

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Welcome from the Editor



Dear IIOA member,

I am very pleased to release the latest issue of the *International Input-Output Association Newsletter*. Many thanks to all of you that have contributed by sending your inputs.

This issue contains a brief update from the IIOA President Sanjiv Mahajan, the latest ESR articles, highlights in Journals and recent I-O books, and the announcements of some events happening in person soon! You can also find an introduction to the IIOA archive initiative, job positions, a couple of new databases, and other news from the I-O world. The Social Accounting Corner brings this time conversations with Bart Los and Rossella Bardazzi. It is another issue with plenty of interesting news that I hope you will enjoy.

Any feedback, comments or suggestions are greatly appreciated. I also welcome contributions to future issues.

Andre Carrascal Incera

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

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INTERNATIONAL INPUT-OUTPUT ASSOCIATION

A Brief Update from the IIOA President – Sanjiv Mahajan



Dear IIOA Member,

Time is flying by!! Some say, the older you get, the quicker time goes by. Personally, I prefer, the more fun you have, the quicker time goes by.



Some general IIOA matters

Since becoming the IIOA President, various work has been progressing steadily over and above the business as usual, a few examples:

- As previously mentioned, an open process and election from within the IIOA Council completed to select two **IIOA Vice-Presidents**: Kirsten Wiebe and Norihiko Yamano.
- The **IIOA Council** met online (4th March 2022) - this will now be followed by a new initiative of quarterly IIOA Council Meetings.
- Another new initiative, the IIOA Council will meet to discuss **specific IIOA issues** in-between the quarterly IIOA Council Meetings. Two such meetings have been held to date: the IIOA Long-Term Strategy (6th May 2022) led by Bart Los and the ISIOA Future Strategy (20th May 2022) led by José Rueda Cantuche. Both meetings were very useful as a first step in helping to shape the future. Progress and outcomes will be shared with IIOA Members in due course.

- The **IIOA Webinar Programme** work is now being led by Kuishuang Feng and work has progressed to resurrect the IIOA Webinars. Also, Kuishuang, Elmar Hanhofer and I are developing a separate webpage for the webinars. A key date for your diaries, the next IIOA webinar will be held on Thursday, 16th June 2022, at 13.00 Central European Time. We are happy to have Pablo R. Liboreiro (Technical University of Madrid) to cover "Estimating disguised unemployment by means of non-linear input-output analysis".
- I am pleased to convey, the "**Restoration - Towards an IIOA historical archive of treasures**" is now moving to the next stage of development. I am keen for this work to be successful as it will provide many benefits to many I-O aficionado's across the world and avoid losing significant material forever. My thanks to Rossella Bardazzi coordinating the work, and in particular, Bert Steenge and Josef Richter for enthusiastically undertaking a lot of the leg-work. There is more on this wonderful initiative in this Newsletter.
- We are also collating a list of **IIOA Council roles**, responsibilities and initiatives which we will place on the website. This will help to provide IIOA Members a better flavour of the types of IIOA Council activities as well as generate IIOA Members interest in taking up these roles in the future.

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

A Brief Update from the IIOA President – Sanjiv Mahajan



2022 IIOA Conference

The 2022 IIOA Conference in Malaysia is coming soon (28th August to 2nd September 2022). This will be the first physical IIOA Conference since 2019 in Glasgow, Scotland and will be held in the tropical paradise of Langkawi Island, Malaysia.

This will be the 28th IIOA Conference and will hold the 10th Edition of the International School of Input-Output Analysis - four training modules will be available.

Mohd Yusof Saari (LOC Chair), Shigemi Kagawa (SPC Chair) and their teams are working hard to put all the Conference arrangements in place. Further communication will be soon circulated to IIOA Members but please note, Early Registration ends 1st July 2022.

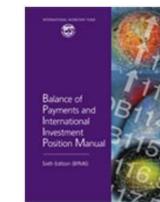
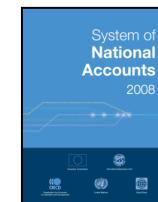
In the meantime, for further details of the Conference and the various events that will be taking place, please check out the Conference Website....

<https://www.iioa.org/conferences/28th/conference.html>

International Guidelines

All producers and users need to be aware that various international guidelines are being updated. The world is rapidly changing with new industries, new products, new processes and new technologies thus requiring updating of the various standards. In particular, the UN System of National Accounts (2008 SNA) and the Balance of Payments and International Investment Position (BPM 6) as well as the industrial classifications (e.g., ISIC Revision 4) and the product classifications (e.g., CPC Version 2.1). All related standards will also in turn require updating.

The new SNA is likely to be the 2025 SNA, this will include lots of influences from our community such as a separate chapter on SUTs, separate chapter on IOTs and other chapters covering I-O related products such as Extended SUTs, Digital SUTs, Trade in Value Added, Global Value Chains, etc. I am happy to say that I privileged to be one of the five Supporting Editors to the Lead Editor and Project Lead for the 2025 SNA. As developments evolve, I will keep you informed thus watch this space.



Finally, it is worth mentioning that the **role, relevance and prominence of SUTs and IOTs continues to grow**. Presently, I have been involved in, and or have seen, a lot of impact analyses of the Russian / Ukraine situation from various product(s) supply chain analyses affecting countries across the world to national focussed areas to invest to aid a quick recovery. More importantly, separate from the analytical dimension, spare a thought for the suffering that many fellow humans are undergoing - we can only hope that the situation quickly comes to a peaceful end.

Hope you all remain safe, take care and have an enjoyable summer holiday period.

Best regards

(Sanjiv Mahajan - President of the IIOA, June 2022)



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Restoration - Towards an IIOA historical archive of treasures

Introduction

Welcome to a new and evolving initiative to restore, bring together and develop a historical repository of I-O and I-O-related materials.

The I-O community across the world has a long and rich history of analysis, publishing articles, data, etc. However, as time goes by, paper-only documents and even electronic materials become obsolete or even lost. Thereby many people, especially younger scholars, lose out on the benefits of the availability of such materials.

The initiative seeks to gather such materials and store them electronically to be made available to I-O related connoisseurs via the IIOA website. This will become a significant electronic treasure chest of information.

Background

About a year ago, the IIOA started a project to produce an inventory and to collect documents relevant for ensuring that the historical roots of the I-O domain are preserved. In May 2021, the IIOA Council endorsed the initiative and appointed long-serving and dedicated IIOA Members, Bert Steenge and Josef Richter (us), as "archive planners" to start a feasibility study to identify problems and to commence this project if possible. Additionally, Rossella Bardazzi was nominated as the lead IIOA Council Member to be responsible for the coordination between the parties concerned. A letter of support was written by then President, Satoshi Inomata. Since then, we have made considerable progress with inputs from Rossella Bardazzi, Chris Paparella, Oliver Fritz and Sanjiv Mahajan.

Aims

The short-term goal of the project was defined as to preserve relevant materials covering early I-O analysis that, without immediate action, would otherwise be lost forever. The scope is wide for example, persons retiring, their personal archive(s), papers, presentations or notes being lost, institutions reorganising themselves, et cetera. The long-term goal is to create a historical knowledge repository for I-O related materials and the history of I-O analysis. In this context, I-O should be seen in a wider sense to include related areas such as regional economics, environmental economics and mathematical economics, as well as various satellite accounts extending the I-O framework.

The overall aim is to identify and collect material that is not already accessible on the web or in libraries or that is (very) difficult to find. The focus for the moment is on documents created before the digital age. This implies that these materials will have to be digitised.

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Restoration - Towards an IIOA historical archive of treasures

What has been achieved so far?

Up to now, we have successfully collected a considerable amount of material, mainly because we gained access to several private archives of I-O related literature. Based on these materials, the emphasis has been on digitising the contributions to the early Conferences on Input-Output Techniques. We hope to make these materials available to members in autumn this year via a newly created and dedicated webpage for this work on the IIOA website.

In addition, more than 50 pioneers in the field, including previous IIOA Presidents, IIOA Fellows and other eminent experts were contacted. They were asked if they could provide a contribution in the form of printed or digitised materials, photographs, books or hard to get chapters in books. These efforts have also resulted in valuable contributions and have made it clear that there is a lot more to gather.

An important step toward the envisaged archive was the creation of an infrastructure to make these materials available in a convenient form. Above all, it will be important to allow users to search for documents in an efficient way. The prototype of such a system is currently being tested and we are optimistic that the system will be available in autumn this year.

Next steps

The purpose of this note is to inform IIOA Members about the initiative to create an I-O historical archive and repository of materials. As soon as the system will be operational and organisational issues resolved, we will be in a better position to provide additional information about the availability and use of the system.

Most importantly, later this year we will approach all IIOA Members with a request to provide us with valuable historical materials before the digital age of the above-mentioned characteristics for the archive. It would be great if IIOA Members could start thinking about what type of materials they may be able to contribute to the archive.

Thanks!!



Josef Richter, Bert Steenge, (Archive planners)

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Events

SHAIO events



Dear colleagues,

We are glad to announce the **9th Spanish Conference on Input-Output Analysis** of the Hispanic-American Input-Output Society (SHAIO) that will take place in Aveiro, Portugal, on the **22nd and 23rd of September 2022**.

It is going to be a great pleasure to visit the **University of Aveiro** and enjoy the fantastic Conference organized by the GOVCOPP (Research Unit on Governance, Competitiveness, and Public Policies) together with CeBER (Centre for Business and Economics Research of the University of Coimbra) and the CARME (Centre of Applied Research in Management and Economics of the Polytechnic Leiria).



The University of Aveiro, placed in the lovely Aveiro, the Portuguese Venice, is one of the fastest-growing institutions in Portugal and one of the most prestigious institutions that combine spatial planning, economics, and other social sciences. Aveiro, located between the historical cities of Coimbra and Oporto, is an energetic city with excellent restaurants and a landscape shaped by the Aveiro lagoon.

The Conference's official languages will be English and Spanish; however, as this meeting will be held in Portugal, we will also have special sessions in Portuguese. The program will include the fourth edition of the Spanish School of Input-Output Analysis (ESAIO), plenary and parallel sessions, the Emilio Fontela Award ceremony, and some other amazing surprises that will make this event a perfect opportunity to know this area of Portugal.

Please save the key dates and join us in Portugal!

Key Dates:

- **Abstract submission** → June 15, 2022
- **Special sessions proposals deadline** → June 15, 2022
- **Notification of acceptance** → June 25, 2022
- **Full paper submission** → July 30, 2022
- **Registration for the Spanish School deadline** → July 30, 2022
- **Submission Emilio Fontela Prize deadline** → July 30, 2022
- **Early bird registration deadline** → July 30, 2022
- **Regular registration deadline** → August 11, 2022
- **Spanish School of IOA** → September 21, 2022
- **Spanish Conference on IOA** → September 22-23, 2022

More information at: <http://io9.shaio.es/en/>

See you in Aveiro!



CARME
CENTRE OF APPLIED RESEARCH
IN MANAGEMENT AND ECONOMICS

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Events



Co-funded by the Horizon 2020 programme
of the European Union

GI-NI International Conference

The Impact of the Global Transformations on Inequality

ORGANISERS

The first conference on the economic impact of technological transformation, globalisation and migration will take place on September 23rd 2022, at the University of Agder, Norway.

Over the past decades, inequality within populations has widened in the majority of countries regarding many dimensions of life. This has been of central concern for both policymakers and researchers alike. To formulate remedies, we must have an integral understanding of the drivers of such widening inequality and their interactions. In addition, we must understand the strengths and weaknesses of our current institutions to deal with these issues. This conference aims to bring together researchers from different disciplines to share and discuss their recent findings related to widening income inequality, living standards, and prosperity more broadly. Researchers from all fields of economics, political science and sociology are invited to present new research results and discuss possible directions for future research activities. We welcome the submission of papers with an empirical, theoretical, and/or policy orientation focusing on micro- or macroeconomic aspects of inequalities linked to globalisation, migration and technological change. The analysis should focus on Europe or be related to it.

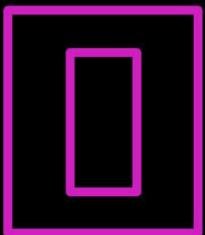
SUBMISSION AND REGISTRATION

Please submit (in pdf format) an extended abstract of your paper (approx. 800 words) or the complete paper along with a cover letter including i) paper title, ii) name(s) of the author(s), and iii) affiliation as well as the email address of the presenting author, to Prof. Dr. Steven Dhondt (steven.dhondt@tno.nl)

Abstracts must include context, purpose, methodology, major findings, implications and keywords. The criteria for selection of papers will be: relevance to the conference theme, quality of methodology, originality, embedding in the literature and soundness of conclusion/s.

Extended abstract submission	June 30th 2022
Notification of acceptance of abstract	July 30th 2022
Last date for submission of selected papers	August 20th 2022
Last date for registration	September 1st 2022

For more information, please see the GI-NI Website
<https://giniresearch.org/gini-international-conference>
Or contact Prof. Bart Los | University of Groningen
b.los@rug.nl



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Events



69th Annual North American Meetings of the Regional Science Association International, November 9-12, 2022

Join us for the 69th Annual North American Meetings of the Regional Science Association International. The meetings will be held in Montreal, Canada and will run from Wednesday, November 9 – Saturday, November 12.

<https://www.narsc.org/newsite/conference/>

<https://www.narsc.org/newsite/conference/call-for-papers/>

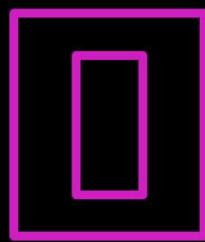
Details on the annual NARSC Graduate Student Paper Competitions are posted on [this page](#).

Important dates:

- **July 1:** Deadline for Submission of Abstract and Special Sessions
- **August 1:** Deadline for Submitting Full Paper and Accompanying Support Materials for Student Paper Competitions
- **August 15:** Early Bird Registration Closes
- **August 15:** Deadline for abstract earmarking, and paying registration fee (for conference presenters)
- **October 7:** Program Published
- **October 11:** End of Discounted Hotel Rate
- **October 26:** Advance Registration Closes
- **October 28:** Manuscripts to be sent to discussants
- **November 9-12:** Conference in Montreal, Canada

If you have any questions or suggestions, here's who to contact:

- Local arrangements: [Bruce Newbold](#)
- Program Chair: [Neil Reid](#)
- Overall Arrangements: [John Sporing](#)



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Ongoing research projects

Title of the Project: '**Measuring Food-Energy-Water Nexus Footprint Using A Systematic Input-Output Approach: A Case Study of Pune District**' funded/sponsored by Colorado State University, Fort Collins, USA and Helmholtz-Zentrum für Umweltforschung GmbH - UFZ, Leipzig, Germany

Principal Investigator: Kakali Mukhopadhyay, Professor, GIPE, Pune and Adjunct Professor and Senior Academic Fellow, McGill University, Montreal, Canada

Short Abstract: Given the role of urbanization, a city or district level study is of greater significance for understanding community-wide Food-Energy-Water (FEW) consumption patterns and region-specific characteristics of economic activity, thus providing a bottom-up approach to the decision-making process. To this end, the Input-Output (IO) analysis framework has been widely used for quantifying the economic interlinkages and as a basis for carrying forth analysis relating to environmental management. The development of the comprehensive IO framework with emphasis on FEW resources in Pune region is, to the best of our knowledge, the first study of its kind in India and serves as a precursor for effective policy framework, implementation and assessment.

Results indicate that the most resource intensive sectors in Pune district include Manufacturing Fuels, Electricity, Food Processing Sector, Motor Vehicles and Electrical Engineering & Instrument. The projected rise in Pune's population and expected industrial growth until 2030 indicate that demand for FEW resources is expected to witness triple-digit growth of more than 135% between 2018-30. The consequent FEW burden of national and regional policies shows that the automobile sector is expected to grow exponentially.

This comprehensive economy-wide analysis at the district level intends to serve as a precursor to a better understanding of the mixed effects of urbanization and climate change at the regional level. The study not only establishes the interlinkages between the three resources, but also charts the inter-connected resource characteristics in the rest of economy and the activities thereof. Considering this study as a template, future studies can not only replicate this analysis for other urban agglomerations but also go beyond it to factor in inter-district or inter-regional planning for better resource mobilization.

Databases



The **EMERGING** model is a new global MRIO framework based on bilateral trade data and national statistics at the individual country level. The contributions are (1) global scale and including emerging economies to the largest extent; (2) containing enough detail on sectors to capture structural changes in supply chains and economic developments; (3) covering changes over time; (4) up-to-date representation of changes to allow for timely policy implications; and (5) using modular compilation for timely updates.

Based on this model framework, the **EMERGING MRIO** database now covers 135 sectors in 245 economies over the period 2015-2019. It will be an essential tool to conduct supply-chain and environmental impact analysis, especially for global emerging economies.

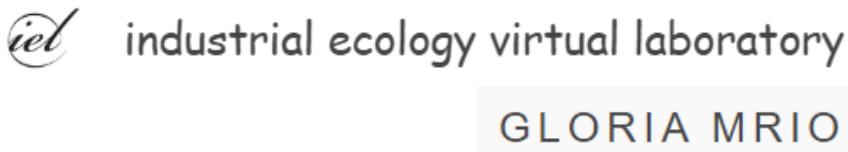
The **EMERGING** model includes nine modules and adopts corresponding compilation procedures according to the data source and the economy. The methodology paper on EMERGING MRIO construction is published in the Journal of Industrial Ecology recently (<https://doi.org/10.1111/jiec.13264>). The full database is open access: <https://ceads.net/>.

Queries about the EMERGING database and further collaboration can be addressed to:

Jing Meng: jing.j.meng@ucl.ac.uk

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Databases



The **GLORIA model** (GLObal Resource Input-output Assessment) is a multi-regional input-output database that was built by the University of Sydney in collaboration with by a collaboration the CSIRO, Wirtschafts-Universität Wien, and UNSW Sydney.

It was created in the Global MRIO Lab – a branch of the NeCTAR Industrial Ecology Virtual Laboratories (IELabs, <https://ardc.edu.au/services/nectar-research-cloud/>), for the UN International Resource Panel (UN IRP, <https://www.resourcepanel.org/global-material-flows-database>) in the context of the update of the material footprint accounts forming part of the UN IRP Material Flows Database.

To use synergies between different UNEP initiatives it was decided to use GLORIA also as underlying MRIO model for the Sustainable Consumption and Production Hotspots Analysis Tool (SCP-HAT, <http://scp-hat.lifecycleinitiative.org>).

GLORIA has 164 regions, 120 sectors each, supply-use transactions, final demand, value added in 5 valuations (basic prices, trade margins, transport margins, taxes on products, subsidies on products) and a continuous time series for 1990-2020. Accompanying satellite accounts (extensions) cover GHG emissions, materials, energy, air pollution, land use, water use, biodiversity, skills and employment. Footprint trends have been calculated for all satellites from 1990-2020. The paper “Implementing the Material Footprint to measure progress towards SDGs 8 and 12” (Lenzen, M et al, Nature Sustainability 5, 157-166, 2021) outlines the construction approach for the MRIO table, lists the source data sets that were used, the quality checks that were performed, and holds additional, method- and data-specific information about the construction process. All data, Release Notes, ReadMe files and visualisations are available for download at <https://ielab.info/resources/gloria/supportingdocs>.

GLORIA is made available under a creative commons attribution non-commercial license (<https://creativecommons.org/licenses/by-nc/3.0/au/>). For commercial applications please contact Prof Tommy Wiedmann via the IELab Members section at <https://ielab.info>.

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

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

Latest ESR articles

[Economic Systems Research](#)

[Journal of the IIOA](#)

[Volume 34, Issue 1, 2022](#)



Radomír Mach, Milan Ščasný & Jan Weinzettel
[The role of allocation of retail trade margins across household segments on their carbon footprint calculation](#)

The homogeneity assumption, inherent to input-output (IO) analysis, implies that every euro spent within one product group is assigned the same environmental burden. We address this assumption applied to price conversion of household expenditures from purchasers' to basic prices when the carbon footprint of consumption is calculated for specific household segments by linking the IO table and micro-level household consumption data. We perform a sensitivity analysis of the different allocations of the retail trade margin of two consumption groups (Food and Goods) across household expenditure deciles. While a differently allocated retail trade margin influences the carbon footprint of household segments, it does not challenge the general finding that households with higher expenditures are responsible for higher footprints. This finding holds also for different emission intensities of retail trade margins.

Óscar Dejuán, Ferran Portella-Carbó & Mateo Ortiz

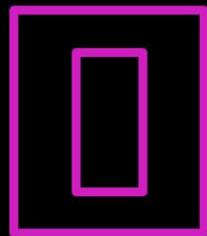
[Economic and environmental impacts of decarbonisation through a hybrid MRIO multiplier-accelerator model](#)

This paper analyses the impacts of decarbonisation in three energy-intensive sectors/institutions (electricity generation, road transport, and household consumption) on four economic and environmental variables (value added, employment, energy consumption, and emissions). In our basic scenario, the EU is supposed to complete the decarbonisation of the selected sectors in 30 years, whereas in the rest of the world these sectors will be 30% decarbonised. We hypothesise that emissions and employment will fall once renewable sources of energy replace fossil fuels. Yet, in the meanwhile, massive investments are needed to build the required infrastructure. To compute the full impact, we apply a multiplier-accelerator model to a global multiregional hybrid input-output table derived from EXIOBASE3. In the EU, such a decarbonisation reduces yearly energy consumption, CO₂ emissions, and employment by 22%, 19%, and 4%, respectively. Thus, additional measures are necessary to avoid global warming and absorb unemployment.

Ignacio Cazcarro, Antonio F. Amores, Inaki Arto & Kurt Kratena

[Linking multisectoral economic models and consumption surveys for the European Union](#)

Multisectoral models usually have a single representative household. However, more diversity of household types is needed to analyse the effects of multiple phenomena (i.e. ageing, gender inequality, distributional income impact, etc.). Household consumption surveys' microdata is a rich data source for these types of analysis. However, feeding multisectoral models with this type of information is not simple and recent studies show how even slightly inaccurate procedures might result in significantly biased results. This paper presents the full procedure for feeding household consumption microdata into macroeconomic models and for the first time provides in a systematic way an estimation of the bridge matrices needed to link European Union Household Budget Surveys' microdata with the most popular multi-regional input-output frameworks (e.g. Eurostat, WIOD, EORA, OECD).



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Sabina Szymczak & Joanna Wolszczak-Derlacz
[Global value chains and labour markets – simultaneous analysis of wages and employment](#)

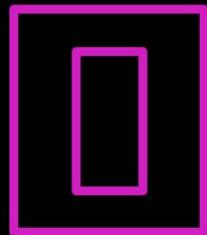
This study examines the overall effect of global value chains (GVCs) on wages and labour demand. It exploits the World Input-Output Database to measure GVC involvement via recently developed participation indices (using both backward and forward linkages) and the relative GVC position using three-stage least squares regression. We find that the relative GVC position is negatively correlated with wages and employment and that the GVC participation effect depends on whether backward or forward linkages are considered. Moreover, we find heterogeneity across both countries (middle- vs high-income) and sectors (manufacturing versus services). Notably, the effect of GVC involvement on the labour market differs from that produced by traditional domestic trade.

Shohei Tokito, Shigemi Kagawa & Tesshu Hanaka
[Hypothetical extraction, betweenness centrality, and supply chain complexity](#)

Two frameworks, hypothetical extraction and betweenness centrality analysis, can be used to identify environmentally important sectors in complex supply chains. This study derives an analytic expression for the relationship between hypothetical extraction and betweenness centrality analysis. Second, using the Eora and WIOD, this study analyzes the degree of difference in 'important' sectors identified by hypothetical extraction and betweenness centrality analysis. While the results obtained by rank correlation yield similarities, both methods have advantages. This study demonstrates that estimating betweenness centrality is meaningful and less computationally expensive, and can help us to understand the structural positions in the global supply chain network. The hypothetical extraction indicators can be easily computed using the betweenness centrality indicators' mathematical relationship. We conclude that the implementation of effective CO₂-reduction policies through greener global supply chain engagement center around two key sectors, chemical and metal products from China, and their higher betweenness centrality should be strengthened.

Ana-Isabel Guerra, Laura Varela-Candamio & Jesús López-Rodríguez
[Tax reforms in Spain: efficiency levels and distributional patterns](#)

This paper approximates the efficiency levels of the most relevant tax categories and their distributional patterns for a European country considering Spain as an illustrative example. This is done computing the 'marginal' excess burden of these taxes, taking into account the structure of the Spanish tax system before and after the major tax reforms undertaken since 2010. In doing so we use a static applied general equilibrium model, which features heterogeneous households classified according to their taxable income. In addition, and in identical terms, another alternative tax reform is evaluated: a flat value-added tax system and a reduction in employers' social security contributions. Our results indicate that the alternative tax reform would have slightly improved the degree of efficiency of these taxes while implying a lower negative impact on aggregate income. Regarding distributive effects, we do not find significant differences between the actual and the alternative tax policies.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Economic Systems Research

Journal of the IIOA

Volume 34, Issue 2, 2022



Claudia V. Montañá & Sandy Dall'erba

Multi-dynamic interregional input-output shift-share: model, theory and application

Shift-share decomposition has been extensively used to identify the key drivers of sectoral and regional economic growth. Traditionally, shift-share does not pay attention to any form of interregional externalities and the rare exceptions define them based on geographical proximity only. However, given the increasing role of global value chains in economic growth, this paper introduces the Multi-dynamic interregional input-output shift-share decomposition in order to capture the dynamic intersectoral relationships between a spatial unit and any other unit it trades with. The methodology is illustrated on 35 productive sectors of 15 European Union countries over 1995–2006. The results show that the most important driver of output growth in these countries are their sectoral linkages with other European countries, followed by the domestic sectoral linkages.

Bernhard Michel & Caroline Hambé

Export-sustained employment: accounting for exporter-heterogeneity in input–output tables

Exports matter for domestic employment in both export-producing firms and upstream suppliers. Their total effect can be captured through an input-output-based indicator of export-sustained employment. However, as industry classifications used in regular input-output tables are based on product similarity, they fail to account for within-industry technological heterogeneity between exporters and other firms, which may lead to a bias in results for export-sustained employment. In this paper, we describe the breakdown of manufacturing industries into export-oriented and domestic-oriented firms in Belgian input-output tables and employment data based on detailed firm-level data for industry totals and input-output structures. Based on the resulting export-heterogeneous tables, we find that 585,000 jobs or 13% of economy-wide employment in Belgium is sustained by manufacturing exports. This is overestimated by 4% with regular tables. Moreover, we identify who contributes to and who gains from exports for groups of firms rather than aggregated industries.

Hong-Dian Jiang, Mei-Mei Xue, Kang-Yin Dong & Qiao-Mei Liang

How will natural gas market reforms affect carbon marginal abatement costs? Evidence from China

Having recognised the significant role of natural gas in reducing carbon abatement costs, China is rapidly promoting its growth. However, obvious distortions exist in China's natural gas market, and it is unclear how these may affect abatement policies going forward. Therefore, to assess the effects of energy market distortions on the carbon marginal abatement costs (MACs) in China, this study proposes a computable general equilibrium model for China's natural gas sector, which considers the monopoly market structure, price regulation, and import restrictions. Results show that deregulation of gas prices will lead to an effective decrease in China's MACs. China's MACs are insensitive to liberalisation of the market monopoly or gas import restrictions. When all three distortions are fully deregulated, China's MACs show an obvious upward trend. Finally, this study uses China's carbon trading policies as an example to propose policy implications under different scenarios of natural gas market reform.

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**María T. Álvarez-Martínez, Salvador Barrios,
Diego d'Andria, Maria Gesualdo, Gaetan
Nicodeme & Jonathan Pycroft**

**How large is the corporate tax base erosion and
profit shifting? A general equilibrium approach**

The paper uses the computable general equilibrium model CORTAX to analyse the extent of base erosion and profit shifting (BEPS) in the EU, Japan and the US. Our approach estimates the direct fiscal losses of BEPS and accounts for the second round effects, in particular on the cost of capital and corporate investment. Our central estimates show that the net corporate tax revenue losses in the EU are €36.0 billion per year (7.7% of CIT revenues), €24.0 billion in Japan and €100.8 billion in the US (in both cases representing 10.7% of corporate tax revenues). Our estimates are comparable in size to the global tax revenue losses found using newly reported statistics on foreign affiliates. Our macroeconomic results suggest that eliminating profit shifting would slightly reduce investment and GDP and rise corporate tax revenues, which would positively affect welfare.

**Tesshu Hanaka, Keiichiro Kanemoto & Shigemi
Kagawa**

**Multi-perspective structural analysis of supply
chain networks**

Determining the structural positions and characteristics of multi-role sectors is critical for understanding supply chain networks. Thus, in this study, we developed an attribution analysis framework to assess the structure of sectors with multiple roles in a supply chain. Subsequently, we applied the framework in a case study, where the top-ranking Japanese sectors were identified for production-oriented, betweenness-oriented, and consumption-oriented carbon dioxide emission scores. Additionally, these attribution indicators were utilized to identify/visualize the structural positions of sectors. Using company-level data, we also evaluated the structural positions of Japanese companies in relation to their carbon disclosure project (CDP) reporting practices. The results demonstrate that a company's role in the supply chain is unlikely to be related to CDP reporting.

**Julio Sánchez Chóliz, Rosa Duarte & Sofía
Jiménez**

**Structural components of income growth: an
application to the evolution of the Spanish
economy, 1980–2014**

This paper analyses the structural and technical changes in Spain since the 1980s, using annual input-output tables. Specifically, a differential structural decomposition analysis (SDA) is applied to shifts in value-added, revealing eight different components and allowing the estimation of the impacts of technical change on the process of economic transformation on a sector-by-sector basis. We conclude that growth in the Spanish economy in recent decades was a mix of technological modernization and general economic expansion, although with some heterogeneity among sectors over time. High-technology services played a key role in modernization in the late 1980s and 1990s. In fact, the growth of High-technology, Medium-high-technology, Energy and Construction sectors accelerated through the 2008 crisis. Labour compensation and returns from capital followed different trends both during expansions and recessions, intensifying income inequality in Spain.

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

[Economic Systems Research](#)

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Huiwen Liu, Huibin Du, Zengkai Zhang, Huimin Wang, Kunfu Zhu, Yaling Lu & Xi Liu

[Trade heterogeneity and virtual water exports of China](#)

China is facing serious water scarcity, and the effects of international trade on its water resources have been widely examined. Processing exports account for nearly half of China's gross exports. Adopting China's multi-regional input-output table that captures processing exports, we enrich the literature on virtual water exports by accounting for trade heterogeneity. The results show that China's virtual water exports show a significant trade heterogeneity. Normal and processing exports are attributed to 86.7% and 13.3% of the Agriculture sector's water use induced by exports respectively. Conversely, normal and processing exports are attributed to 31.8% and 68.3% of the Communications Equipment, Computers sector's water use induced by exports respectively. In addition, a cross-regional compensation is needed to deal with the unequal regional distribution of water uses and economic benefits related to exports.

Lena Kilian, Anne Owen, Andy Newing & Diana Ivanova

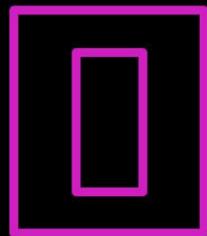
[Microdata selection for estimating household consumption-based emissions](#)

To estimate household emissions from a consumption-perspective, national accounts are typically disaggregated to a sub-national level using household expenditure data. While limitations around using expenditure data are frequently discussed, differences in emission estimates generated from seemingly comparable expenditure microdata are not well-known. We compare UK neighbourhood greenhouse gas emission estimates derived from three such microdatasets: the Output Area Classification, the Living Costs and Food Survey, and a dataset produced by the credit reference agency TransUnion. Findings indicate moderate similarity between emission estimates from all datasets, even at detailed product and spatial levels; importantly, similarity increases for higher-emission products. Nevertheless, levels of similarity vary by products and geographies, highlighting the impact microdata selection can have on emission estimates. We focus our discussion on how uncertainty from microdata selection can be reduced in other UK and international contexts by selecting data based on the data generation process, the level of disaggregation needed, physical unit availability and research implications.

Daniel Herrero & Adrián Rial

[Productive linkages in a segmented economy: the role of services in the export performance of German manufacturing](#)

This article analyzes the causes that affect the export performance of the German manufacturing sector. By applying a subsystem approach to input-output analysis, we take into account the interlinkages between manufacturing and services. In particular, we consider two types of relationships that influence manufacturing competitiveness: the wage squeeze in services due to institutional factors and outsourcing; and the role played by knowledge-intensive business services (KIBS) as innovation drivers. Taking vertically integrated sectors as units of analysis, an export model is estimated. We find that labor costs play only a minor role for international competitiveness, while non-price factors are the main drivers of German exports. Therefore, although the wage squeeze in services is the centerpiece in the unit labor costs and export prices moderation, it is of minor importance for export growth. Conversely, the growing integration of KIBS provides a strong stimulus for non-price competitiveness and export growth.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Yuwang Duan, Erik Dietzenbacher, Bart Los &
Cuihong Yang

[Processing trade in Chinese interregional input-output tables: construction and application](#)

We construct new interregional input-output tables for China, which can be used to analyze changes in the interindustry linkages within and between eight Chinese regions, and their consequences. We claim that analyses based on these tables yield more accurate results than analyses using existing interregional input-output tables for China, because our tables explicitly account for a typical feature of the Chinese economy: the importance of processing exports activities. These activities rely heavily on imported inputs and much less on inputs sourced from domestic regions. Accounting for such differences between processing exports and other production activities reduces aggregation biases. We illustrate the usefulness of the tables by computing supply chain fragmentation indices for China and quantifying the biases that are avoided by using our input-output tables instead of conventional ones. We make our tables (for 2002, 2007 and 2012) publicly available.

Luis Enrique Pedauga, Agustín Velázquez & Elvis Hernández-Perdomo

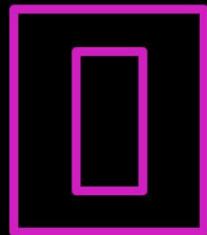
[Systemic risk and macro-financial interconnectedness using an FSAM framework](#)

We provide a general framework to assess the traceability of systemic risk and macro interconnectedness to understand the financial risk transmissions channels. Our contribution help address the information need established in the DGI-2 in a FSAM-based model that fully captures the interconnectedness between real and financial sectors. Recent developments in the field of IO and SAM evaluations have led to a renewed interest in the usage of linkage analysis to measure the role that a sector play within the economy. Focusing on the backward and forward linkage, hypothetical extraction method, and structural path analysis, we show how feasible it is to include heterogeneous financial institutions to study risk interactions effects on macroeconomic outcomes. This paper's proposal may be useful for thinking about how micro-data and macro-aggregates can be incorporated into the set of financial soundness indicators, allowing to obtain an idea of the vulnerabilities of the financial sector.

Rayan Wolf, Angelo C. Gurgel, Leonardo C. B. Cardoso, Ian M. Trotter, Marcos S. Nazareth & Erly C. Teixeira

[Welfare impacts of a negative income tax on regions of Brazil](#)

This paper aims to analyze the effects of a public policy based on negative income tax (NIT) ideals as an alternative to the current social programs of income transfer in Brazil. A multiregional applied computable general equilibrium model of Brazil's economy is used to analyze the impacts on households' welfare, split into 10 income classes, and 2 factors (capital and labor) for each of 5 major regions. By analyzing two scenarios for the proposed policy, we show that the NIT could be more effective than the current social programs as well as resulting in longer lasting outcomes.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Maureen Lankhuizen, Dario Diodato, Anet Weterings, Olga Ivanova & Mark Thissen

Identifying labour market bottlenecks in the energy transition: a combined IO-matching analysis

This paper combines an input-output model and a novel regional labour market matching model in order to identify potential bottlenecks in regional labour markets resulting from shocks in demand caused by the energy transition. Identifying these bottlenecks provides relevant information for policymakers to determine in which regions and industries policy intervention in labour markets may be needed to ensure a smooth transformation. We analyse the effects of a shock that is illustrative for the energy transition in the Netherlands. Our results indicate that the aim of the Dutch government to substantially reduce greenhouse gas emissions may, at least in the short run, be hampered by bottlenecks in labour markets.

Ryo Itoh & Kiyoshi Yonemoto

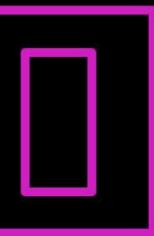
An interregional input-output analysis with the Eaton-Kortum model

This study proposes a multi-regional input-output (I-O) model obtained from comparative statics analysis and a linear approximation of Eaton and Kortum's (2002). [Technology, geography, and trade. *Econometrica*, 70(5), 1741–1779. <https://doi.org/10.1111/ecta.2002.70.issue-5>] general equilibrium trade model. The derived reduced form, which represents the effect of a final demand shock, is equivalent to the Leontief inverse, which means that our model is a straightforward extension of the conventional I-O framework. In addition, supply-side shocks, such as a decrease in transport costs, and the corresponding welfare gains are also calculated without setting any structural parameters. The linear reduced forms also enable us to decompose the welfare gains into various ripple channels, such as by sector, region, or the time that the gain arrives. A Japanese multi-regional I-O table is used as a numerical example to derive the effect of a reduction in transport costs (for the links around the northern region). The results indicate that more than half of the welfare gains in the southwest region are delivered through indirect channels, and their time to arrival is more than twice of that in the northern region, which is close to the shock.

Marina Yegorovna Anokhina

Fuzzy cognitive model of agricultural economic growth

Agrarian growth is becoming increasingly important to many countries as the global demand for food rises, natural resources become scarcer, and environmental problems deepen. Herein, I propose a mechanism for designing agricultural growth management strategies that is based on fuzzy cognitive logic. The research presented is built on three main findings. First, it integrates established theories of economic growth, economic cyclicalities, and sectoral market theories into a model of agricultural growth management. This enables the identification of main growth factors and the determination of the nature of their effects on agricultural dynamics. Second, I develop an algorithm for cognitive analysis of agricultural growth management and justify both this mathematical apparatus and the tools it uses. And third, I conduct a computational experiment that applies cognitive technologies to generate what I believe is the best agricultural economic growth strategy for Russia.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Enrique Gilles, Javier Deaza & Alejandro Vivas

[The role of imported intermediates in productivity change](#)

We address the role of imported intermediates in productivity by applying a methodology that proposes an equivalence between input-output analysis and data envelopment analysis, and decomposes sectoral productivity gains into two factors: efficiency change and technical change. We illustrate this by using data for Spain in the 2008–2015 period with three levels of labor skills, capital, and twenty-eight industries, and compare the results of two different settings: one including only domestic intermediates and the other incorporating total (i.e. both domestic and imported) inputs. We find differential results regarding productivity, efficiency, and technical changes that are attributable to imported intermediates. We also find that the main drivers of productivity change are high-skilled labor and the manufacturing sector. Our results suggest the importance of both trade and educational policies that respectively foster international economic complementarities and promote higher qualification of labor.

Aleksandra Kordalska & Magdalena Olczyk

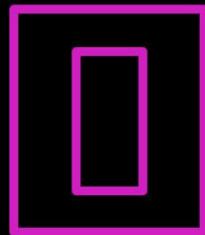
[Upgrading low value-added activities in global value chains: a functional specialisation approach](#)

This paper aims to identify patterns of functional specialisation (FS) in global value chains (GVCs) and determinants of upgrading them for selected Central Eastern European (CEE) economies. By combining the World Input-Output Database with data on occupations, we reveal a new FS pattern among subgroups of CEEs. Poland and Slovakia have an unfavourable GVC position and specialise in low value-added fabrication function. In contrast, other CEEs have competitive advantages in high value-added tasks: the Baltic countries and Slovenia in management services, the Czech Republic and Slovenia in R&D. We identify upgrading factors for different types of FS in GVCs. The wages convergence of CEEs with developed economies, and strong GVC backward linkages support the path to higher value-added in almost all business functions. Higher GDP per capita and lower economic distance to Germany allow CEEs to escape from 'factory economies' status and also generate higher value-added in R&D activities.

Davit Stepanyan, Georg Zimmermann & Harald Grethe

[Stochastic simulation with informed rotations of Gaussian quadratures](#)

Given the fast growth of available computational capacities and the increasing complexity of simulation models addressing agro-environmental issues, uncertainty analysis using stochastic techniques has become a standard modeling practice. However, conventional uncertainty/sensitivity analysis methods are either computationally demanding (Monte Carlo-based methods) or produce results with varying quality (Gaussian quadratures). In this article, we present a computationally inexpensive and reliable uncertainty analysis method for simulation models called informed rotations of Gaussian quadratures (IRGQ). We also provide an R script that generates IRGQ points based on the required input data. The results demonstrate that this method is able to produce approximations that are close to the estimated benchmarks at low computational costs. The method is tested in three different simulation models using different input data in order to demonstrate the independence of the proposed method on specific model types and data structures. This is a methodological paper for practitioners rather than theorists.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Andrea Bonfiglio, Silvia Coderoni, Roberto Esposti & Edoardo Baldoni

[The role of rurality in determining the economy-wide impacts of a natural disaster](#)

Rural areas may be highly vulnerable to natural disasters because of their lower economic diversification and a higher incidence of sectors that may suffer from a larger impact produced by these adverse events. In addition, because of their trade dependence, local effects can be transmitted to neighbouring regions more diffusely so amplifying total impacts. This paper aims to quantify the economy-wide impacts generated by the earthquake sequence that mostly hit a markedly rural area of Central Italy in 2016–2017. To this purpose, a non-linear programming model based on a multi-regional IO table with a mixed territorial scale is adopted. Results indicate that some negative effects are transmitted outside the seismic area and a few positive effects are also produced. Moreover, they confirm that rural areas are more vulnerable to disasters and that the effects of disasters in these areas are more likely to be transmitted to the neighbouring space.

Tânia Moreira Alberti, Kênia de Souza & Alexandre Porsse

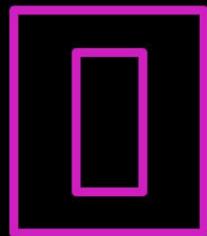
[Poverty and the functional distribution of income in the input-output framework: in pursuit of strategies for inclusive growth](#)

The eradication of poverty as proposed by the first Sustainable Development Goal is one of the main challenges faced by all countries, especially the underdeveloped and developing nations. In this paper, we develop an approach for integrating the input-output framework with a microsimulation model where consumption and income data are highly disaggregated and along with Miyazawa linkages. This allows us to identify how sectoral economic structure affects income distribution. This, in turn, provides information relevant to the inclusive growth policies that can create work opportunities for the low-income population and, thereby eliminating poverty. Results show how labor-intensive sectors might be important in ending poverty and in reducing inequality. They even show the set of activities that could best contribute to this goal via changes in the productive structure.

Timon Bohn, Steven Brakman & Erik Dietzenbacher

[Who's afraid of Virginia Wu? US employment footprints and self-sufficiency](#)

Globalization has brought about concerns of domestic job losses due to outsourcing to countries like China. The 'employment footprint' concept provides new insights into the implications of trade for employment. Using this approach for the period of 1995–2008, we analyze the relation of US jobs with international trade, particularly with China. Furthermore, we compare the US employment footprint with its labor endowment to assess if the country could be self-sufficient in terms of labor. We find that the US's consumption increasingly depends on foreign workers. The country 'consumes' more labor than is nationally available; thus, self-sufficiency is not possible under realistic assumptions. Moreover, the US has benefited from jobs – especially in services – generated by the world economy. Referring to Albee's famous play about living in illusions, we use 'Virginia Wu' as a Chinese version of 'Virginia Woolf' to argue that the perceived threat of China (Virginia Wu) is only an illusion.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Christian Lutz, Maximilian Banning, Lara Ahmann & Markus Flautz

[Energy efficiency and rebound effects in German industry – evidence from macroeconometric modeling](#)

Increases in energy efficiency are reduced by the rebound effect. Efficiency gains on the micro level do not lead to proportionate reductions of energy consumption on the macro level. The German energy-economy model PANTA RHEI is applied to better understand the rebound effect. To get more robust estimates micro data from a cost structure survey of the German manufacturing sector was used to derive price elasticities of energy demand. The mesoeconomic rebound effect of an autonomous increase in energy efficiency at the industry level in manufacturing is between 7% in 2021 and 12% in 2030. The macroeconomic rebound effect lies between 12% in 2021 and 18% in 2030. Inclusion of necessary investment and assumptions of higher elasticities of substitution increase the effects. Rebound effects limit the scope of technology-driven efficiency improvements and must be considered in the design of ambitious energy efficiency programs and climate policies.

Heran Zheng, Johannes Többen, Erik Dietzenbacher, Daniel Moran, Jing Meng, Daoping Wang & Dabo Guan

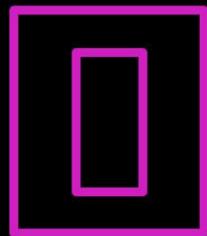
[Entropy-based Chinese city-level MRIO table framework](#)

Cities are pivotal hubs of socioeconomic activities, and consumption in cities contributes to global environmental pressures. Compiling city-level multi-regional input-output (MRIO) tables is challenging due to the scarcity of city-level data. Here we propose an entropy-based framework to construct city-level MRIO tables. We demonstrate the new construction method and present an analysis of the carbon footprint of cities in China's Hebei province. A sensitivity analysis is conducted by introducing a weight reflecting the heterogeneity between city and province data, as an important source of uncertainty is the degree to which cities and provinces have an identical ratio of intermediate demand to total demand. We compare consumption-based emissions generated from the new MRIO to results of the MRIO based on individual city input-output tables. The findings reveal a large discrepancy in consumption-based emissions between the two MRIO tables but this is due to conflicting benchmark data used in the two tables.

Rossella Bardazzi & Leonardo Ghezzi

[Large-scale multinational shocks and international trade: a non-zero-sum game](#)

International trade has improved living standards but has also become a major channel for spreading shocks on a global scale. The increasing relevance of intersectoral linkages and trade in intermediates renewed interest in input-output techniques. This paper enriches the literature on empirical trade models with an input-output/econometric approach including substitution effects and price spillovers. Our model shows that (a) trade elasticities and bilateral shares are not constant in time and differ across sectors and countries; (b) international price changes alter the relative competitiveness between competitors; (c) final demand components such as consumption and investment react to changes in international prices. Large multi-country shocks produce feedback effects in national economies as they adapt by import substitution across exporters, by changing the import content of domestic production and by adjusting final demand. These feedbacks affect the global demand producing an asymmetric non-zero-sum game.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

José L. Zofío, Julio González, Angel Prieto &
Juan Vicente

[Modelling the spatial and sectoral benefits of productivity enhancing innovations using a transport oriented multiregional IO framework: the 'megatruck' in Spain](#)

We render operational the model outlined by Carter (1990) via the introduction of the research methods necessary for studying the spatial and sectoral (upstream and downstream) benefits of productivity-enhancing innovations within a real interregional input-output framework. As case study we examine the reduction in production costs derived from the adoption of longer and heavier vehicles in freight road transportation. We exploit a new Spanish regional table including a detailed disaggregation of the transportation sector. The productivity gains at the national level, resulting from a 30% reduction in transport costs, amount to 2.95% of the GVA at market prices. Results show that firms operating in this niche market appropriate most of the gross operation surplus (which increases by 10%), consistent with the existence of market power. The remaining transportation sectors see profits slightly worsened, suggesting limited substitution effects. A high regional heterogeneity exists because of the different input-output structures.

Anton Pichler & J. Doyne Farmer

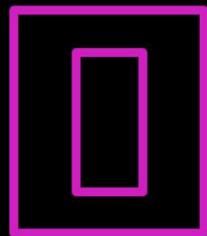
[Simultaneous supply and demand constraints in input-output networks: the case of Covid-19 in Germany, Italy, and Spain](#)

Natural and anthropogenic disasters frequently affect both the supply and demand sides of an economy. A striking recent example is the Covid-19 pandemic which has created severe disruptions to economic output in most countries. These direct shocks to supply and demand will propagate downstream and upstream through production networks. Given the exogenous shocks, we derive a lower bound on total shock propagation. We find that even in this best case scenario network effects substantially amplify the initial shocks. To obtain more realistic model predictions, we study the propagation of shocks bottom-up by imposing different rationing rules on industries if they are not able to satisfy incoming demand. Our results show that economic impacts depend strongly on the emergence of input bottlenecks, making the rationing assumption a key variable in predicting adverse economic impacts. We further establish that the magnitude of initial shocks and network density heavily influence model predictions.

Timothé Beaufils & Leonie Wenz

[A scenario-based method for projecting multi-regional input-output tables](#)

Multi-regional input-output (MRIO) data are a powerful tool to analyze complex interdependencies in the international trade and supply network. Their field of application is however limited by the fact that MRIO datasets are only available for past years whereas the structure of the international trade network has been found to change profoundly over time. We here propose the SPIN method, a simple and flexible algorithm that can project MRIO tables into the future based on transparent scenarios of how gross domestic product and trade relations may evolve in that time. By combining well-established input-output techniques, namely the Leontief quantity model and an RAS-type algorithm, our method provides a straightforward mean to convert quantitative scenarios of the world economy into consistent MRIO tables. We illustrate the functioning of the SPIN method by projecting the evolution of the trade network after the 2008 financial crisis under different alternative scenarios of recovery.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Jan Weinzel

[Aggregation error of the material footprint: the case of the EU](#)

The material footprint (raw material consumption) was proposed as a basis for monitoring SDGs 8.4 and 12.2. However, there is no institutionalized procedure providing globally consistent national material footprints. The OECD aims to institutionalize the material footprint through the development of one official inter-country input-output (ICIO) database applicable for its calculation. Inherent to input-output analysis is the aggregation error, which may impair the results. Therefore, in the case of the EU I analyze the aggregation error which can be expected if NACE rev2 classification is utilized for this ICIO database, and investigate the most important disaggregations, depending on the desired focus of the results. I conclude that the disaggregation level should reflect the intended purpose of the RME indicators. For their deeper analysis, and determination of strategies for their decrease, I conclude that NACE rev2 classification is inappropriate, and recommend high disaggregation and utilization of hybrid units.

Yoshihiro Hashiguchi, Norihiko Yamano & Colin Webb

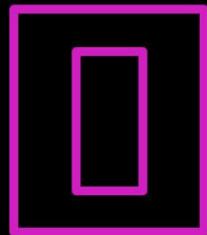
[How thick is your armour? Measuring economic resilience to shocks in global production networks](#)

When economic shocks occur, whether at home or abroad, economic agents are expected to react to reduce the negative impact or amplify the positive effects. The ability of a country to contain economic losses can be defined as the resilience to economic shocks. Using the OECD's annual Inter-Country Input-Output (ICIO) tables from 1995 to 2011, this paper investigates the relationship between changes in final demand and production structures for 61 economies. We found that, during economic downturns, countries that are able to prop up the economy through the domestic service sectors instead of domestic goods and foreign sectors are more resilient to negative shocks. Therefore, understanding the substitutability between goods and service sectors and between domestic and foreign sectors is crucial for gauging the potential risk to a country's domestic economy from shocks abroad - whether economic, environmental, health-related or political.

Arndt Feuerbacher, Scott McDonald & Karen Thierfelder

[Peasant farmers and pandemics: the role of seasonality and labor-leisure trade-off decisions in economy-wide models](#)

Pandemics attack the primary asset (labor) of peasant households and the rural poor. Peasant households must simultaneously allocate labor between farm and household activities, where the demand for agricultural labor is seasonal, which limits intra-temporal substitution, without perfect foresight. A pandemic reduces the supply of labor, through deaths and morbidity, with the scale of reductions in labor supply depending on the seasons in which a pandemic occurs. The analyses, using a recursive dynamic economy-wide model for Bhutan, demonstrate that outbreaks in high labor demand seasons cause increases in wage rates almost three times as high as for outbreaks in low labor demand seasons. Increases in wage rates induce peasant households to reallocate labor time between farm and household activities through the labor-leisure trade-off mechanism. Such changes in the allocation of labor time are important elements of peasants' mitigation responses, and can reduce the negative economic implications of a pandemic.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Paul de Boer, Jan van Daal & João F. D. Rodrigues

[Consumer preferences in CGE models when data are scarce: comparing the linear expenditure and the indirect addilog systems](#)

The linear expenditure system (LES) is a popular option for modeling consumer preferences in computable general equilibrium (CGE) models when data are scarce, since its underlying functional form is parsimonious in parameters. The goal of this paper is to compare the performance of LES against the indirect addilog system (IAS), a hardly known alternative, in terms of their theoretical properties and in a case study. Both systems are equally easy to implement and require the same information for parameter calibration. IAS, however, offers a richer description of consumer preferences. On the basis of an expenditure survey of Statistics Palestine in 1998, we find overwhelming statistical evidence that the IAS demand equations perform better than those of the LES. Simulations with a CGE model developed for disaster impact analysis applied to the intifada of the early 2000s show that the absolute value of the equivalent variation is larger for IAS than for LES.

Syeda Tasnia Hasan, Michael Oliver Wood & Simron Singh

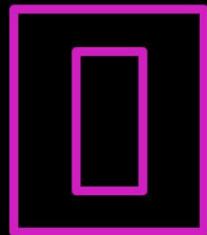
[Revealing embedded carbon emissions within the Comprehensive and Progressive Agreement for Trans-Pacific Partnership](#)

The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), representing approximately USD 13.5 trillion of the global GDP, is one of the largest free-trade agreements in the world. This trade agreement considers many important issues yet fails to address climate change or carbon dioxide (CO₂) emissions. CO₂ emissions in trade are critical as all CPTPP parties have made significant carbon emissions reduction commitments of between 8-36% through the COP21- Paris Agreement. Herein lies a paradox. This study assesses the amount of embedded CO₂ emissions in the CPTPP through an input-output analysis of consumption-based emissions in ten carbon-intensive sectors, under three scenarios. The results reveal that as trade between partners increases, so will CO₂ emissions across those sectors. These findings are essential for policymakers who are striving to grow Partnerships (Sustainable Development Goal 17) while seeking to address Climate Action (Sustainable Development Goal 13), which appear to be conflicting goals.

Arianto A. Patunru & Prema-chandra Athukorala

[Measuring trade in value added: how valid is the proportionality assumption?](#)

For countries that have only aggregate ('competitive type') input-output (IO) tables, value added in exports is commonly estimated using the 'proportionality assumption' to separate imported-inputs from domestically procured inputs. We test the validity of this assumption using non-competitive type IO tables, which contain separately compiled domestic- and imported-input matrices, for Indonesia, Thailand, Malaysia, Taiwan, and Australia. The results show that the proportionality assumption leads to an overestimation of domestic value-added in exports, and that the magnitude of the bias becomes amplified when the export composition of a country shifts from primary products to manufactured goods through integration into global production networks.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Makiko Tsukui, Chen Lin, Kaiyan Ji & Xiaoliang Lang

[The true cost of trade among neighbors: the role of Japanese imports in waste generation in China](#)

China's rapid economic development has caused considerable environmental problems in waste generation and treatment. One important reason for this is China's manufacturing exports to other countries such as Japan, a major trading partner. However, the contribution of such importing countries has not yet been fully explored. This study quantitatively examined how final demand in trade between China and Japan affects both countries' economies and waste generation. The results show that imports of final consumption goods from China to Japan induced enormous waste generation in China, while the wastes induced in Japan were negligible. Even if final demand exports from China to Japan are significantly economically beneficial to China, the cost to China from addressing the induced waste generation seems too much to make these exports worthwhile. To encourage constructive discussions, improvement of reliability and transparency of waste statistics in China that allows comparison with other countries would be significant.

Markus Simbürger

[Filter methods for MRIO tables: an evaluation](#)

Researchers who deal with network analysis based on multi-regional input-output (MRIO) tables cannot avoid the intensively discussed issue of filtering, which means identification of the most important and significant trade connections. The question of what is an appropriate filter method remains. This paper expands the existing discussion and brings new insight based on the evaluation of existing filter methods for MRIO tables. Six filter methods from the prevailing literature are identified as relevant and tested on the published MRIO tables: EORA26 and EXIOBASE. The results are verified by a case study. The evaluation shows that the Tolerable Limit approach and filter based on the Weaver–Thomas Index are the most restrictive. The Leontief filter and the filter based on holistic accuracy can be partially recommended. The filter on absolute trade values and average transactions can be recommended as 'good' methods.

Ning Chang & Chaohui Han

[Regional CO₂ emissions and cross-boundary mitigation potential in China](#)

This paper presents a new framework for investigating regional CO₂ emissions from the perspective of the domestic supply chain, with a combination of linkage analysis and structural decomposition analysis (SDA), which allows for a better understanding of spatial emission distributions and cross-boundary potential for CO₂ mitigation. Based on the multi-regional input-output (MRIO) tables of 2007 and 2012, Chinese provinces (cities) are categorised into three groups according to linkage characteristics, among which, Group I is suggested to be given priority in formulating mitigation policies due to their stronger regional CO₂ influence characteristics. Moreover, regions in Group I have been more affected by inter-regional trade than other groups with regard to their local CO₂ emissions. Therefore, turning Group I into a low-carbon production pattern could help construct greener domestic supply chains. The results emphasise that regional analysis on CO₂ emissions should go beyond the local factors, and that regional mitigation policies should consider the position and participation degree of different regions in domestic supply chains.

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Casiano A. Manrique-de-Lara-Peña & José J.
Déniz-Mayor

[The business accounting matrix: a proposal
with an application](#)

National accounting matrices (NAM) perfectly describe the economic structure of a national economy, summarising the whole process of generation of primary income and its distribution among the different institutional sectors of the economy. It is not just a way to represent the main economic statistics of an economy but it also serves as the basis for most macroeconomic modelling efforts. The business accounting matrix (BAM) presents the most relevant information for the firm in a similar way, adapted to the descriptive potential of financial accounting, what we believe can be useful both for economic modellers and for decision makers at the firm level. Our intention is not to convince business administrators to change their accounting paradigm but to help analysts and researchers to obtain a comprehensive description of the activity of a firm aligned to well recognised economic statistical standards.

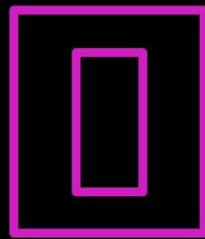
Muhammad Daaniyall Abd Rahman, Bart Los,
Anne Owen & Manfred Lenzen

[Multi-level comparisons of input-output tables
using cross-entropy indicators](#)

We introduce a cross-entropy (CE) indicator to quantify the extent to which two input-output tables or two tables with results based on input-output analysis differ from each other. Our work deploys a unique feature of the CE indicator: it can be decomposed, allowing for matrix comparisons at various levels within one coherent framework. To illustrate the power of this approach, we apply the technique to five multi-region input-output (MRCIO) tables for 2011, derived from the Eora, EXIOBASE, GTAP, OECD and WIOD databases. We make pairwise comparisons between MRCIOs and between global value chain (GVC) computations based on these MRCIOs. We find that answers to questions related to broader aggregates are generally quite similar, but that answers to questions at the level of single industries can be rather different across MRCIOs.

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INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Highlights in journals

Bui Trinh & Nguyen Viet Phong

Measure Value Digital in Economy: Case of Vietnam

Case Studies Journal

Recently, the phrase "digital economy" has been mentioned by the media and even by economists as a fashionable word. Many people "boldly" predict how much the digital economy will account for as a percentage of GDP or how much will the digital economy make growth GDP? Some international organizations such as OECD, ADB, UN.. also offer methods to measure the digital economy in the economy. This article tries to provide a method to measure the digital economy in the economy based on the input - output system with the case of Vietnam.

Kirsten S. Wiebe, Vibeke S. Norstebø, Fabian R. Aponte, Moana S. Simas, Tina Andersen & Gerardo A. Perez-Valdes

Circular Economy and the triple bottom line in Norway

Circular Economy and Sustainability

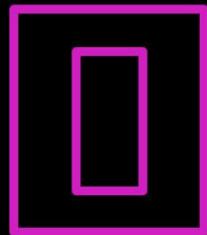
A more circular economy aims to reduce global material consumption, make the most out of our resources, and create a more sustainable economic system. In this paper, we analyze how different circular economy actions in Norway affect indicators in the three pillars of sustainable development: economic prosperity (measured by value added), social equity (measured by employment opportunities), and environmental protection (measured by greenhouse gas emissions). Based on priorities of the EU's Circular Economy Action Plan and characteristics of the Norwegian economy, we have selected five value chains for analysis: electronics; textiles; construction and building; packaging and plastics; and metal efficiency. The results show that there is a substantial potential for increased value added and employment in Norway related to the circular transition, while at the same time mitigating greenhouse gas emissions. For increased material efficiency (plastic packaging, metals), employment gains can be substantial, while imports of metals and plastics decrease, resulting in lower upstream emissions, but higher Norwegian emissions. For consumer goods (textiles, electronics), the positive effects come about from shifting from a buy-and-discard model to a buy-repair/share/use longer model, resulting in increased employment in Norway and decreased imports, which potentially leads to lower emissions, but also lower employment globally. For re-use/re-purpose and recycling of building materials, emission-intense material extraction and processing activities are replaced by more labour intense activities, but has the largest potential of decreasing emissions within Norway.

Arunima Malik, Azusa Oita, Emily Shaw, Mengyu Li, Panittra Ninpanit, Vibhuti Nandel, Jun Lan & Manfred Lenzen

Drivers of global nitrogen emissions

Environmental Research Letters

Nitrogen is crucial for sustaining life. However, excessive reactive nitrogen (Nr) in the form of ammonia, nitrates, nitrogen oxides or nitrous oxides affects the quality of water, air and soil, resulting in human health risks. This study aims to assess the drivers of Nr emissions by analysing six determinants: nitrogen efficiency (Nr emissions per unit of production), production recipe (inter-sectoral dependencies), final demand composition (consumption baskets of households), final demand destination (consumption vs. investment balance), affluence (final consumption per capita) and population. To this end, we construct a detailed multi-regional input-output database featuring data on international trade between 186 countries to undertake a global structural decomposition analysis of a change in global Nr emissions from 1997 to 2017. Our analysis shows that nitrogen efficiency has improved over the assessed time-period, however affluence, final demand destination and population growth have resulted in an overall increase in Nr emissions. We provide a global perspective of the drivers of nitrogen emissions at a detailed country level, and breakdown the change in emissions into contribution from domestic footprint and rest-of-world footprint. We highlight that food production coupled with growing international trade is increasing Nr emissions worldwide.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Ya-Fang Sun, Yue-Jun Zhang & Bin Su

[How does global transport sector improve the emissions reduction performance? A demand-side analysis](#)

Applied Energy

Transport sector is one of the main global carbon emitters. Its production-side aggregated carbon intensity (i.e., the ratio of carbon emissions to GDP, AI) has been well explored, but its demand-side aggregated embodied carbon intensity (i.e., the ratio of embodied emissions to embodied value added, AEI) is always ignored, which is not conducive to improving its demand-side emissions reduction performance. Thus, using the latest world input-output table from EXIOBASE, this paper adopts the environmentally extended multi-regional input-output model and the structural path analysis model to investigate this issue from the views of globe, region, transmission layer, and final demand structure, respectively. The results indicate that: first, the AEI and AI of global transport sector contribute to global AI with 4.2% and 6.7%, respectively. The AI of global transport sector is chiefly contributed by water transport and air transport, followed by land transport, while its AEI is mainly contributed by land transport, followed by water transport and air transport. Second, transport sector highly contributing to regional AEI are mostly from the developed regions in Europe. Land transport, water transport, and air transport highly contributing to the AEI of regional transport sector are generally from the regions with low AEI of transport sector, the coastal regions, and the developed regions in Europe, respectively. Finally, the critical transmission layers of the AEI of regional transport sector have great differences in various regions, but their critical final demands are similar.

Enci Wang, Bin Su, Sheng Zhen & Qinxin Guo

[China's Embodied SO₂ Emissions and Aggregate Embodied SO₂ Intensities in Interprovincial and International Trade](#)

Technological Forecasting and Social Change

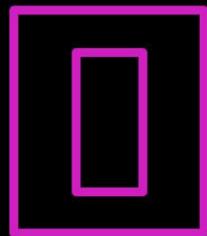
Reducing SO₂ emissions remains crucial for China in terms of controlling air pollution. There is great heterogeneity in SO₂ emissions across provinces in China due to trade. This paper applies a hybrid approach to study SO₂ emission transfer among 31 provinces (including Tibet) in China in 2015. The differences of SO₂ emissions are compared from the perspectives of pollution transfer in the domestic supply chain and international supply chain. Moreover, this paper calculates the aggregate embodied SO₂ emission intensity (ratio between embodied SO₂ emissions and embodied value added) from demand perspective. The results show an inequitable distribution of SO₂ emissions and embodied intensities in China's 31 provinces. The provinces in the eastern region account for a large proportion of interprovincial import trade and international exports. For the provinces in the western region, the proportions of embodied SO₂ are higher than those in the central region. Under the consumption-based principle, the eastern region is the main contributors to SO₂ emissions. In addition, the emission intensity in the eastern region is much lower than that in the western region. The SO₂ emission intensity generated by international export trade is lower than that generated by interprovincial trade. Therefore, China should strengthen both the joint management in various provinces and international cooperation, so as to promote the coordinated management of the industrial chain.

Xin Xiang & Xiuli Liu

[Research on the economic and environmental impacts of China's seawater desalination industry with different technologies in the macroeconomic system](#)

Desalination

Reverse osmosis (RO) and multiple-effect distillation (MED) are China's main seawater desalination technologies. This paper made the cost analysis of RO and MED industries, compiled China's 2007, 2012 and 2017 input-occupancy-output tables with RO and MED industries specially separated, then estimated their economic and environmental impacts in China's macroeconomic system. Results show that RO and MED had a similar pulling effect on China's economy, and their pulling effects were higher than the average level of all 50 industries. From 2007 to 2017, the ranking of direct CO₂ emission coefficient of MED industry rose from 5th to 3rd, and that of RO industry rose from 12th to 8th. Expanding the unit output of the seawater desalination industry brought more CO₂ emission than the average level of all industries. Unit production of MED brought more CO₂ emission than that of RO. With the CO₂ emission APL model, the upstream three energy production industries, which had the strongest connection with the CO₂ emission of RO and MED industries were identified. To reduce CO₂ emission from RO and MED industries, it is practical to take CO₂ emission reduction measures on the upstream three energy production industries.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Xuefeng Li & Xiuli Liu

Identifying Hub Wastewater Propagation Chains in China's National Economic System: A Model Coupled Input-Output Analysis with Graphical Theory
Water

Wastewater propagation chains (WPCs) measure inter-sector average propagation lengths (APL) of wastewater discharge. To achieve sustainable wastewater management, one needs to understand the propagation mechanisms by identifying WPCs at a national level over time. However, the traditional model of identifying WPCs is prone to retaining APLs with lower values but larger wastewater discharge intensities, ignoring many linkages whereby intensities are less than a preset threshold. Nevertheless, these overlooked linkages are valuable in understanding wastewater propagation mechanisms. This study proposed a new model coupled input-output analysis with the graphical theory, called the average propagation lengths-hub covariance graph (APL-HCG). This model can investigate WPCs where the closeness of sector linkages exceeds the preset thresholds. Furthermore, it is capable of retaining linkages for identifying hub wastewater propagation chains (HWPCs). Based on APL-HCG, the resultant HWPCs are decomposed as separated sub-chains which are basically composed of linkages among certain significant sectors belonging to the secondary industry or the tertiary industry. Scenario analyses show that HWPCs are effective in reducing wastewater discharge in the national economic system. The total wastewater discharge would decrease by 1.36%, 2.53%, 2.46%, and 2.11% if we reduced 10% of the final demand of all sectors in HWPCs in 2002, 2007, 2012, and 2017. The APL-HCG model outperforms the traditional model on WPCs by 0.14%, 1.61%, 0.47%, and 0.10%, respectively. The APL-HCG model is 0.21%, 0.68%, 0.70%, and 0.35% better than the scenario of random sampling with the number of sectors equal to HWPCs, respectively. Certain policy implications were provided to reduce wastewater effectively at the national level.

Zhongxiao Sun, Laura Scherer, Arnold Tukker, Seth A. Spawn-Lee, Martin Bruckner, Holly K. Gibbs & Paul Behrens

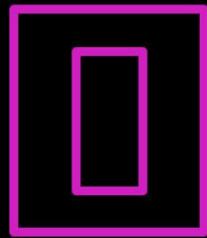
Dietary change in high-income nations alone can lead to substantial double climate dividend
Nature Food

A dietary shift from animal-based foods to plant-based foods in high-income nations could reduce greenhouse gas emissions from direct agricultural production and increase carbon sequestration if resulting spared land was restored to its antecedent natural vegetation. We estimate this double effect by simulating the adoption of the EAT-Lancet planetary health diet by 54 high-income nations representing 68% of global gross domestic product and 17% of population. Our results show that such dietary change could reduce annual agricultural production emissions of high-income nations' diets by 61% while sequestering as much as 98.3 (55.6–143.7) GtCO₂ equivalent, equal to approximately 14 years of current global agricultural emissions until natural vegetation matures. This amount could potentially fulfil high-income nations' future sum of carbon dioxide removal (CDR) obligations under the principle of equal per capita CDR responsibilities. Linking land, food, climate and public health policy will be vital to harnessing the opportunities of a double climate dividend.

Zhongxiao Sun, Paul Behrens, Arnold Tukker, Martin Bruckner & Laura Scherer

Shared and environmentally just responsibility for global biodiversity loss
Ecological Economics

Human land use is the main driver of terrestrial biodiversity loss. It has been argued that producers and consumers have a shared responsibility for biodiversity loss because this land use is directly and indirectly driven by the local and global demand for products. Such responsibility sharing would be an important step for global biodiversity cooperation and conservation. Here, we use a global multiregional input-output framework to estimate consumption-based biodiversity loss, integrating with both the physical Food and Agriculture Biomass Input-Output (FABIO) dataset and a global monetary input-output table (EXIOBASE). We use an environmental justice framework for assigning biodiversity loss responsibility between producers and consumers. In this framework, we employ the Human Development Index (HDI) as a proxy of the weighting parameter for both producers and consumers. An environmental justice perspective may provide a fairer distribution of responsibility in a world where different nations have very different capabilities and see varying benefits from international trade. Environmentally just accounting increases the footprint of the Global North compared to other common approaches for sharing responsibility across all producers and consumers along international supply chains. We describe how environmental justice may inform cooperation in biodiversity protection between stakeholders along global supply chains.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Quanliang Ye, Martin Bruckner, Ranran Wang, Joep F Schyns, La Zhusuo, Lan Yang, Han Su & Maarten S Krol

A hybrid multi-regional input-output model of China: Integrating the physical agricultural biomass and food system into the monetary supply chain

Resources, Conservation and Recycling

Lacking systematic supply-use information of agricultural biomass and food products within China makes the existing provincial environmental pressure assessments (e.g., water consumption) either not detailed enough (e.g., by the input-output table-based approach) or not comprehensive enough (e.g., by the process-based approach). This study develops a symmetric inter-provincial multi-regional input-output (MRIO) model that hybridizes the physical food and agricultural biomass system with the monetary supply chain of China. First, we construct the inter-provincial supply, use, and input-output tables in physical units of 84 agriculture, food and forestry products. These physical supply/use/MRIO tables systematically capture agri-food product flows, at an unprecedented level of product detail, along domestic supply chains within China. Then we integrate the physical MRIO table of agri-food products into the monetary all-sector MRIO table to construct a symmetric hybrid MRIO table of China. The application of our hybrid MRIO model to the case of provincial blue water footprint assessments reveals that the hybrid model enhances both the monetary MRIO table-based approach and the process-based approach from different aspects. For instance, the hybrid MRIO model can reduce the uncertainty of monetary MRIO modeling due to the aggregation of products with different environmental properties into homogeneous sectors. Lastly, uncertainty analysis is implemented to quantify the main sources of uncertainties, and understand the reliability of our new hybrid MRIO model for future sustainable development design.

Navoda Nirmani Liyanapathirana, Amanda Grech, Mengyu Li, Arunima Malik, Manfred Lenzen & David Raubenheimer

Nutrient-sensitive approach for sustainability assessment of different dietary patterns in Australia

The American Journal of Clinical Nutrition

Understanding the relation between sustainability and nutrients is important in devising healthy and sustainable diets. However, there are no prevailing methodologies to assess sustainability at the nutrient level.

The aim was to examine and demonstrate the potential of integrating input-output analysis with nutritional geometry to link environmental, economic, and health associations of dietary scenarios in Australia with macronutrients.

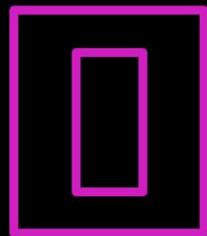
One-day dietary recalls of 9341 adult respondents (age ≥ 18 y) of the latest available cross-sectional National Nutrition and Physical Activity Survey-2011/12 of Australia were integrated with the input-output data obtained from the Australian Industrial Ecology Virtual Laboratory to calculate the environmental and economic impacts of dietary intakes in Australia. Australian adults' dietary intakes were classified into 3 dietary scenarios: "vegan," "pescatarian," and "omnivorous." Then, the relations between nutritional, economic, and environmental characteristics of the 3 dietary scenarios were demonstrated with the diets' macronutrient composition in a multidimensional nutritional geometry representation to link the sustainability indicators with macronutrients.

Á. García-Alaminos, E. Gilles, F. Monsalve & J. Zafrilla

Measuring a university's environmental performance: A standardized proposal for carbon footprint assessment

Journal of Cleaner Production

The global contribution of all kinds of organizations to greenhouse gas (GHG) emissions is noteworthy. Calculating, reporting, reducing, and compensating for carbon footprints are the appropriate steps to take to guide companies toward a path that is compatible with their country's objectives for the fulfillment of the Paris Agreement. In Latin American countries, carbon footprint reporting is limited and incipient. This paper aims to start closing this gap by assessing the carbon footprint of a university operating in the city of Bogotá, Colombia. Based on a city input-output table (IOT) nested in a multiregional input-output (MRIO) table framework, we estimate the three categories of the carbon footprint (scopes 1, 2, and 3) identified by the Greenhouse Gas Protocol using an improved multiregional tiered hybrid analysis of the university's energy and other input expenditures. Our results show that 94% of the entire institution's footprint is attributed to scope 3, which represents indirect emissions linked to the upstream value chain. The results allow us to identify emission hotspots and their impact on the supply chain, which can be helpful for reducing costs and encouraging organizations, users, and suppliers to make more sustainable decisions.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Vishnu S. Prabhu & Kakali Mukhopadhyay

Assessment of wind energy in India at the national and sub-national level: attributional LCA exercise

International Journal of Green Energy

The Government of India has set the target of 60 GW wind energy capacity to be achieved by 2022. The Attributional Life Cycle Assessment methodology and E3-India model are used to study the total economic, energy, and environmental impact of the operational phase of wind turbines across the country. It is expected to generate waste from 2021 until 2051 at the rate of 217.89 tonnes/wind turbine, cumulatively amounting to 7.9 million tonnes. This generates an opportunity for recycling and resale of the metal materials worth USD 4.5 billion, which can be utilized in manufacturing 3.3 GW of wind turbines, thus emphasizing its high circular economy potential. The embodied energy and CO₂ emission savings by substituting virgin material are estimated to be 17,215 GWh and 6,626 million tonnes, respectively. Thus, measures like Extended Producer Responsibility could help create a viable circular economy through the partially closed-loop recycling of wind turbines.

Raffaele Giammetti, Luca Papi, Désirée Teobaldelli & Davide Ticchi

The network effect of deglobalisation on European regions

Cambridge Journal of Regions, Economy and Society

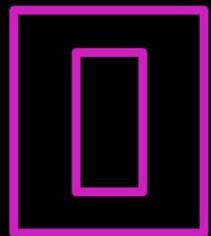
This paper investigates the effects of a retreat from global economic integration on the European regional production network for the period 2000–2010. We find that production has become increasingly fragmented, although the degree of heterogeneity across regions is substantial. This heterogeneity is also present in the direct and indirect effects of three different deglobalisation scenarios that we simulate. Our results show that deglobalisation generates winners and losers. Specifically, two groups of regions emerge; regions that would benefit from a return to a less integrated world, and regions that would instead gain from a strengthening of the European production network.

Raffaele Giammetti, Luca Papi, Désirée Teobaldelli & Davide Ticchi

The optimality of age-based lockdown policies

Journal of Policy Modeling

This paper studies an age-based lockdown that keeps over-60 workers at home as policy response to COVID-19 pandemic in a sample of thirty countries of the European single market. Three main policy issues are addressed, and the results can be summarized as follows. First, age-based lockdown policies are associated with limited output losses and, therefore, are an efficient strategy to limit the spread of the virus in a pandemic, especially in presence of strong age-dependent fatality rates. Second, lockdown policies generate substantial spillover effects; hence, international policy coordination avoiding that too many countries are in lockdown contemporaneously or that such coordination takes place across the countries with the highest integration of over-60 workers along GVCs may be helpful in reducing disruptions. Third, non-targeted lockdowns are much more costly than age-based ones; therefore, other things equal, age-based policies should always be preferred to non-targeted ones. Our analysis also suggests that, in our sample, the over-60 workers are relatively more numerous in sectors where the value added and the integration in GVCs is lower; this feature should be kept in mind in the design of other policies as it might play an important role.



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Jacobo Ferrer-Hernández & Luis Daniel Torres-González

[Some Recent Developments IN The Explanation of The Empirical Relationship Between Prices and Distribution](#)

Contributions to Political Economy

The paper complements recent contributions towards the explanation of the regularities in the behaviour of prices and capital intensities as an effect of hypothetical changes in the rate of profits in empirical production-price models. It is shown that theoretical price and capital curves, i.e. prices and capital values as a function of the rate of profits, depend on the product of the eigenvalues and what we call the eigenlabours —the representation of the labour vector in the space spanned by the eigenvectors of the input matrix. We report robust evidence that the eigenvalues by themselves cannot produce the curves regularly reported in the literature, but rather it is the joint action of the eigenvalues and the eigenlabours. It is conjectured that the tendency towards zero of the subdominant eigenlabours is driven by the statistical tendency towards proportionality between the labour vector and the Perron–Frobenius eigenvector of the input matrix.

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Recent I-O Books and related

Input-Output Analysis: Foundations and Extensions

3rd Edition, 2022

AUTHORS

Ronald E. Miller, University of Pennsylvania

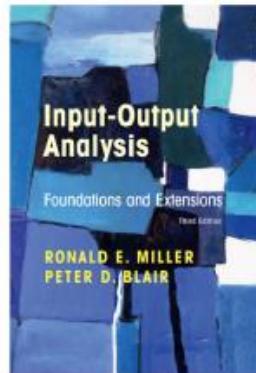
Peter D. Blair, George Mason University

ISBN: 9781108484763

New Supplemental Online Resources

This essential reference book for students and scholars in the input-output research and applications community has been fully revised and updated to reflect important developments in the field.

Associated with the text, Cambridge University Press has released a collection of online resources supplementing the text. These resources are contained in five online folders located on the textbook web site: <http://www.cambridge.org/millerandblair>.



Supplemental Chapter Appendices:

- Appendix S2.1 The Relationship between Approaches I and II
- Appendix S3.1 Basic Relationships in the Multiregional Input-Output Model
- Appendix S4.1 Supplemental Discussion of Aggregation Bias
- Appendix S5.1 Alternative Approaches to the Derivation of Transactions Matrices
- Appendix S5.2 Elimination of Negatives in Commodity Technology Models
- Appendix S5.3 Left and Right Inverses in Nonsquare Input-Output Systems
- Appendix S7.2 Hypothetical Extractions with Partitioned Matrices
- Appendix S8.1 Alternative Additive Decompositions of $x = LBf$
- Appendix S8.2 Additional Early Additive Structural Decomposition Studies
- Appendix S8.3 The Approximate Economy-wide Equivalence of Additive and Multiplicative SDA Effects
- Appendix S10.2 Detailed Results for the Numerical Illustration in Section 10.4
- Appendix S10.3 Brief History of Leontief Inverses with Errors in the Coefficients of A
- Appendix S12.1 Earlier Formulation of Energy Input-Output Models

Exercise Problems and Solutions. This folder includes exercise problems illustrating many of the basic methodological concepts and applications highlighted throughout the text and organized by chapter in Appendix SP1. Summaries of solutions to these exercise problems are provided in Appendix SP2. Some problems reference illustrative data sets included in Appendices SD1 and SD2, described below. A computational workbook providing expanded discussion of the problems and solutions is included as Appendix SP3:

Appendix SP1 Exercise Problems

Appendix SP2 Exercise Problem Solutions

Appendix SP3 Computational Workbook

Reference Input-Output Data Tables. This folder includes machine readable versions (Microsoft Excel spreadsheets) of highly aggregated historical US Input-Output tables (Appendix SD1) and of other data tables referenced in the text and exercise problems (Appendix SD2).

Appendix SD1 US IO Data

Appendix SD2 Other Real-World Tables

Exploring Input-Output Analysis with APL. This folder includes an expanded version of the computational workbook included as Appendix SP3 that provides additional computer software notes.

Errata. This folder will contain periodic updates of accumulated errata for the text, appendices, problems, data tables, and workbook.

About the Authors

Ronald E. Miller is Professor Emeritus of Regional Science at the University of Pennsylvania. A pioneer in the development of interregional input-output models, his research providing key insights about interregional feedback effects and many other features of regional economic models spans five decades.

Peter D. Blair is Distinguished Senior Fellow in the Schar School of Policy and Government, George Mason University. Published widely in many fields, his career includes management, research and teaching at the National Academy of Sciences, the Congressional Office of Technology Assessment, Techncon Analytic Research and the University of Pennsylvania.

INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Recent I-O Books and related

By Kakali Mukhopadhyay

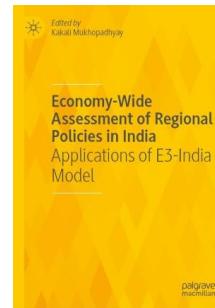
[Economy-Wide Assessment of Regional Policies in India](#)
[Applications of E3-India Model](#)

The book, titled, '**Economy-Wide Assessment of Regional Policies in India: Applications of E3-India Model**' is an extended synthesis from E3-India (Economy, Energy, Emissions) project, an initiative aimed at enabling evidence-based policy making at the regional level in India.

This volume edited by Prof Kakali Mukhopadhyay (Gokhale Institute of Politics and Economics, Pune & McGill University, Canada) is a compilation of sector-specific studies that exploit the E3-India model to assess the national and sub-national policy implications and their distribution across states.

To this end, the project constructed the first ever set of **regional Input-Output tables for each of the 32 States and Union Territories in India** for comprehensive economy-wide assessment of regional policies. E3-India is a macro-econometric model based on Keynes-Leontief-Klein framework, used to simulate the effects of economic and energy policy at the national and sub-national level, providing the information that policy makers need when assessing the merits of policy proposals. The model has been in the public domain and freely available to researchers since December 2019.

(<https://www.e3indiamodel.com/>)



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Job Positions



As the science and knowledge service of the Commission, the mission of DG Joint Research Centre is to support EU policies with independent evidence throughout the whole policy cycle.

The JRC is located in 5 Member States (Belgium, Germany, Italy, the Netherlands and Spain). Further information is available at:

<https://ec.europa.eu/jrc/>

Graduate Trainee positions

Code: GT_PERM_2022-000005

October 2022 Call for expression of interest – scientific trainees

Deadline: 07/06/2022 23:59 Brussels time Info:

[More info](#)

Note that "the call is open to recent university graduates (no more than five years after the last degree awarded) who have completed at least a standard 3-year higher education degree (180 credits), corresponding to a complete Bachelor's cycle, or equivalent, at the closing date of the present call".



UNIVERSITY OF MINNESOTA
Driven to Discover

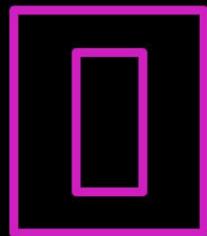
INSTITUTE ON THE
ENVIRONMENT

Do you believe in a future where people and the planet prosper together? Are you entrepreneurial and interested in **building an impactful, collaborative research program in Sustainability**? At the Institute on the Environment we are looking for someone to expand our work at the intersections of social, economic, and ecological sustainability challenges.

The [Institute on the Environment](#) (IonE) at the University of Minnesota seeks research scholars in [Natural Capital & Ecosystem Services, Sustainability, and Energy Transition](#) to develop externally funded programs focused on advancing sustainable outcomes by increasing the use of knowledge in societal decision making processes. We are looking for candidates at any career stage who would excel leading and developing a research portfolio at IonE that is focused on moving the needle on important sustainability outcomes.

These positions are a cluster hire to enhance the capacity of the University of Minnesota, through the IonE, to pursue interdisciplinary and collaborative research that advances sustainable systems through community-engaged and societally impactful scholarship.

TO APPLY: To learn more and apply, visit the University's employment page and search for Job IDs 347369 (Natural Capital), 347375 (Sustainability), or 347367 (Energy Transition) (<https://humanresources.umn.edu/content/find-job>). We are requesting applications by May 23 (June 10 for the energy position); we will fully consider all applications that are submitted by June 1 (June 16 for energy).



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

The Social Accounting Corner

Questions: 1) How did you learn about Input-Output for the first time? Can you remember your first thoughts? 2) Which was your first IIOA conference? Any memory that you want/can share? 3) Recommend the readers of the newsletter a paper that surprised or inspired you.

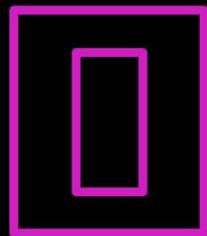
Bart Los – Professor at the Global Economics & Management Department, University of Groningen (The Netherlands)



1) I first encountered Input-Output Analysis in late 1986 or early 1987. I was a first-year student when a young lecturer in jeans and with quite a bunch of hair taught the course “Orientation on Core Topics in Econometrics”. The young lecturer was Erik Dietzenbacher and (not so surprisingly) the first core topic was IO. I liked Erik’s Freudian jokes about the location of the origin while mimicking a 3D-graph more than IO... In my third year, when I was fed up with the huge amounts of abstract mathematics in the course programme, I took an elective course in IO, taught by Theo Junius (who developed the GRAS method with Jan Oosterhaven; he passed away about a year ago). We first studied the 1968-book *Input-Output Analyse* by Jochen Schumann. I did not really like that, partly because I was not good at reading German. We then continued discussing *General Equilibrium Models for Development Policy* by Dervis, de Melo and Robinson, which had been published by the World Bank in 1982. This great book got me excited about IO. It used rigorous treatments of methods to understand structural change and economic development in a way that appealed to me.

2) It was the 1995 conference in New Delhi, India. It was actually my very first scientific conference altogether and it is still the by far most eventful conference I have ever been to! It shouldn’t be too hard to fill an entire Newsletter with stories about that conference. Especially the excursion (to the Taj Mahal and, if the driver of our bus would not have made a crucial mistake, the Red Fort in Agra) was something that I will never forget. But I will also continue to remember the keynote lecture by the famous professor Ozaki. He showed a 300x300 IO table for Japan on one of his overhead slides (in very small print) and carefully discussed some of its elements. After five minutes or so, when he wanted to replace the slide, he suddenly apologized that he had put the slide on the projector upside-down. Nobody in the audience had noticed...

3) I have always viewed *The Future Impact of Automation on Workers* by Wassily Leontief and Faye Duchin (1986) as a great book. Its topic is relevant for the second field to which I sometimes contribute (the economics of technological change) and it provides consistent scenarios about which policymakers should have cared at the time. When it comes to recommendations, however, I think we should pay much more attention to what mainstream economists are currently doing using input-output tables. In our circles, we tend to focus almost entirely on demand-side issues, while economic networks are also frequently hit by supply-side shocks. A recommendation (also to myself) is therefore to read many more papers like “Supply Chain Disruptions: Evidence from the Great East Japan Earthquake” by Vasco Carvalho and his co-authors in *Quarterly Journal of Economics* (2020). Just going through the list of references provides ample opportunities for broadening our perspectives and expanding our toolbox!



INTERNATIONAL INPUT-OUTPUT ASSOCIATION

The Social Accounting Corner

Questions: 1) How did you learn about Input-Output for the first time? Can you remember your first thoughts? 2) Which was your first IIOA conference? Any memory that you want/can share? 3) Recommend the readers of the newsletter a paper that surprised or inspired you.

Rossella Bardazzi – Professor at the
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1) I came into contact with IO analysis for the first time during my bachelor's degree and then studied it further during my doctorate with the writing of my thesis. I developed the modelling of indirect taxes in a multi-sectoral model for the Italian economy, with a focus on value added tax and energy taxes. My first impression was that this type of analysis could make me really 'see' the interrelationships between sectors of the economy that are instead lost in the macro analysis. Secondly, I found the idea of simulating the effects of economic policies and suggesting possible changes exciting. This has always been the most interesting aspect for me.

2) I still have so many vivid memories of my first IIOA conference even many years later! It was actually 1989, in Keszthely, Hungary, so it's really been a long time. I presented my first paper on indirect tax modelling and met for the first time my colleagues from the INFORUM group (Interindustry Forecasting at University of Maryland) with whom I have continued to collaborate throughout my life. Thanks to my supervisor, Dr. Maurizio Grassini of the University of Florence (Italy), I met Dr. Clopper Almon, the founder of INFORUM, whose scientific contributions I had read and who welcomed me into this family of researchers based in many different countries around the world.

This international openness that I have constantly felt at IIOA conferences has always been very inspiring. From that 1989 conference, a special issue of *Economic Systems Research* (vol.3, (1), 1991) came out to present the Inforum Approach to Interindustry Modeling.

3) I have devoted part of my research to the study of household consumption behaviour, recently focusing in particular on energy demand. This line of research was strongly inspired by the work of Almon published in two papers: Almon, C. (1979). A system of consumption functions and its estimation for Belgium. *Southern Economic Journal*, 85-106, further developed in a paper presented at the IIOA conference in New York: Almon, C. (1998). A perhaps adequate demand system with application to France, Italy, Spain, and the USA. In *The 1998 Conference of the International Input-Output Association*.

I thought that the long-run structural perspective of this demand system and its properties were very fascinating and had the potential of a further development to integrate the sectoral analysis with microsimulation modelling. I found this linkage very promising and developed my research on this line, to include other personal consumption drivers such as population aging and cohort effects that in my opinion are currently very relevant in household behaviour.