

**Newsletter**  
Number 60, Feb 2025

# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Welcome from the Editor



Dear **IIOA** member,

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

In this issue, you will find a message from the new IIOA President Dr Kuishuang Feng, information about the new fellow of the IIOA, details on some recent conferences, some job and PhD opportunities, the latest ESR articles, and some highlights in journals.

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

### **Jing Meng**

*IIOA Newsletter* Editor

University College London

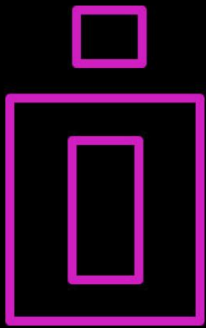
Newsletter E-mail: [newsletter@iioa.org](mailto:newsletter@iioa.org)

Personal E-mail: [jing.j.meng@ucl.ac.uk](mailto:jing.j.meng@ucl.ac.uk)

Would you like to contribute to the IIOA newsletter?  
Send us your news at [newsletter@iioa.org](mailto:newsletter@iioa.org)

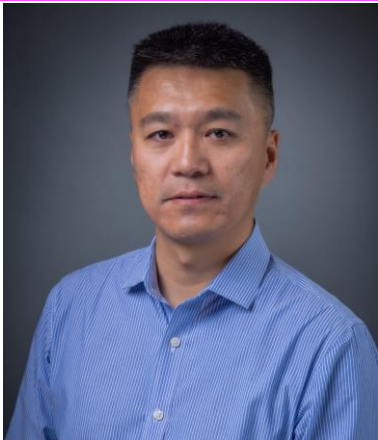
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# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## A message from IIOA President: Dr. Kuishuang Feng



Dear IIOA Members,

It is a great honor to be elected as the President of the International Input-Output Association (IIOA). I am deeply grateful for the trust and support of the Council members and the broader IIOA community. I look forward to working alongside all of you to advance the association's mission, foster collaboration, and continue strengthening our global network. I would like to extend my sincere appreciation to **Sanjiv Mahajan**, our outgoing President, for his outstanding leadership and dedication, particularly in guiding the association through the challenges of the pandemic. His contributions have been invaluable to the growth and resilience of IIOA.

Please join me in welcoming our newly elected Council members, **Kirsten Wiebe** and **Simone Grabner**. Your commitment to serving the IIOA is greatly appreciated, and I look forward to working with you. Additionally, congratulations to **Kirsten Wiebe** and **Jose Rueda-Cantuche** on their election as **Vice Presidents** of IIOA, and to **Luis Pedauga** on his reappointment as Director of the International School of Input-Output Analysis. Your leadership and expertise will undoubtedly strengthen our association.

I am also pleased to announce that the 2025 IIOA Conference will be held in Malé, Maldives. A special thank you to **Cuihong Yang**, who will serve as the Scientific Committee Chair, and **Kirsten Wiebe**, who will act as the Council Liaison Officer, particularly in organizing the Young Researchers' events. I encourage all members to participate, and I look forward to an engaging and successful conference this summer. Let's continue to work together to advance input-output research and strengthen our community. I look forward to connecting with many of you in the months ahead.

Best regards,

Kuishuang Feng

*Associate Professor, University of Maryland at  
College Park, United States*

*President of the International Input-Output  
Association (2025 – 2027)*

*Council Member of the International Input-  
Output Association (2021-2027)*

*Member of the International Input-Output  
Association since 2007*

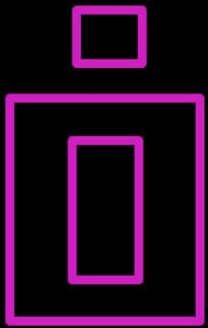
*Leontief Memorial Prize Winner (2013)*

*Editor-in-Chief, Sustainable Production and  
Consumption*

*Editor, Ecological Economics*

*Highly Cited Researcher (top 1%) by Clarivate*

*World's Top 2% Scientists by Stanford University*



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## New IIOA Fellow

### **BERT STEENGE ELECTED AS NEW FELLOW OF THE IIOA**

*Professor, University of Groningen;  
Life member of Clare Hall, University of  
Cambridge;  
Convenor, Cambridge Group in the History of  
Economic Analysis;  
Member of the Academic Committee, Giacomo  
Leopardi School for Higher Studies, University  
of Macerata;  
Managing Editor of *Structural Change &  
Economic Dynamics* (1996-2007);  
Member of the Council of the International  
Input-Output Association (2006-2015);  
Member of the Editorial Board of *Economic  
Systems Research*.*



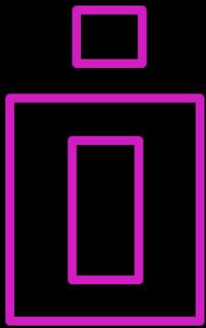
#### **The nomination**

The following text is copied from the nomination letter and adapted from one of the supporting letters.

“Professor Steenge's contribution to input-output analysis is characterized by strengthening the linkage between the past and future of the discipline. This feature aligns with his scientific and professional commitment demonstrated in almost 100 publications. His research on the roots of input-output analysis,

linked to a strong economic theory foundation supported by consistent mathematical models, provides a robust basis for understanding some of the unsolved questions of input-output modeling, needed to address new problems such as climate change and economic disruptions as COVID, among others. His significant role in the creation of the IIOA archive is a good example of this ‘look at the past’; whereas an illustration of the ‘look at the future’ is his continuous coaching of young researchers, both formally (supervising around 20 PhD theses) and informally (supporting the research visiting of many PhD students). Furthermore, Professor Steenge has always been actively involved in the promotion and development of input-output analysis by participating in and organizing special sessions at IIOA conferences, as well as serving as a solid referee of *Economic Systems Research* when required. Altogether, this makes the contribution of Professor Steenge essential for promoting high-quality research in input-output analysis that will yield relevant contributions.”

“Professor Steenge's academic and research life itself has been entirely devoted to research and advancement in input-output analysis, particularly the discussion of fundamental theoretical and mathematical elements. Since his beginnings in the 1970, Professor Steenge has devoted almost 50 years to studying the theoretical, mathematical and conceptual roots that would allow a correct interpretation of the models, with a special interest in their capacity for the description of productive structures, and the implications in terms of income creation and distribution.



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## New IIOA Fellow

It is necessary to recognize that the important mathematical foundations of input-output models require, in addition to the availability of data for the study of traditional problems and new challenges, sound procedures for their management and treatment. It is to these theoretical foundations, to the roots of input-output analysis, that Professor Steenge's research has been intensively devoted throughout his career. His research has addressed questions of such complexity as an operable synthesis between Leontief- and Sraffa-based price theory, also addressing different gaps in the set of input-output models, which have been Professor Steenge's main fields of study.

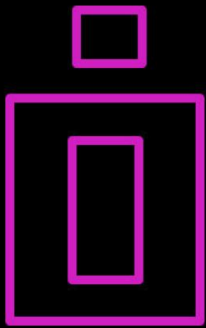
His contributions in this line include, among others, a new interpretation of Quesnay's 'Tableau Economique' to a theory of Ricardian rents, a new income distribution model in Miyazawa's input-output-based analysis, a revision of the dynamic inverse based in the interchange of endogeneity and exogeneity of core variables and closing the gap between Leontief's and Sraffa's income distribution theory (by employing Seton-type extended I-O matrices). All this long-standing research in theoretically and methodologically complex aspects, often not adequately valued in traditional impact metrics, in my opinion has been and will be determinant for generations of input-output researchers, contributing to the necessary solidity, formal rigor and interpretability of the models and indicators used, and of the results obtained.

A more recent and highly valued contribution is his commitment to the generation of the IIOA Historical Archive. Together with Josef Richter and Rosella Bardazzi, they have worked very intensively and delicately to put together a unique collection of materials of the highest academic value, being a scientific and professional contribution to the IO community and association.

Finally, Professor Steenge has been an active and kind supporter of the work of young researchers in the input-output world. In this sense, he has always been open to hosting and mentoring a significant number of scholars from the IO community. Several PhD. students and IO colleagues have benefited from research visits in Groningen, highlighting the generous accompanying of Professor Steenge so that their stays were fruitful and enjoyable."

### **Short bio**

- After graduating from secondary school, Bert spent one year in the U.S. on a scholarship granted by the Netherlands-America Institute at the University of Arkansas in Fayetteville.
- 1964-1970: Study of Quantitative Economics at the State University of Groningen.
- 1970-1986: Assistant and Associate Professor at the University of Groningen, first in the Sub-Faculty of Econometrics, later in the Department of Economics.
- 1980: Defense of his Ph.D. thesis (cum laude) entitled "Stability and Standard Commodities in Multisector Input-Output Models." The thesis describes properties of a dynamic model of the industrial structure of a country or region in terms of a specific type of value standard with empirical applications to several countries.
- 1980-1986: Various periods of study and research abroad, including six months of research at the Economic Institute of the Hungarian Academy of Sciences in Budapest during the period 1982-1983 (with Andrew Bródy).



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

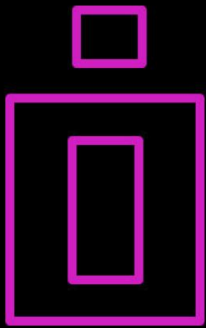
## New IIOA Fellow

- 1986-2008: Full Professor of Economics at the Faculty of Public Administration and Public Policy, University of Twente, the Netherlands, later part of the School of Management and Governance of the University of Twente. Visiting Professor or Visiting Scholar at several institutes or universities, including Rensselaer Polytechnic Institute, the University of Bologna, the University of Cambridge, and the Massachusetts Institute of Technology.
- From 2007 onwards: return to the 'Alma Mater' in Groningen as Honorary Professor at the Faculty of Economics and Business of the University of Groningen.
- A recent development is the creation of a digital "archive" devoted to the safeguarding of materials (books, articles, letters, photographs, videos, etcetera), that would irrevocably be lost forever to research and students if action is not taken now. The creation of this Archive followed an invitation in 2021 to Bert Steenge and Josef Richter by the then President of the IIOA, Satoshi Inomata. In the context of the Archive, another potentially very important development concerns efforts to save (part of the) personal libraries of well-known scholars in input-output analysis. A first effort, initiated together with British colleagues, resulted in the personal library of Graham Pyatt being saved and installed at the Economics Library of the Universidad de Castilla-La Mancha (UCLM), Albacete, Spain, thanks to the collaboration of Pilar Osorio from UCLM.

### ***Summary of the election process***

The bylaws on the nomination and election of "Fellows of the IIOA" were slightly changed in January 2024, so I will start here with a summary of the procedure (the full details are in the bylaws). The aim of electing Fellows of the IIOA is to honor appropriate members for their contributions to the field of input-output analysis. The contributions may be scientific or related to, for example, data acquisition inspired by applications in sub-national, national and multinational input-output studies. Once every calendar year, members of the IIOA not being a Fellow, are invited by the Chair to nominate other members for election. Each nomination must be supported by two additional IIOA members. All living Fellows are invited to deliver their votes on the election of the new Fellows and at least 50% of them should participate to achieve a quorum. For each nominee, the Fellows are requested to vote "yes" or "no". A nominee will be declared sufficiently supported if he/she receives at least 75% of the votes cast as "yes". Because the maximum number of new Fellows is two, a second round is required in case that more than two nominees receive sufficient support. This year Bert Steenge was the only nominee implying that a second round was not necessary.





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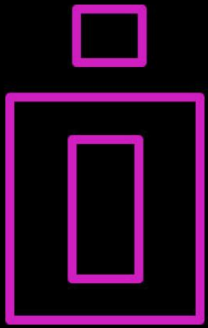
## New IIOA Fellow

### *Personal note*

The pleasure to inform you about the election of Bert Steenge is extra large because Bert was the person who introduced me in 1979 to input-output in his third year's bachelor course Mathematical Economics which he taught in Groningen. It was an introduction that has had substantial impact, at least for me. He supervised my master's thesis (and took the risk to grade it before there was anything like an end-product, because he went abroad for a research visit) and my PhD thesis (giving me the maximum amount of freedom). In that period, we talked about a lot of things, including IO-related issues, but little about my thesis. Bert introduced me to academic life, in all its aspects. From the joy of working hard to get your paper ready for conference submission to enjoying the fruits of this hard work later (like a pitcher of beer in Boston at the 1985 conference of the Econometric Society). Bert also showed me that when all scientists are looking in the same direction, it may not harm to occasionally look in another direction. Try to be open, sometimes this leads to unexpected outcomes. In my view, this Fellowship is very well deserved!

Writing these words brought back many memories and took me to my boxes with pictures. The one that is attached shows Bert when giving his speech at my PhD ceremony in January 1991. A portrait of the Fellow as a young man.

*Kindly provided by Erik Dietzenbacher, Chair of the Election Process*



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Databases

The OECD (Organisation for Economic Co-operation and Development) has released a new economic indicator to identify chokepoints of global supply chains

The pass-through frequency (PTF) captures the degree of supply chain exposure to geographic concentration risk in global production networks. It measures the frequency that a supply chain involves transactions with suppliers of a particular industry/country throughout the production processes.

The indicator is conceived and developed by Dr. Satoshi Inomata of the IDE-JETRO, Japan, and Dr. Tesshu Hanaka of Kyushu University, Japan.

The link to the relevant OECD webpage with an access to the database is as follows. (There are also the links to the background papers of the indicator.)

<https://www.oecd.org/en/data/datasets/pass-through-frequency.html>

[Background paper]

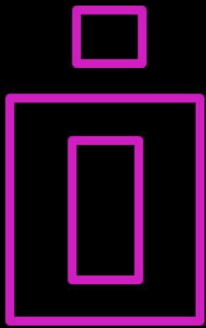
Inomata, S. and T. Hanaka (2024), "[Measuring exposure to network concentration risk in global supply chains: Volume versus frequency](#)", Structural Change and Economic Dynamics, Vol.68, Elsevier, pp.177-193.

The screenshot shows the OECD website interface. At the top, there is a navigation bar with the OECD logo and links for Topics, Countries & regions, Publications, Data, News & Events, and About. Below the navigation bar, the breadcrumb trail reads: OECD > Data > Datasets > Trade in value-added: Pass-through frequency indicator. The main heading of the article is "Identifying hot spots in global supply chains using frequency measurement". Below the heading, there is a summary paragraph: "The pass-through frequency (PTF) indicator captures the degree of supply chain exposure to geographic concentration risk in global production networks. It measures the frequency that a supply chain involves transactions with suppliers of a particular country throughout the production processes." A "Dataset" button is visible below the summary.

### About

The quest for optimal resource allocation across borders has often led to the clustering and concentration of critical production capacities within specific countries. However, in an increasingly uncertain global economy, these production hubs can swiftly transform into "choke points", disrupting the entire economic system.

The OECD's [Trade in Value-Added \(TVA\) indicators](#) reveal the origins of value added in gross exports and final demand, but what about the stages in between? The [pass-through frequency \(PTF\) indicator](#) addresses questions such as: How many countries and industries do intermediate goods and services traverse, and how frequently, before being used in final production? Where, [identify chokepoints in global supply chains](#)



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Databases

### **New Update: EMERGING MRIO V2.5 Database Now Available**

EMERGING MRIO V2.5 database is now available for download on the CEADs website. The new release is available from the CEADs website at [https://ceads.net/data/input\\_output\\_tables/](https://ceads.net/data/input_output_tables/), with data downloads at <https://doi.org/10.5281/zenodo.14258422>.

This new version (V2.5) includes several key improvements:

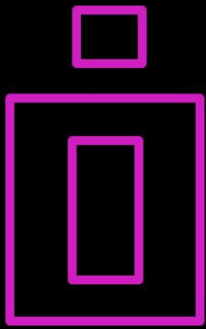
- The removal of the 27th sector, reducing the total to 133 sectors (down from the 27 sectors in EMERGING2.0).
- Significant optimizations to the intermediate input matrix, trade volumes (imports and exports), and total output for key sectors such as electricity, transportation, and energy across 245 economies, with a particular focus on small and medium-sized emerging economies.
- Data is now available for the year 2018, and we plan to release EMERGING MRIO V2.5 data for the period 2010–2023 in 2025.

The database is available for free download for academic research purposes. For queries or further collaboration related to the EMERGING database, please contact Dr. Jingwen Huo at [huojw20@hotmail.com](mailto:huojw20@hotmail.com).



**Carbon Emission Accounts and Datasets**





# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Databases

### **New release of the EE-MRIO EXIOBASE 3 - version 3.9.4 has been published in January 2025**

EXIOBASE 3 provides a time series of environmentally extended multi-regional input-output (EE MRIO) tables ranging from 1995 to 2020 (plus now-casted tables for 2021 and 2022) for 44 countries (27 EU member plus 17 major economies) and five rest of the world regions.

The main improvements in the new version are:

1. Major updates to timeliness: EXIOBASE will now be updated annually. EXIOBASE 3.9.4 includes a major update of all data to 2020, and the upcoming 3.10 will have updates to 2022, and nowcasts to 2024.
2. Supply & Use Tables: Updated data based on the official SUT tables and improved SUT balancing for better accuracy.
3. Emissions: Major update to the integration of combustion emissions which results in more reliable emissions factors, as well as an update to the process emission dataset. We now produce derived Scope 1,2,3 emissions factors consistent with the GHG protocol in a readily useable format.

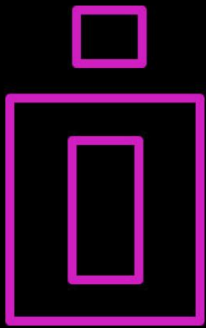
4. Materials, Land & Employment: Updated to latest available data.

EXIOBASE is available on Zenodo at <https://zenodo.org/records/14614930>

Pymrio can be used to process data directly from Zenodo  
<https://pymrio.readthedocs.io/en/latest/notebooks/autodownload.html#EXIOBASE-3-download>

Please follow the EXIOBASE group on LinkedIn  
(<https://www.linkedin.com/groups/10010767/>) for up-to-date news, research reports and discussions.





# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Conferences



*International Research Seminar*  
**Malaysia-Japan Future Sustainability Summit**  
3-4 September 2024 | School of Business and Economics, UPM

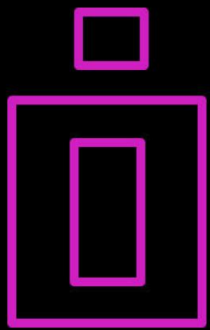


On the 3-4 September 2024, the School of Business and Economics, Universiti Putra Malaysia (SPE UPM), in collaboration with the Malaysia Input-Output Economics Association, successfully co-organized the International Research Seminar Malaysia-Japan Future Sustainability Summit 2024. This two-day event brought together nearly 90 participants from six Japanese universities, five Malaysian universities, and representatives from national and state governments.

Four prominent keynote speakers graced the event, including Prof Dr Shigemi Kagawa from Kyushu University, Prof Dr Shaufique Fahmi Ahmad Sidiques from Universiti Putra Malaysia, Dr Mohd Yusof Saari from the Ministry of Human Resources and Emiratization in the UAE, and Prof Dr Sangwon Suh from the University of California, Santa Barbara. Each delivered thought-provoking presentations, sharing valuable insights on sustainability and quantitative analysis.

The seminar featured the presentation of 27 research papers, each focusing on quantitative methods to assess the impact of environmental sustainability using input-output analysis. Additionally, 26 poster presentations were made by postgraduate and undergraduate students from both Japanese and local universities, enriching the discourse with fresh perspectives.

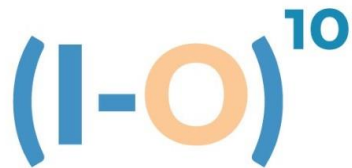
*Prepared by Muhammad Daaniyall Abd Rahman, PhD  
Vice President, Malaysian Input-Output Economics Association  
School of Business and Economics, Universiti Putra Malaysia*



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# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Conferences



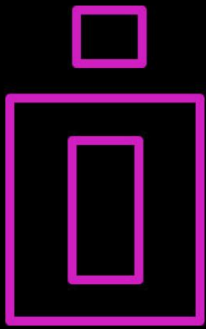
10th Conference on  
Input-Output Analysis



**The 10th Spanish Conference on Input-Output Analysis**, organized by the Hispanic-American Input-Output Society (SHAIO), successfully took place from September 4th to 6th, 2024, at the University of Oviedo's Gijón campus in Spain. Returning to its roots, the conference was held in the same city where SHAIO's journey began in 2005.

Hosted by the University of Oviedo and REGIOlab, the event was held at the School of Commerce and Tourism, within the beautiful Laboral-Ciudad de la Cultura. Gijón provided a vibrant and culturally rich backdrop for the gathering, offering attendees an engaging setting for both professional exchange and social activities.

The conference featured sessions in both English and Spanish, including the fifth edition of the Spanish School of Input-Output Analysis (ESAIO), plenary and parallel discussions, and the Emilio Fontela Award ceremony. The event offered not only a rich academic program but also a memorable opportunity to explore the cultural and natural beauty of Asturias.



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# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Conferences

### **International Conference on “2024 Digital Economy and Sustainable Social Development Conference”**

**September 28-29, 2024**

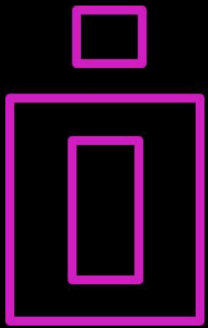
**Online and Onsite in Xiamen University of Technology, Xiamen, Fujian, China**

The 2024 Digital Economy and Sustainable Social Development Conference took place on September 28-29, 2024, both online and onsite at Xiamen University of Technology, Fujian, China. Organized by the School of Economics and Management at Xiamen University of Technology in collaboration with the Asia-Pacific Applied Economics Association, the conference aimed to foster academic research and international collaboration in the areas of digital economy and sustainable development.

The event brought together experts and scholars from economics, finance, and financial management, with a focus on exploring the impact of the digital economy on various sectors. Key topics included corporate strategy transformation, fintech, green finance, and behavioral economics, with a special emphasis on empirical, theoretical, and modeling approaches. Participants were encouraged to submit manuscripts that advanced understanding of digital transformation and addressed current managerial and policy issues.

Keynote speeches were delivered by prominent scholars, including Paresh Narayan from Monash University, Australia, and Sushanta Mallick from Queen Mary University of London, UK. The conference offered a platform for interdisciplinary dialogue and knowledge exchange, contributing valuable insights into the evolving dynamics of the digital economy and its implications for sustainable social development.





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# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Conferences

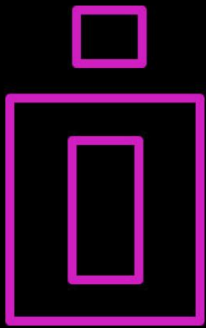


### 21st WORKSHOP IN ECONOMIC MODELING (WEM) 2025

The University of Las Palmas de Gran Canaria (ULPGC) is planning to organise a workshop in economic modeling. The topic is '**Computable General Equilibrium Analysis of Trade and Climate Policies using GTAPinGAMS and MPSGE**'. This workshop is planned to take place in **the island of Gran Canaria**. The planned period for the 5-day workshop is **17th – 21st February 2025**.

The workshop will provide computational tools developed in the GAMS modeling language to extract the GTAP database of the global economy, use empirical GTAP data for computable general equilibrium (CGE) analysis facilitated by mathematical programming system for general equilibrium (MPSGE) as a meta-language to implement CGE models in a compact non-algebraic manner. The workshop will demonstrate the practical usefulness of CGE analysis by means of policy-relevant applications to carbon tariffs in climate policy, disruptive trade policies, and supply chain shocks.

More information at: <https://wem.ulpgc.es/>



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Conferences

### **The 13th Annual Conference of Chinese Input-Output Association August 15-17, 2025, Xiamen, Fujian, China**

The 13th Annual Conference of Chinese Input-Output Association (CIOA) will take place on August 15-17, 2025 in Xiamen, China. CIOA organized conferences every year, including regular conferences every three years, and interim meetings on certain topics in other years. The conference will be organized by College of the Environment & Ecology, Xiamen University. The aim of this conference is to promote the development of input-output techniques through the academic exchanges among researchers and practitioners to better address pressing social and economic problems.

#### I. Suggested Topics

The topics for the conference include (but are not limited to) the following areas:

1. High-quality development and economic structural transformation
2. New quality productive forces: measurements and effects
3. Regional economic integration and coordinated development
4. Restructuring of Global and Regional Value Chains
5. Climate change and the carbon peak and neutrality targets
6. Input-Output Analysis and resource-environment nexus
7. Input-output techniques and industrial ecology
8. Compilation of the input-output tables and updating approaches
9. Basic theories and methods of input-output techniques
10. CGE model and its application

Papers regarding the above topics and other input-output related issues are invited to be submitted and discussed during the conference; we are also welcome proposed special sessions, for details please contact the organizers.

#### II. Important Dates

Deadline for abstract submission: March 31, 2025.

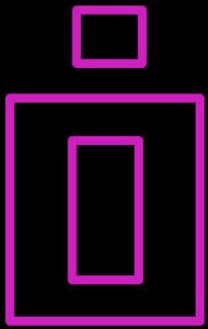
The abstract should contain: the title, an abstract of not less than 300 words, authors and contact information.

Deadline for full paper submission: May 30, 2025.

#### III. Submission Requirements

1. Papers should be submitted to the email addresses provided below.
2. Paper submission should contain the paper title, author names, the paper body, references, and abstract and keywords. The authors' information should be attached, including: institute or organization, postal code, Email address, landline or cell phone number, etc.
3. Authors of accepted abstracts/papers will receive the conference announcement by June 30, 2025.





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# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Conferences

**The 13th Annual Conference of Chinese Input-Output Association**  
**August 15-17, 2025, Xiamen, Fujian, China**

#### IV. Contact Persons

Name: Chuanzeng Zheng  
E-mail: zhengchuanzeng1@163.com

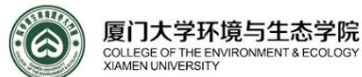
Name: Zengkai Zhang  
E-mail: zengkaizhang@xmu.edu.cn

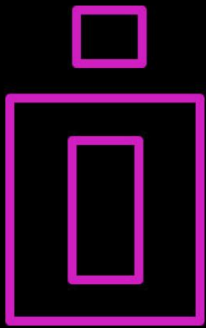
Name: Jiansuo Pei  
E-mail: ioachn@126.com

For more information, please contact <http://cioa.ruc.edu.cn/>

We sincerely invite you to participate in the 13th Annual Conference of Chinese Input-Output Association.

Chinese Input-Output Association  
College of the Environment & Ecology, Xiamen University





# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Job Positions

### IonE Postdoctoral Fellowship Program

Did you earn or are you about to defend a PhD in any area with a related sustainability focus? Do you believe in a future where people and the planet prosper together? Do you believe in interdisciplinary academic research and community-engaged scholarship? Are you interested in solutions-oriented research to support equitable and just sustainability transition for all? If yes! We need you at the [Institute on the Environment](#) (IonE).

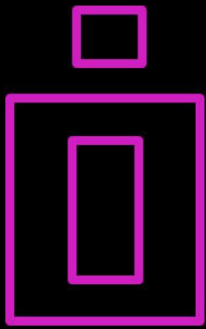
IonE is accepting applications for its third round of a cohort-based [Postdoctoral Fellowship Program](#). We anticipate having an annual cohort of 5-10 fellows every year. Each Fellow will receive a postdoctoral fellowship salary commensurate with experience between \$60,000-\$68,500; additionally, they will receive research and professional expenses, moving expenses, as well as [benefits](#), including health care coverage and paid leave.

The IonE Postdoctoral Fellowship strives to accelerate the transition to a sustainable future by supporting breakthrough research across disciplines, developing the next generation of global leaders, and building transformative partnerships across the state, region, and globe. IonE Postdoctoral Fellows will lead 1-2 projects during their tenure.

You can apply now, [learn more](#) and visit the IonE Postdoctoral Fellowship webpage to submit your application ([z.umn.edu/ione-postdoc-fellows](https://z.umn.edu/ione-postdoc-fellows)). Our application closes on February 2, 2025.

We invite you to share this opportunity by reposting us on [Facebook](#) and [LinkedIn](#).

Thank you for sharing this post with your colleagues who are interested in sustainability research. If you have any questions, please contact us at [ione-research@umn.edu](mailto:ione-research@umn.edu).



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## PhD Positions

**A PhD position is available in the Sustainability Assessment Program at UNSW Sydney.**

Location: UNSW Sydney, Kensington Campus, NSW 2052, Sydney, Australia

Open To: Australian residents and outstanding international candidates

Remuneration: \$37,684 per annum for three years

Closing Date: 31 March 2025

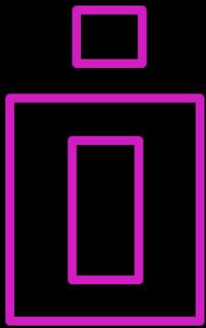
Project background and aims:

Previous global integrated assessment modelling has shown that including degrowth into future climate mitigation scenarios is necessary to have a realistic chance of attaining internationally agreed global warming targets. A new project funded by the Australian Research Council and conducted in collaboration at UNSW, the University of Sydney and Monash University aims to develop enhanced modelling techniques that are capable of representing a degrowing economy. It will model the effects of key degrowth policies and find future pathways in which Australia can reduce its greenhouse gas emissions to below its net-zero target while also improving wellbeing.

This project will be the first to build modelling capability and infrastructure to simulate degrowth pathways for Australia, including key degrowth policy feedbacks and dynamics. To do so, it will build upon specific models previously developed for Australia. Two of these models are a national integrated assessment model (MESSAGEix IAM) and a virtual laboratory-based computable general equilibrium model (IELab CGE), with which the PhD student will work. The project will provide the opportunity for the first multi-model integration and intercomparison of different modelling paradigms for simulating degrowth pathways and advancing scholarship and practice. Expected outcomes include quantitative descriptions of distinct and consistent future degrowth policies for Australia.

PhD opportunity: CGE modelling of Australian degrowth futures to meet ambitious climate targets:

The PhD student will enable IELab's CGE model for degrowth applications and will port the CGE model into the MESSAGEix IAM. This involves resolving the shortcoming of these CGE models in handling negative values for investment variables that result from declining GDP trajectories. The student will re-interpret negative investment as stranded assets and insert new and concrete technology descriptions of those assets that remain operational. They will also introduce additional behavioural constraints linking energy and non-energy demand.



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## PhD Positions

Later in the PhD project, the candidate will embark on a highly beneficial improvement, i.e. to port the IELab-CGE's multi-sectorial structure into MESSAGEix, which currently represents the economy by one sector only. They will conduct intercomparisons between the two (mono- and multi-sectoral) MESSAGEix variants, and establish the consequences of this enhancement for degrowth scenarios. They will demonstrate how the multi-sectoral enhancement of the MESSAGEix CGE will enable an improved representation of degrowth pathways. Finally, the PhD student will work with the whole project team to formulate, intercompare and synthesise alternative scenario pathways from the different models. They will collaborate in disseminating their joint work at conferences and through peer-reviewed high-impact journals.

Desired student skillset:

The PhD candidate will have a solid and relevant background in economics, sciences or engineering with strong experience in computer programming and data management and some experience with economy-environment/climate modelling. A first-class Honours or Masters degree is essential. They should have interest in climate change and/or sustainability science. They should be familiar with or able to learn the IAM's Python code and the Industrial Ecology Virtual Laboratory (<https://ielab.info>).

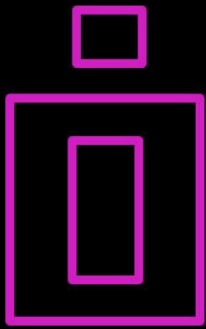
This background will be necessary to realise the essential parts of the CGE modelling, including the disaggregation of sectors in all model components.

These tasks require strong programming and data handling skills but also allow for pioneering publications as a novel modelling framework will be created. The PhD student will participate in evaluating scenario outcomes quantitatively, including reconfiguration of model parameters and routines according to stakeholder feedback, as well as writing scientific publications and reports.

Supervisory Team and Application:

The successful candidate is eligible for a UNSW tax-free stipend of \$37,684 per annum for three years or may be able to secure [their own primary domestic or international scholarship](#) or any equivalent scholarship from overseas. A secondary Top-Up scholarship (\$5,000) may be available to exceptional applicants, depending on the type of scholarship.

The PhD candidate will join the [Sustainability Assessment Program \(SAP\)](#) at UNSW, which is embedded in the Water Research Centre in the School of Civil & Environmental Engineering. This provides a focal point for multidisciplinary research in sustainability, industrial ecology and ecological economics. SAP aims to support governments and industry in improving their decision making with an integrated assessment framework that combines economic, environmental and social dimensions. We take an economy-wide systems perspective that accounts for both synergies and trade-offs.



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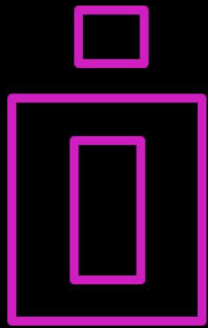
# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## PhD Positions

Candidates should have the ability to conduct independent research with limited supervision, with excellent written and communication skills, and will be expected to interact regularly with other researchers and project stakeholders. Knowledge of sustainability assessment and modelling (CGE/macro-economic modelling, input-output analysis) will be beneficial for the position.

Candidates will be supervised by [Prof Thomas Wiedmann](#) and one other supervisor from UNSW Sydney as well as two supervisors from the University of Sydney. All supervisors are internationally recognised leader in sustainability and climate mitigation research with an award-winning track record of publications and a well-established professional and collaboration network. Applications should be emailed to [t.wiedmann@unsw.edu.au](mailto:t.wiedmann@unsw.edu.au) with the subject heading "SAP PhD position", along with a cover letter, academic transcripts, and a CV, including qualifications, academic achievements, list of publications, work history and references. Please submit your application by the deadline of 31st March 2025 to the email address above.





# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

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

### [Economic Systems Research](#)

Journal of the [IIOA](#)

Volume 36, Issue 3, 2024



**Sora Matsushima, Shigemi Kagawa, Keisuke Nansai & Jinjun Xue**

### [A comparison of deflation methods for carbon footprint calculations using Japanese data](#)

An embodied CO<sub>2</sub> emissions intensity database estimated from input-output data at current prices is now available in Japan. This study compares two non-survey methods: The double-deflation (DD) method and an elaborated approach combining the DD method with the generalized RAS method to deflate an input-output table (IOT). We used these methods to estimate new datasets of embodied CO<sub>2</sub> emission intensity data in Japan, utilizing Japan's IOTs for 2005, 2011, and 2015 at constant prices in 2015. Furthermore, we compare the estimated data of 367 commodity sectors for a specific year (2005 or 2011). The results reveal that the intensity for certain aggregated sector groups, such as non-ferrous metals and finance and insurance, exhibits higher uncertainty owing to the extreme price homogeneity assumption associated with the DD method. Consequently, we recommend that life-cycle-assessment practitioners use an open database when analyzing changes in the carbon footprint of products over time.

**Andrzej Torój**

### [Estimating high-resolution interregional input-output tables: a Bayesian spatial approach](#)

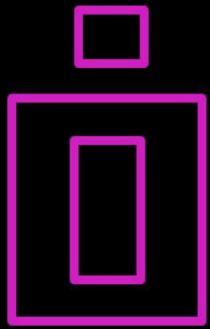
Due to the scarcity of subnational interregional input-output (IRIO), various approaches to their estimation are actively under investigation in the literature. This paper focuses on the application of spatial econometric method. It determines intra- and interregional coefficients through a joint procedure which successfully avoids the direct recycling of estimates for other geographies and granularities. Instead, the use of Bayesian methods is proposed, which formally integrate limited evidence from existing regional tables (Finland) with a set of sectoral data on value added for 73 NUTS-3 regions in Poland, the latter being dominant. An empirical test of replicating the Korean survey-based IRIO table demonstrates that the accuracy of this approach slightly outperforms an alternative IRIOLQ procedure. The incorporation of time-based distance measurement has only modest effects on empirical fit, and the use of big geolocation dataset to account for commuting relocates 18.9% of the induced effect from a city to its periphery.

**Irlan A. Rum, Arjan de Koning, Arnold Tukker & Arief A. Yusuf**

### [The construction of an environmentally extended multi-scale MRSUT: the case of Indonesia](#)

This article presents the construction of an environmentally extended multi-scale multi-region supply and use table (MRSUT) combining the global MRSUT from EXIOBASE with a national MRSUT at the provincial level for Indonesia using TERM database (called INDOTERM). The multi-scale MRSUT covers 2010 and 2016, reflecting comprehensive information on the transactions of 80 products among 80 different industries across 34 Indonesian provinces, 43 countries, and 5 remaining continents. To ensure the consistency of Indonesian provincial data in the multi-scale MRSUT, we use a (sub)national accounts consistent approach. Extensions are created in the MRSUT, providing valuable information regarding GHG emissions, land use, and job creation. As an illustrative example of the practical utility of this multi-scale MRSUT, a case study is used to demonstrate how changes in global consumption can have differential economic and environmental impacts on specific provinces within Indonesia.





# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**Sandy Dall'erba, Nicole Riemer, Yilan Xu, Ran Xu & Yu Yao**

**[Identifying the key atmospheric and economic drivers of global carbon monoxide emission transfers](#)**

This paper proposes a structural decomposition analysis (SDA) augmented with cross-country atmospheric circulation and uncovers that changes in carbon monoxide (CO) levels are driven by atmospheric flows way more than by any of the traditional SDA components. Applied to a five-region model, our results show, among others, that South Korea has certainly been able to reduce the CO emissions in its own territory by 0.8Tg over 1990–2014 but up to 10.6Tg of CO flowing to its borders came from its upwind neighbor China. That amount was primarily driven by activities satisfying the growth of China's domestic demand, although changes in foreign demand and in the technology effect were not negligible. By quantifying the role of upwind countries in air pollution changes, our methodology allows us to identify more comprehensive global emission abatement policies than the consumer- or producer-focused approaches currently used.

**Elisa Bardazzi, Gabriele Standardi, Francesco Bosello & Ramón E. Key Hernández**

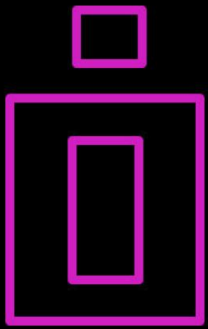
**[Toward the full implementation of the water-energy-food nexus in computable general equilibrium modelling: methods and macroeconomic implications](#)**

This paper contributes to the advancement of Computable General Equilibrium (CGE) modelling in addressing the Water-Energy-Food (WEF) Nexus. As such, it introduces water resources as a production factor for both the energy sector and irrigated agriculture, as well as their competition for the endowment, aiming to explicitly represent additional components of the WEF with respect to a standard CGE in the literature. Thus, it develops different modelling structures by computing impacts on regional GDP, sectorial prices, and production outputs in response to hypothetical water scarcity scenarios. This analysis allows for the determination of the role of data and modelling assumptions, such as production function, water substitutability with other endowments, water mobility across sectors, and sectorial water intensity, in influencing the results. Finally, the paper develops a dynamic scenario analysis, showing that an enhanced representation of the Nexus can significantly affect the macroeconomic dynamics of the simulations and their regional implications.

**Angela García-Alaminos, Jorge Zafrilla & Fabio Monsalve**

**[Forced labour in the fashion industry: a hypothetical EU-driven reorganisation of textile value chains](#)**

Given recent breakdowns in global value chains, like the COVID-19 crisis or the conflict in Ukraine, developed economies are trying to develop resilience to address future drawbacks. Backshoring and nearshoring arise as attractive solutions to reduce exposure to global disruptions and undesirable practices such as forced labour. This study analyses the labour impacts of a hypothetical EU-driven reconfiguration of value chains of the fashion industry through a multi-regional input-output model. Using the Structural Path Analysis methodology, how forced labour is transmitted within Europe is explored. Once the forced labour hotspots are determined, we explore the socioeconomic consequences of a trade-restructuring strategy simulated through the source-shifting technique. Our results show that the forced labour embodied in the European final demand for fashion products could fall by up to 34.2%. This strategy could generate more than 190,000 jobs in Europe, while China and India could lose more than 1.5 million jobs each.



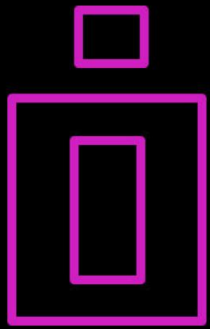
**Newsletter**  
Number 60, Feb 2025

# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**Ahmed Owais Durrani & Yousaf Ali**

**[Risk-based dynamic inoperability input-output and non-linear optimisation models to analyse resilience in the construction industry](#)**

Pakistan has faced significant economic losses due to catastrophes, specifically floods. This study aims to assess the ripple effects of the 2022 floods, focusing on the Construction Industry, which has been gaining importance in the national economy, and on the resilience of economic sectors absorbing the negative shocks from floods. The study uses the Asian Development Bank's (ADB) Input-Output database for Pakistan using the Dynamic Inoperability Input-Output Model (DIIM) with the Fuzzy Full Consistency Method (F-FUCOM). The analysis revealed that the Construction Industry's weak resilience resulted in a prolonged recovery period and that the lack of flood risk mitigation infrastructure was identified as the most critical. The results suggest that policymakers prioritise such infrastructures, like dams, early warning systems, and transportation infrastructure, to enhance the resilience of the overall economy.



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## [Economic Systems Research](#)

Journal of the **IIOA**

[Volume 36, Issue 4, 2024](#)



## **Arunima Malik & Roberto Schaeffer**

### [Integrated assessment modelling and input-output analysis](#)

This Editorial is the introduction to a special issue on the development of advanced frameworks harbouring integrated assessment models and inter-sectoral detail from input-output databases. This Editorial aims to explain the rationale for dedicating a special issue to this emerging area of research, with the potential for contributing to policy issues linked to sustainability. This is followed by an introduction to the eight contributions to this issue. Then, a concluding section outlining future directions for integrated assessment modelling (IAM) and input-output analysis (IOA) is presented.

## **Maik Budzinski, Richard Wood, Behnam Zakeri, Volker Krey & Anders Hammer Strømman**

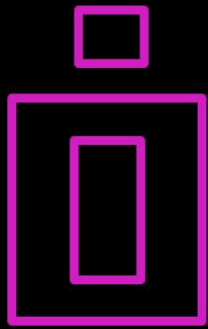
### [Coupling energy system models with multi-regional input-output models based on the make and use framework – insights from MESSAGEix and EXIOBASE](#)

Technology-rich integrated assessment models (IAMs) provide high resolution of the energy-related climate impacts, when exploring prospective climate change mitigation strategies. However, energy system models (ESMs), the core of integrated assessment models, usually ignore industrial linkages other than those related to energy. Furthermore, these models focus on climate change and neglect other environmental pressures. In this manuscript we present an approach for coupling ESMs with multi-regional input-output models (MRIOs) based on the Make and Use framework. The main advantage of using the Make and Use framework can be seen in improving both models simultaneously. An exemplary case study is carried out for the energy system model of MESSAGEix and the multi-regional input-output database of EXIOBASE. We further elaborate on the methodology to illustrate the usefulness but also challenges of this approach. Finally, we identify further steps to be carried out toward systematic prospective analyzes.

## **Nicolas Dai, Qiyu Liu, Mengyu Li, Arunima Malik & Manfred Lenzen**

### [Coupling an integrated assessment model with an input-output database](#)

MESSAGE is an Integrated Assessment Model (IAM) useful for developing anthropogenic climate change scenarios and the evaluation of long-term energy policies. MESSAGE is constrained by its internal scenario generator, which project energy commodity demand inputs based only on population and GDP growth assumptions; the lack of sectoral and supply-chain details prevents modeling impacts from developments in non-energy sectors. Here we link MESSAGEix-Australia, a national-level MESSAGE IAM variant, to an input-output scenario builder to generate future energy commodity demands. The coupled IO\_IAM framework then captures indirect energy implications of various socio-economic scenarios. Two scenarios were used to demonstrate this capability: first on the policy-based decarbonisation pathways for Australia, and second on the adoption of self-healing roads. This study showcases that a link between IO and IAM methods provides an opportunity for bringing together the strengths of the two approaches for assessing a wide range of sustainability questions.



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Mengyu Li, Lorenz Keyßer, Jarmo S. Kikstra,  
Jason Hickel, Paul E. Brockway, Nicolas Dai,  
Arunima Malik & Manfred Lenzen

[Integrated assessment modelling of degrowth scenarios for Australia](#)

Empirical evidence increasingly indicates that to achieve sufficiently rapid decarbonisation, high-income economies may need to adopt degrowth policies, scaling down less-necessary forms of production and demand, in addition to rapid deployment of renewables. Calls have been made for degrowth climate mitigation scenarios. However, so far these have not been modelled within the established Integrated Assessment Models (IAMs) for future scenario analysis of the energy-economy-emission nexus, partly because the architecture of these IAMs has growth 'baked in'. In this work, we modify one of the common IAMs – MESSAGEix – to make it compatible with degrowth scenarios. We simulate scenarios featuring low and negative growth in a high-income economy (Australia). We achieve this by detaching MESSAGEix from its monotonically growing utility function, and by formulating an alternative utility function based on non-monotonic preferences. The outcomes from such modified scenarios reflect some characteristics of degrowth futures, including reduced aggregate production and declining energy and emissions. However, further work is needed to explore other key degrowth features such as sectoral differentiation, redistribution, and provisioning system transformation.

Jarmo S. Kikstra, Mengyu Li, Paul E. Brockway,  
Jason Hickel, Lorenz Keyßer, Arunima Malik,  
Joeri Rogelj, Bas van Ruijven & Manfred Lenzen

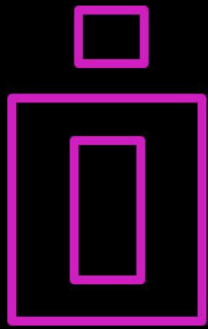
[Downscaling down under: towards degrowth in integrated assessment models](#)

IPCC reports, to date, have not featured ambitious mitigation scenarios with degrowth in high-income regions. Here, using MESSAGEix-Australia, we create 51 emissions scenarios for Australia with near-term GDP growth going from +3%/year to rapid reductions (–5%/year) to explore how a traditional integrated assessment model (IAM) represents degrowth from an economic starting point, not just energy demand reduction. We find that stagnating GDP per capita reduces the mid-century need for upscaling solar and wind energy by about 40% compared to the SSP2 growth baseline, and limits future material needs for renewables. Still, solar and wind energy in 2030 is more than quadruple that of 2020. Faster reductions in energy demand may entail higher socio-cultural feasibility concerns, depending on the policies involved. Strong reductions in inequality reduce the risk of lowered access to decent living services. We discuss research needs and possible IAM extensions to improve post-growth and degrowth scenario modelling.

Cormac Lynch, Yeliz Simsek, Jean-Francois  
Mercure, Panagiotis Fragkos, Julien Lefèvre,  
Thomas Le Gallic, Kostas Fragkiadakis, Leonidas  
Paroussos, Dimitris Fragkiadakis, Florian Leblanc  
& Femke Nijse

[Structural change and socio-economic disparities in a net zero transition](#)

A net zero transition is likely to generate substantial and irreversible economic transformation. High-carbon industries and their related occupations will disappear, while new low-carbon industries and occupations will be created. In the aggregate, the impact of the transition on GDP and employment is commonly projected to be relatively moderate. However, such estimates hide drastic distributional issues that are sectorally and regionally concentrated. We use three sectorally detailed and regionally disaggregated macroeconomic models to explore the possible levels and impacts of structural change in a well below 2°C scenario. In addition to the expected decline in the carbon-intensive industries, we observe secondary impacts, particularly in the services sectors, that vary significantly between models. The risks entailed with structural change involve worsening economic disparity and societal division that could exacerbate existing socioeconomic and political polarisation. Impact assessments of decarbonisation should consider such distributional issues to avoid post-industrial decline and widening socioeconomic inequalities.



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**Yiyi Ju, Nur Firdaus & Tao Cao**

**[Industry's role in Japan's energy transition: soft-linking GCAM and National IO table with extended electricity supply sectors](#)**

Japan's energy transition towards carbon neutrality by 2050 will require a shift from fossil fuel energy on the energy supply side. The introduction of new power generation capacities and infrastructures will then lead to increasing demand for materials and industrial products. To capture such industrial energy service demand, we conducted a soft-linking between an integrated assessment model (GCAM) with an input-output framework (IONGES), considering both inter-model and inter-period iteration. The results show that: i) the industrial final energy under the carbon neutrality scenario would be 0.2-0.7EJ more after linking, which is almost the gap between the carbon neutrality and the reference scenario; ii) to achieve carbon neutrality by 2050, more power generation capacities would be introduced in the near-term periods (2020-2030), bringing additional growth afterward. Our soft-linking approach emphasized the role of industries in the energy transition and explored how industries can benefit from an increasingly low-carbon energy supply.

**Ana Norman-López, Rafael Garaffa, Krzysztof Wojtowicz & Marie Tamba**

**[Building a baseline to better integrate air passenger and air freight transport into a global Computable General Equilibrium \(CGE\) model](#)**

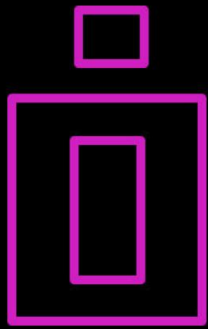
The Covid-19 pandemic has had opposite effects on demand for air passenger and air cargo transport and on the way these two sectors interact with other sectors of the economy. However, macroeconomic models generally represent aviation as a single sector, limiting the ability to assess those interactions. In this study, we split the air transport sector into two sectors (passenger and freight) in GTAP's Multiregional Input-Output table. We assess the sectors' response to a carbon tax by performing a sensitivity analysis. Our results highlight the environmental benefits from the Covid-19 pandemic will only be transitory unless policies and consumer demand rein in traffic growth in the aviation industry. Particular attention should be paid on leisure travel, due to its large share in the aviation industry and the potential steep rise in demand (87%) in the EU27 projected between 2015 and 2030.

**Julien Lefèvre**

**[Integrated assessment models and input-output analysis: bridging fields for advancing sustainability scenarios research](#)**

Technology-rich Integrated assessment models (IAMs) and Environmentally-Extended Input-Output Analysis (EEIOA) are widely employed for sustainability analysis, each offering unique strengths. IAMs focus on forward-looking scenarios, exploring technological shifts and climate change mitigation costs. EEIOA provides more comprehensive but static assessments of environmental and socio-economic impacts throughout supply chains, adopting a lifecycle perspective. I conduct a literature review to assess the current state of IAM-IO integration, paving the way for future research opportunities with advanced models. Existing studies have loosely linked IAM and IO models to improve one field or the other. This perspective highlights the potential for more advanced IAM-IO model linking and identifies three domains within sustainability scenarios research where IAM-IO integration could play a crucial role: the energy-industry nexus in decarbonization pathways, multi-dimensional sustainability impact assessment and demand-side solutions and post-growth climate mitigation scenarios. The expected research insights may be pivotal to design effective sustainable policies.





# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Latest ESR articles

[Economic Systems Research](#)

[Journal of the IIOA](#)

[Latest articles \(up to 8 Feb\)](#)



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

[Estimating inter-regional trade: the radiation model versus the gravity model](#)

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

**Cristian Mardones & Matías Correa**

[Methodological proposal to approximate the sectoral impacts of a carbon tax at the regional level – the case of Chile](#)

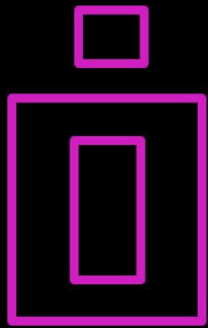
This study proposes a methodological approach to approximate the sectoral impacts of carbon taxes in the different regions of Chile through the environmental extension of intraregional input – output models. These models are calibrated by regionalizing technical coefficients using an indirect method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

**Prithu Sharma & Aparna Sawhney**

[Understanding export-generated employment in India](#)

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





# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**Cheng Yongwei**

[Spread efficiency of energy demand in the industrial chain: a perspective from economic distance](#)

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

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

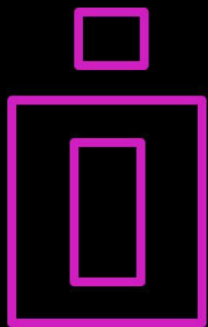
[Uncertainty in dynamic econometric input-output models: a Norwegian case study](#)

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

**Federico Riccio, Giovanni Dosi & Maria Enrica Virgillito**

[Functional specialisation and income distribution along global value chains](#)

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



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**Fátima Cardoso & António Rua**

**[Gone with the wind: a structural decomposition of carbon emissions in Portugal](#)**

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

**George Philippidis & Ana I. Sanjuán-López**

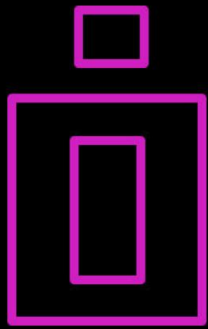
**[An ex-ante study on the impacts of reduced EU sugar consumption: a sweet mix of health and environmental benefits](#)**

This paper estimates the health and environmental benefits from reducing sugar intake in EU households. A CGE model is modified by linking probability density functions of body mass index for EU populations to a complete demand system with nutrition accounting. Following the WHO recommendation, sugar intake is reduced to 10% of total dietary energy intake, whilst two further scenarios explore more ambitious targets of 7.5% and 5%. This dietary transition leads to a relative reduction in overweight and obese EU adults of between 8 and 15 million by 2050, with potentially significant health gains in Scandinavia. Environmental 'footprints' reveal relative land and emissions savings of up to 56m<sup>2</sup> and 20 kgCO<sub>2</sub>e per capita per year by 2050. With scientific evidence supporting a virtuous circle of improved health, higher wages and increased macroeconomic performance, the reported negative impacts on economic indicators in this study could be reversed through targeted redistributive policies.

**Kênia Barreiro de Souza, Edson Paulo Domingues & Geoffrey Hewings**

**[Economic consequences of eliminating gender discrimination in the labor market](#)**

Theoretical and empirical literature on labor market discrimination is extensive on showing persistent wage gaps across genders at individual level. However, at the aggregate level, the economic consequences of gender discrimination remain unclear. In this article, economic consequences of gender discrimination are estimated through interacting a wage decomposition model (individual) and an input-output model (aggregated level). Using the decomposition's results, it was possible to calculate individual wage adjustments, so that all individuals are remunerated according to their observable characteristics as well as the group of non-discriminated individuals. In turn, these estimates were used to simulate changes on labor nominal costs (price effect) and consumption (income effect). Our results indicate that the income effect generated through consumption overcomes the price effect, raising production (0.90%), welfare (2.70%) and employment (0.94%). Nonetheless, the results are very heterogeneous across sectors and households.



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**Aoi Tsukioka & Shigemi Kagawa**

**[Identifying critical supply chain sources of imported inflation: evidence from Japan](#)**

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

**Min Jiang & Euijune Kim**

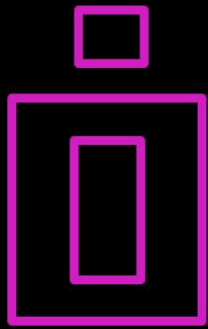
**[Measuring impacts of retirement age extension on economic growth and labor market in China using a recursively dynamic CGE model](#)**

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

**Gulay Gunluk-Senesen & M. Banu Yobas**

**[Gender multipliers of informal employment: an analysis with the total-flow model for the Turkish case](#)**

This article analyses gendered patterns of informal employment in Türkiye using the Total-Flow model to account for deliveries to both final demand and intermediate demand. We presume that informal employment is sustained in the economy due to the cost advantage not only for the employer but also for the purchasers of its products. We explore patterns of upstream transmission of gendered informal labour. We address the gendered formal–informal divide with demographic characteristics to unravel the intertwined social norms and economic realities. A noteworthy finding, based on cross-sectoral multipliers, is that informal employment in agriculture is highly associated with outputs of all other sectors. We introduce the rent gain from informality into our model and estimate the liability of formalization in employer sectors under three scenarios. We draw attention to the significance of the gender pay gap with the estimated high value of supplementary compensation for transition to formalization.



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# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

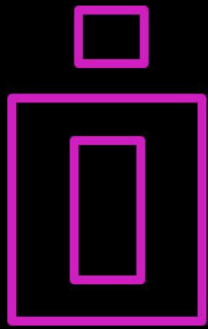
**Maximilian Koslowski, Edgar Hertwich & Richard Wood**

[From single to joint-production under rectangular technology choice](#)

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

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# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Highlights in journals

Edgar Hertwich, Maximilian Koslowski & Kajwan Rasul

[Linking hypothetical extraction, the accumulation of production factors, and the addition of value](#)

*Journal of Industrial Ecology*

This paper reviews the literature on linkages using hypothetical extraction in input-output analysis and on supply chain impact analysis in industrial ecology. It shows that these methods are equivalent and can be understood in terms of a broader approach to hypothetical extraction. The paper derives quantity and price models for all cases and shows that the price model, which has so far received little attention, can be used to calculate the portion of embodied factors or value added that are due specific intermediate product(s), industries, or transactions. The method has a much wider range of applications that has been realized.

Karan Kumar, Kakali Mukhopadhyay & Paul J. Thomassin

[Water conservation pathways in agriculture in India to 2030: an input-output framework](#)

*Sustainable Water Resource Management*

India is a water stressed country and projected to face an acute water crisis in the next 10 years (2020 to 2030). Due to hydrological limits, the utilizable water cannot be increased in the country. However, prudent policies are needed to judiciously use water in different sectors of the economy. It is important to account for the green (rainwater), blue (irrigation), and gray (wastewater) water flow in the economy, especially in agriculture as it is the most water intensive sector in the country. The study estimates water saving from adopting alternate cropping patterns and irrigation technologies in 2030. In this context, four simulation exercises are conducted. These include shifting government procurement from staple to coarse cereals, upgrading irrigation technologies, adopting a water saving genomic variety of rice, and reducing irrigation subsidies in agriculture. The Input-Output framework is used to estimate inter-sector flows of water withdrawal and consumption in different sectors of the economy in 2030. Results reveal shifting government procurement from staple to coarse cereals saves 20.86 billion cubic meters (BCM) of blue water, however, trade-offs between green, blue, and gray water must be considered in the context of climate change. In comparison, adopting a genomic variety of rice saves 42.58 BCM of blue water. The highest blue water saving is estimated in upgrading irrigation technology, and ranges from 588.06 BCM to 1445.54 BCM. Increasing the average irrigation cost by 30 per cent saves 104.3 BCM of blue water, implying the importance of pricing incentives in water conservation in agriculture.

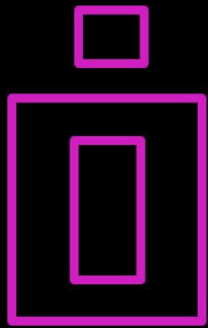
Jan Oosterhaven

[A decomposition of economic growth decompositions](#)

*The Annals of Regional Science*

This paper critically compares the ability of all three decomposition techniques that explain economic growth and its variation between regions and nations. Old time shift-and-share analysis (S&S) presumes that industry mix and regional competitiveness are all important. Structural decomposition analysis (SDA) presumes that final demand growth and input-output coefficient changes are all that matter. Growth accounting (GA) presumes the same for the growth of production factors and technological progress. This paper concludes that an econometric estimation of a GA equation without its residual factor productivity growth component, but with industry mix and demand components from S&Ss and SDAs, respectively, offers the best approach to explain longer term economic growth and variations therein.





# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**Vishnu S. Prabhu & Kakali Mukhopadhyay**

**[The Economic and Environmental Consequences of Electric Vehicle Transition in India](#)**  
*Energy for Sustainable Development*

India is pursuing a 'twin-transition trajectory' with the expansion of RE sources in the power sector and the expansion of Electric Vehicles (EVs) in the transport sector. This strategy is in line with SDG 2030 goals 7, 11 and 13. This study intends to analyse the macroeconomic impact of EV battery manufacturing and the energy and environmental impact of EV battery charging with coal and solar power for the years 2022 and 2030. A net-positive economy-wide impact across Output, GDP and Employment of 0.5 %, 0.08 % and 0.34 %, respectively is observed with minerals such as copper, manganese and bauxite benefitting the most. Through the deployment of 16 million EVs, health cost savings from reduced on-road emissions is expected to be \$2.1 million per vehicle substituted with a cumulative reduction in imports of approximately 30 million barrels of crude oil. Solar-powered EV battery charging vehicle lead to 12 % to 25 % reduction in emissions in different scenarios. It is pivotal to ensure the synergy between power and transport sectors for constructing a decarbonization roadmap with the long-run target of achieving net-zero emissions by 2070.

**Anne Owen & Milena Büchs**

**[Examining changes in household carbon footprints across generations in the UK using decomposition analysis](#)**  
*Journal of Industrial Ecology*

To meet climate targets, consumption-based household emissions need to fall rapidly. An important but still poorly understood question is whether generational change could contribute to decreases in emissions. It is sometimes assumed that younger generations such as Millennials and Generation Z are more concerned about climate change and have greener lifestyles than previous generations of the Silent Generation, Baby boomers, and Generation X, but carbon footprinting analysis typically focuses on age groups rather than comparing generations over time. This paper provides a first assessment of the change in consumption-based carbon footprints of the Silent, Baby boomer, Generation X, and Millennial generations within the United Kingdom between 2001 and 2020 and a comparison of the footprints of different generational groups. The analysis is based on environmentally extended input-output analysis, using the Living Costs and Food Survey and emission data from the UK multi-regional input-output database. We find some evidence for the hypothesis that younger generations have smaller footprints than older generations as Generation X and Millennial households have smaller carbon footprints compared to the generation before them at a similar life stage. We find that factors such as decarbonization, household occupancy, total expenditure, and changing consumption patterns contribute to the UK's changing carbon consumption emissions between 2001 and 2020, and the importance of these factors varies for different generational groups. However, future research that uses a longer time series is required to assess generational differences in carbon footprints over the whole lifespan of several generations.

**Guadalupe Arce, Ángela García-Alaminos, Mateo Ortiz & Jorge Zafrilla**

**[Attributing climate-change-related disaster displacement responsibilities along global production chains](#)**  
*iScience*

Climate change creates hostile living conditions in various regions, provoking climate-driven migration. The literature points to a polarization between the countries responsible for climate change and the regions suffering its consequences. Given this dichotomy, this study analyses the link between unsustainable consumption by world powers and the increasing vulnerability of some developing countries. We identify the most vulnerable countries to climate migrations and perform a responsibility assessment on environmental migration through historical consumption-based contributions to climate change. The main results show that the areas most vulnerable to climate migration are low-income countries from Asia and Africa, whereas the US, China, Japan, and Russia are the major economies responsible for climate change driving those migrations. According to our estimations, top responsible countries should contribute 0.2%–0.5% of their GDP to a global financial fund for climate migrants. This work supports the principle of climate justice regarding worldwide current challenges.