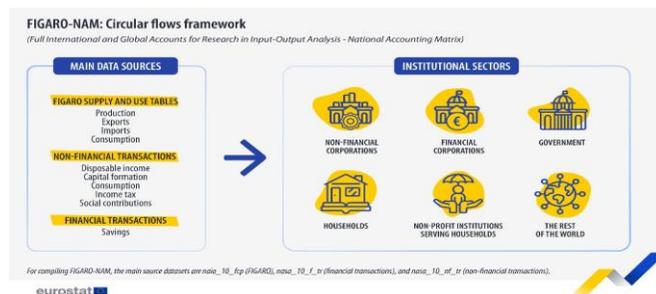
Databases

FIGARO-NAM: Multi-country National Accounting Matrices based on FIGARO – 2025 edition, the database has been developed by the European Commission's Joint Research Centre (JRC), with the support of Eurostat, and has been released as new experimental statistics.

The FIGARO-NAM database is a National Accounting Matrix derived from the FIGARO tables (Full International and Global Accounts for Research in Input-Output Analysis) and aligned with the System of National Accounts, to include the complete circular flow of income of an economy. FIGARO-NAM expands the existing FIGARO tables, which focus on production and consumption, by adding information on income generation, income distribution, capital formation and more. This new resource links data on production and consumption with data on income and saving, helping users understand how economic flows move between institutional sectors and how they interact with industries and products.

The FIGARO-NAM database encompasses 49 countries, one rest-of-the-world region, 64 industries, and 64 products. It shows how different sectors within the domestic economy interact, enabling economic modelers and policymakers to assess the socioeconomic impacts of EU trade and industrial policies, among other areas.

Links :
FIGARO NAM database: https://circabc.europa.eu/ui/group/cec66924-a924-4f91-a0ef-600a0531e3ba/library/51ea2943-4fe8-4216-9ec7-d746b307f5d9?p=1&n=-1&sort=name_ASC
FIGARO NAM Statistical working paper:
https://ec.europa.eu/eurostat/en/web/products-statistical-working-papers/w/ks-01-25-050
National accounting matrices based on FIGARO:
https://ec.europa.eu/eurostat/web/experimental-statistics/national-accounting-matrices-figaro
Experimental statistics:
https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20251209-1
FIGARO database:
https://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/information-data#figaro
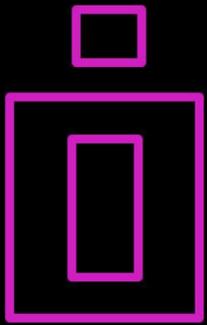
FIGARO-NAM: Circular flows framework
(Full International and Global Accounts for Research in Input-Output Analysis - National Accounting Matrix)

Conferences

32nd International Input-Output Association Conference

The 32nd International Input–Output Conference / 11th SHAIO Conference will bring the global input–output community together in Seville, Spain, continuing a long-standing tradition of innovation, collaboration, and impactful research in Input–Output Economics.

Building on the success of the 2023 European conference, this event marks the first joint conference of IIOA and SHAIO, representing an important milestone in international academic exchange.

Under the theme *"Advancing policy resilience through input–output economics: global, regional, and local perspectives",* the 2026 conference invites contributions that demonstrate how input–output methods can inform policy responses to key challenges, including climate change, the green transition, digitalization, and post-pandemic recovery. Researchers are encouraged to explore applications of input–output economics that strengthen policy resilience across global, national, and regional scales.

You find the Call for Papers here:
https://www.iioa.org/conferences/32nd/call_for_papers.html
All important due dates for the event are listed here:
https://www.iioa.org/conferences/32nd/important_dates.html
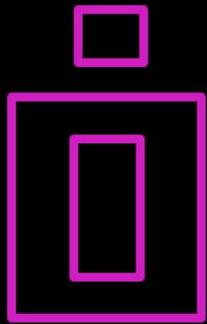
Workshop

22nd Workshop on Economic Modelling: Computable General Equilibrium Analysis of International Trade and Tariff Disruptions using GTAPinGAMS and MPSGE

Responses to global challenges such as international trade conflicts or climate change should be based on the systematic impact assessment of alternative policy options.

Advanced trade structures including Krugman (1980), Melitz (2003), Bilateral Representative Firms (BRF), industrial carbon tariffs, optimal tariffs and trade wars, CO2 emissions embodied in bilateral trade, and trade models for climate policy analysis, are among the specific topics to be covered during he workshop for the analysis of different policy options.

The workshop will show in detail how to transform algebraic CGE models into non-algebraic MPSGE syntax which can substantially lower the entry barriers and time cost of CGE analysis n both – algebraic and non-algebraic – cases, CGE models are stated as mixed complementarity problems (MCP) which link equilibrium conditions as nonlinear inequalities with complementary non-negative economic variables. The fundamental strength of CGE models implemented as MCP is the ability to handle corner solutions and regime shifts that might be central to the analysis of discrete production decisions (e.g. firm location) or the selection of international value chains (e.g. switching of trade links).

The workshop will consist of four segments:

Part 1: Economic Equilibrium and Mixed Complementarity Problems (MCP)
Part 2: Empirical trade theories and data management using GTAPinGAMS
Part 3: Standard CGE trade models for policy analysis
Part 4: Advanced trade structures and large-scale applications

Enrolment is limited to 15 participants to ensure efficient, close interaction. For further information, please visit https://wem.ulpgc.es/, or check the 'Take a GAMS course' section at https://www.gams.com/.

Department of Applied Economic Analysis at the University of Las Palmas de G.C. (Canary Islands, Spain), 16th – 20th March 2026
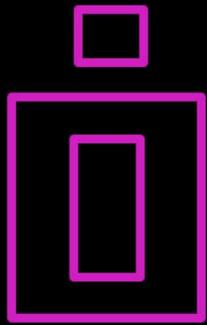
INTERNATIONAL INPUT-OUTPUT ASSOCIATION

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.

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 CO_2 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 CO_2 emissions. We consequently recommend access to cleaner energy resources, targeted mitigation policies, and government support of low-carbon lifestyles.

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.
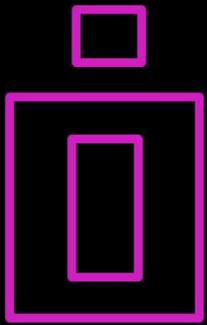
Stefano D'Angelo, Claudio Di Berardino & Giuseppe Pernagallo

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.

**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.

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.
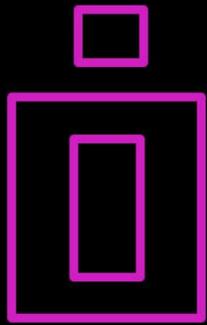
Gilang Hardadi & Stefan Pauliuk

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.

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.
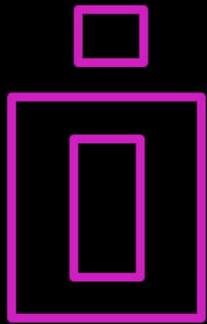
Latest ESR articles

Economic Systems Research

Journal of the IIOA

Latest articles (up to 03 Feb)

Yu-Wen Su, Ya-Syun Syu & Yu-Hsin Yao

Quantifying carbon reduction from dietary behavioral changes in Taiwan

Achieving net-zero emissions requires not only technological transitions but also changes in everyday lifestyle choices. Although many governments promote green lifestyle behaviors, few studies quantify how much carbon reduction different behaviors can realistically achieve. This study develops the Green Lifestyle Economic Behavior (GLEB) Model, a consumption-based framework that uses Taiwan's data to estimate carbon emissions associated with dietary consumption. By decomposing emissions into two components – consumption quantity and carbon intensity – we evaluate multiple dietary behavioral scenarios. The results show that, when accounting for both per-capita carbon reduction and the likelihood of widespread adoption, eating locally and seasonally and choosing unprocessed foods offer the highest aggregate reduction potential. The GLEB Model provides a systematic method for governments to prioritize lifestyle-based mitigation policies and identify high-impact behavioral interventions. The findings demonstrate that individual actions matter; targeted behavioral changes can unlock meaningful carbon reductions with minimal disruption to daily life.

**Inácio F. Araújo, Kieran P. Donaghy, Eduardo A. Haddad & Geoffrey J.D. Hewings**

Supply-chain propagation of local economic shocks: an interregional general equilibrium analysis of the ISIS conflict in Iraq

Extreme events, particularly human-induced conflicts, pose complex challenges for measuring higher-order effects and their geographical propagation through supply chains. This study develops an interregional computable general equilibrium model to evaluate conflict-related disruptions, integrating input–output linkages and resilience modeling to capture higher-order effects across regions and sectors. We apply the model to the ISIS conflict in Iraq (2014–2017), using an interregional input–output table for 18 Iraqi governorates. The analysis estimates GDP and gross regional product losses, identifies vulnerable sectors, and quantifies regional spillovers from conflict-induced shocks in capital stock, labor markets, and household income. The results reveal significant economic losses in directly affected governorates, offset by modest gains in indirectly affected regions due to spatial substitution in supply chains. This methodology provides a practical tool for post-conflict economic assessment, adaptable to other extreme events, such as natural disasters or climate-related shocks, and supports policymakers in prioritizing recovery and resilience strategies.

Kirsten S. Wiebe, Fabian R. Aponte, Kristine Bly, Nikki Luttikhuis, Moana S. Simas, Meron A. Arega & Adrian T. Werner

Linking the sustainable development goals to input–output analysis: sensitivity of indicators to global input coefficients for renewable electricity production

To achieve a climate-neutral economy, the deployment of low-carbon technologies is accelerating. Their impacts inherently involve trade-offs among the UN Sustainability Development Goals (SDGs) due to the complexity of global value chains (GVC). To capture these effects, we develop a framework connecting future technology adoption to changes in GVC as represented in global multi-regional input–output data. This allows translating GVC data into more than 30 SDG indicators. We apply this framework to examine effects of offshore wind and solar PV adoption by changing the structure of electricity production. Results show that impacts vary significantly across technologies, highlighting the importance of identifying trade-offs individually. We further assess the sensitivity of the results to technological change and shifts in the trade structure of the renewable electricity industry. The findings indicate that for some SDG indicators, even small changes in input-coefficient assumptions, especially trade coefficients, can shift the impacts between positive and negative.
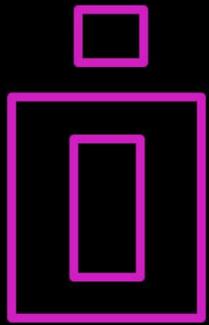
Jérôme Verny, Youssef Bouazizi, Ouail Oulmakki & Luc Savard

Invisible chains of conflict: economy-wide spillovers from an agricultural shock in Ukraine – mixed input–output evidence

This article quantifies how a conflict-related agricultural supply shock propagates through Ukraine's economy. Instead of the conventional demand-driven Leontief model, we use a mixed input – output model that introduces the shock directly as a capacity constraint in agriculture. In our central scenario, a 25% reduction in the agricultural workforce leads to a 4.6% decline in GDP, and impacts spread rapidly beyond farming. Sectors highly dependent on agricultural inputs are hit hardest, with chemicals (−30%) and motor vehicles (−28.8%) showing the largest losses, while public services remain comparatively stable. Sensitivity and robustness checks indicate near proportional effects, consistent with fixed-coefficient technologies and short-run rigidities. The results reveal a hierarchy of vulnerabilities and provide policy-relevant benchmarks to help secure critical supply chains and strengthen economic resilience against cascading shocks.

**Rui Benfica, Patricia Zambrano, Judy Chambers & Jose Falck-Zepeda**

Assessing the development impacts of bio-innovations: the case of genetically modified maize and cassava in Tanzania

Tanzania's agriculture is characterized by low productivity due to unpredictable rainfall and the prevalence of pests and diseases. Genetically modified (GM) maize offering protection against drought and insects are being developed. Likewise, GM varieties resistant to cassava brown streak disease were developed. Building on prior crop-based analyses, we use the Rural Investment and Policy Analysis (RIAPA) CGE model to assess the impacts of the adoption of those GM crops. GM maize and cassava have positive effects on the economy, the Agri-Food System (AFS), and poverty. Given its stronger linkages in the AFS, the effects of the GM maize are stronger, especially in higher adoption and high yield scenarios. Likewise, the effects on the poorest and rural households are greater. The high variation across scenarios, and the significant effect of the high adoption/high yield scenarios, suggests a high return to investments and policies that realize these adoption rates and yield potential.

Ricardo Chiapin Pechansky, Norihiko Yamano & Peter Horvát

The hidden links of trade: mapping female and male workforce in global value chains

Global value chain integration creates economic opportunities but also uneven impacts across firms and workers. Responding to rising demand for data-driven insights on these dynamics, this paper presents new evidence on the connections between jobs held by women and men and global production networks. Using harmonised inter-country input–output and labour data for 43 countries, we introduce a new database that disaggregates employment and labour compensation in global value chains by gender. We show that, in most OECD economies, women are concentrated in non-tradable services, which can mask their true exposure to trade. Through upstream and downstream linkages, women also indirectly contribute to trade by providing inputs to the tradable sectors. This has important implications for understanding gender-related effects of trade shocks, wage gaps, and inclusive-growth policies. Under a harmonised framework, the dataset equips policymakers with tools to design evidence-based strategies that strengthen women's economic empowerment in an interconnected world.
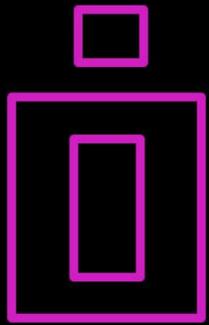
Rajat Verma & Ganesh Sivamani

Modelling the impact of the clean environment cess on India: an environmentally- extended input–output approach

The Clean Environment Cess (CEC) was a tax levied in India on the total sales of all types of coal to reduce emissions and tackle climate change. This paper seeks to simulate the impact of this cess on greenhouse gas emissions and GDP, using an environmentally extended input–output table. The Rs 180/tonne ($2.7) increase to the actual tax rate of CEC in 2016 resulted in a 0.09% reduction in GDP, a 0.90% reduction in emissions from burning coal and petroleum products, and a 0.80% reduction in the emissions intensity. According to our estimates, the coal electricity sector would be most affected by the cess, with a 1.5% reduction in Gross Value Added (GVA). A study found that the cess leads to a 0.47–1.2% reduction in the GVAs of the coal and lignite, cement, crude petroleum, and iron and steel sectors, with emissions reducing across sectors in the same order.

Esteban Fernández Vázquez & Bartlomiej Rokicki

Generalized Cross Entropy estimators and the estimation of interregional trade flows

This paper addresses the challenge of estimating interregional trade flows, a crucial concern for subnational input–output and Computable General Equilibrium models. A commonly used solution is the gravity approach; however, entropy maximization can serve the same purpose. We examine two distinct entropy specifications: the data-constrained Generalized Cross Entropy (GCE) estimator and the moment-constrained GCE estimator. The performance of each estimator is evaluated through numerical simulations. Our results show that entropy-based estimators yield more accurate results than the gravity model, once the possibility of potential errors in row or column totals is taken into account. The larger the potential error and the higher the number of regions, the greater the difference in accuracy between the gravity model and GCE estimators. Additionally, we find that the moment-constrained GCE estimator appears to be more accurate than the data-constrained GCE estimator under specific conditions.

Michel Eduardo Betancourt-Gómez

The impact of market concentration and economies of scale on production networks: a new nonlinear input–output framework

The traditional Leontief input–output model analyzes an economy's productive structure under the assumption of perfect competition. However, this limits its ability to capture the impact of market concentration and economies of scale in production networks. This article proposes a new methodological framework that explicitly incorporates these elements via a nonlinear reformulation of the model. The strategy has two stages: first, a theoretical reformulation that incorporates concentration and scale indicators, and second, econometric estimation of those parameters. The methodology is applied to Mexico using the most recent available input–output table. The results suggest that concentrated industries significantly influence intersectoral relationships. This proposed method opens a new line of research with promising potential for investigating how market concentration shapes the demand for intermediate inputs and influences economic development.

See all latest articles in ESR, volumes and issues

Submit an article
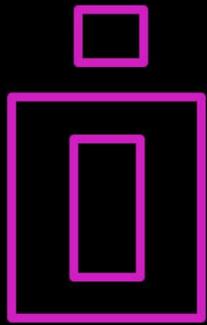
Highlights in journals

Qingling Wang, Han Zhang, Meng Li, Heran Zheng
Ignoring food affordability biases environmental assessments of China's healthy diet transition
Environmental Impact Assessment Review

The Chinese Dietary Guidelines (CDG) establish benchmarks for healthy dietary transitions. Yet complying with CDG can be expensive, putting the recommended diet out of reach for many low-income populations. Previous studies assume universal adoption of CDG, overlooking food affordability concerns and thereby biasing environmental impact estimates of dietary transitions. This study integrates affordability as an economic constraint into the traditional CDG to formulate optimized versions for China's rural populations. Using the recent household consumption data (2015) and a multi-regional input-output (MRIO) model, we estimate four environmental footprints of their anticipated dietary shifts. We found that neglecting affordability constraints can lead to an overestimation of environmental burdens related to GHG emissions (0.49 Gt CO_2-eq), land use (25.29 kha), and eutrophication (1.85 Mt PO_4-eq), while underestimating the benefits in water use, which could potentially save 0.24 Bm3. On average, when affordability constraints are incorporated, the estimated environmental footprint of expected dietary transitions is approximately 38.4 lower than that of the original CDG scenario. Dairy and beef collectively account for 44.2–83.3% of this reduction, which is mainly attributable to rural populations' limited food budgets.
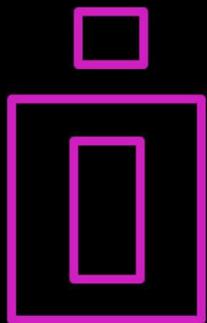
Qingling Wang, Han Zhang, Kuishuang Feng, Pan He, Richard Wood, Peipei Tian, Yiming Wang, Saige Wang, Yu Liu, Huifang Liu, Heran Zheng
Implications of demographic policies on China's food-related environmental footprints amid population ageing
Global Environmental Change

This study quantifies China's four food-related environmental footprints under representative demographic policy scenarios by employing a Quadratic Almost Ideal Demand System (QUAIDS) and a multi-regional input–output (MRIO) model. This study is the first attempt to link China's pro-natalist policies with multi-dimensional food-related environmental footprints through an age-cohort demand model. We find older adults (> 60 years) will become the largest contributor to the nation's total food-related footprints, despite having below-average per capita footprints. From 2020 to 2050, total land use footprint is projected to increase, whereas GHG emissions, water consumption, and eutrophication footprints would decline. Reduction in GHG emissions is primarily driven by declining environmental intensities, while changes in other three footprints are mainly due to dynamic population sizes. Relative to the no-policy baseline scenario, China's demographic policies could lead to an approximate 3–18% increase in environmental footprints by 2050, imposing a notable burden on sustainability targets. Land use footprint would emerge as the most policy-sensitive indicator, with its peak year delayed by at least a decade under the most aggressive fertility-boosting policy. By analyzing dietary change scenarios, we find only ambitious transitions (nationwide adoption of plant-rich diets) can fully offset the policy-induced footprint increases, except for water consumption, in which case plant-rich diets would conversely result in higher footprints.

Yan J.N., Su B.
Energy efficiency impacts from the supply-side structural changes: A multi-principle research of China
Applied Energy Economics

This study established a systematic supply-side research framework for energy intensity, integrating the Ghosh multi-regional input-output (MRIO) model with multiplicative structural decomposition analysis (SDA) under general equilibrium theory and non-competitive imports assumption. To investigate the significant role from the direct and indirect forward industrial linkages, two supply-side energy intensity indicators were proposed, namely the aggregate energy intensity (AI) following the production-based principle and aggregate enabled energy intensity (AEnI) adhering to the income-based one. From the supply side, income-driven regions characterized by a higher AEnI were usually detected in the regions with a well-developed industrial foundation. Meanwhile, production-driven regions featured by a larger AI were always discovered in the resource-intensive and industry-dominated. In 2017, production-driven regions contributed 70.38 % (production-based) and 65.80 % (income-based) to national energy intensity. Alternative accounting principles amplified regional heterogeneity in energy intensity, with disparities between extremes such as Ningxia and Beijing widening by more than 1.5-fold. Unlike the demand-side findings, supply-side efficiency improvements were driven not only by energy intensity effect but also by domestic allocation effect-particularly in income-driven regions. Supply-side structural adjustments consistently enhanced energy efficiency, especially in production-driven.

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

In this paper, we develop a dynamic macroeconomic model of the global economy by combining the Input-Output methodology with Stock Flow Consistent macroeconomic dynamic modelling. It is the first model of its kind to have each industry invest in distinct capital goods based on sector- and asset-specific requirements. The resulting dynamics yield several key insights. The net effect of the above-mentioned expansionary and contractionary forces is to boost GDP growth and entails a high investment share. The relative importance of industries supplying machinery and metals increases. Technological changes stemming from the transition yield mildly deflationary effects. Nevertheless, inflation increases because of rising wage rates. Electricity is the only product whose price decreases with the transition. The only scenario capable of achieving a decline in emissions is the one entailing the strongest transition effort. Finally, electricity production is much higher than projections by the IEA.

Yamuza-Blanco, L., Serrano, F. M., Román-Collado, R., & Sanz-Díaz, M. T.

What is behind the producer GHG emissions footprint of textile and clothing in the EU-27? An environmentally extended multi-regional input-output analysis

Ecological Economics

The article aims to analyse the greenhouse gas emissions footprint of the European Union-27's final textile and clothing producers from 1995 to 2022. The methodology applied combines an Environmentally Extended Multi-Regional Input-Output analysis with a producer footprint analysis, utilizing the Exiobase database. The results indicate that the emissions footprint of producers in the European Union-27's textile and clothing industry decreased by approximately 50 % during the period. However, while the domestic producer footprint saw a reduction of 61 %, the imported emissions decreased by only 27 %. This discrepancy highlights various inefficiencies, demonstrating that importing has a greater emissions impact than domestic production. Additionally, a decoupling analysis is conducted to examine the degree of disassociation between greenhouse gas emissions and the intermediate inputs used throughout the European Union-27's textile and clothing supply chain. In this respect, some supplier partners have positively contributed to decarbonization, underscoring the need for strategic trade relations.

Mukhopadhyay, K., Taron, A.

Evaluating policy measures for a sustainable sanitation service chain: A macroeconomic assessment of Bangladesh

Environment, Development and Sustainability

Ensuring access to improved water, sanitation and hygiene facilities is paramount for achieving Sustainable Development Goal (SDG) 6 – Clean Water and Sanitation. This problem is largely concentrated in Low- and Middle-Income Countries such as Bangladesh which has one of the lowest urban sanitation access rates in South Asia. The objective of this study is to evaluate the socio-economically equitable outcomes, with a focus on the sanitation and hygiene sectors and additionally conduct the economic valuation of Faecal Sludge Management (FSM) along with its co-benefits through organic fertilizer production using an Input–Output framework. Results indicate that the investment in sanitation and hygiene services would increase GDP per capita between US$1.4—US$107 by 2030, with notable growth in total industrial output and employment as high as US$32 billion and 3.9 million respectively by 2030. The positive spillover effects from safely managed sanitation services leads to a Benefit Cost Ratio of 3.33 during the period 2024–30. Effective FSM can boost total industrial production by $153 million and create 18,000 jobs, while also reducing GHG emissions by 7.2 million tCO2eq, thus providing an opportunity to generate US$4.48 million through carbon credits. The study highlights the critical need for increased public and private investments in safely managed sanitation and hygiene services, emphasizing their role in promoting public health and stimulating economic growth.
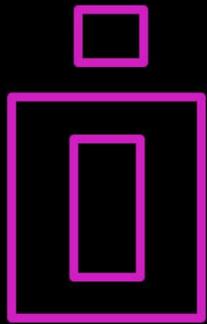
Prabhu, V. S., Mukhopadhyay, K.
Reassessing the Debate on Food vs Fuel Considering the Expansion of the Ethanol Industry in India—An Input Output Framework
BioEnergy Research

India is on track to achieve ethanol-blending with gasoline of 20% (E20) by mid-2025, with the aim of upgrading to E25 by 2030, contributing toward the Sustainable Development Goals 7 and 13. The government is targeting a more diversified portfolio, transitioning from a sugarcane-based ethanol to a rice and maize-based ethanol mix. This study evaluates for the first time the economic and environmental impacts of achieving E25 blending by 2030 using the input–output framework. Results show that maize-based ethanol production has the highest positive macroeconomic impact across total output, GDP, and employment by 0.53%, 0.48%, and 1.69%, respectively, and the least water and GHG footprint compared to sugarcane and rice-based ethanol production. Furthermore, rice and maize-based ethanol leads to the production of 13.5 million tonnes of Dried Distillery Grains, accounting for 13.2% of the livestock feed requirement. Policymakers need to take into consideration the synergy between agriculture and ethanol industries while targeting the decarbonization of the road transportation sector with the long-term goal of net-zero emissions by 2070.

Zhang, J., Ma, B., Hu, X., Wang, Q., Tian, K., Bruckner, M., ... & Zheng, H.
Livestock antimicrobial use embodied in global supply chains
Nature Sustainability

The excessive use of antimicrobials has led to increasing levels of antimicrobial resistance that can spread between livestock, humans and the environment, with important One Health implications. Here we quantify global antimicrobial footprints and trace them through global supply chains from 2010 to 2020. Global livestock antimicrobial footprints peaked at 118.6 kilotons (kt) in 2013, then fell to 84.0 kt by 2020. China and the USA contributed nearly 60% of the global antimicrobial footprint. Most use remained in domestically produced goods, yet the trade-embodied share rose from 16% to 20%, signalling growing cross-border spillovers. Developed economies showed higher per capita use via trade, whereas developing economies' use was concentrated in local production. Brazil surpassed China as the largest exporter of antimicrobials used in livestock production by 2020. Intriguingly, non-food products, particularly the clothing, services and manufacturing sectors, account for half of the trade-embodied antimicrobial footprint. Thus, global spillover of the effects of antimicrobial use extends well beyond the food system thus requiring policymakers to broaden their focus to better address antimicrobial resistance threats.

Tian, P., Feng, K., Chen, X., Li, D., Jiang, M., Li, J., ... & Sun, L.
Consumption inequalities in material use undermining resources sustainability
Nature Sustainability

Growing global material consumption has pushed the Earth beyond safe planetary boundaries, yet little is known about how this burden is distributed across individuals. This study quantifies the inequality in household material footprints (MFs) using detailed global expenditure data from 168 countries, linked with a multiregional input–output approach. Results reveal stark inequalities: the top 10% consumers contribute 36% of global total household MFs, while the bottom 50% of consumers account for merely 18%. Inequality is especially pronounced in non-renewable resources such as metals and fossil fuels. Furthermore, elasticity analysis reveals a recoupling of resource use with high consumption, challenging the notion of absolute decoupling. These findings suggest that current sustainability policies about resource focusing on national efficiency gains may fall short without addressing the material-intensive lifestyles of the affluent. Targeting overconsumption at the top could reduce ecological overshoot and create space for sustainable development and material sufficiency for the global majority.

16