

**Newsletter**  
Number 57, December 2023

# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Welcome from the Editor



Dear **IIOA** member,

I am very pleased to announce the release of the December 2023 issue of the *International Input-Output Association Newsletter*. Sadly, this will be my final issue, but I am aware that the IIOA leaves the Newsletter editorship in excellent hands. I have to say that I enjoyed every issue since the first one back in November 2020. Many thanks to all contributors who have consistently provided valuable input for this and previous editions.

The current issue contains, as usual, the latest ESR articles, the last issue of the ESR, some highlights in Journals and recent related books. You can also find some information about the IIOA archive, some job positions, one call for a special issue, and a couple of awards received by our members.

Wishing you all the best, I encourage and hope that you will continue to contribute with your activities and feedback for forthcoming issues.

### **Andre Carrascal Incera**

IIOA Newsletter Editor

University of Oviedo, Spain

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

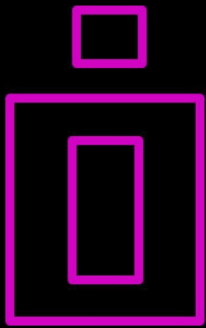
Personal E-mail: [carrascalandre@uniovi.es](mailto:carrascalandre@uniovi.es)

Would you like to contribute to the IIOA  
newsletter?

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## IIOA Archive - Update

In the May 2022 Newsletter, we informed the membership about a new project designed to develop a historical repository of I-O and I-O-related material. The short-term goal of the project was defined as to preserve relevant materials covering early I-O analysis that, without immediate action, most likely would otherwise be lost forever. The adopted scope was wide; including for example, persons retiring, their personal archive(s), papers, presentations or notes being lost or distributed, institutions reorganising themselves, et cetera. The long-term goal was to create a historical knowledge repository for the history of I-O analysis and related materials. In this context, I-O should be interpreted in a wider sense such as including related areas like regional economics, environmental economics and mathematical economics as well.

The overall aim is to identify and collect materials that are not already accessible on the web or in libraries, or materials that are (very) difficult to find.

In the opening session of the Alghero Conference, we informed the participants about the aims and the present status of the Archive. A short “guided tour” through the Archive was offered. Council member Rosella Bardazzi provided additional information about our project during the General Assembly 2023.

The intention of the present article is to provide further information about the current status of the Archive and to invite members make use of the Archive.

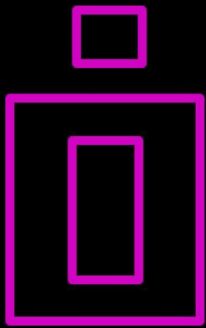
### WHAT HAS BEEN ACHIEVED SO FAR?

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.

#### Creation of an adequate infrastructure

An important step was the creation of an infrastructure to make material available in a convenient form. The IO (historical ) Archive is already accessible to members on the IIOA website. The webdatabase offers very convenient possibilities to search for relevant material. Suggestions and hints how to search are available at the website.

We should stress again that to comply with copyright regulations we do not offer PDFs of (conference) contributions that were published afterwards (or in some cases before) in proceedings or in journals, but we provide links to such publications when such links were/are available. If no copyright problems are to be expected, the documents can be downloaded directly.



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## IIOA Archive - Update

We should also stress again that the IIOA has not been able to contact the rights holders of all contributions offered in the IO (historical) Archive. Here we added the comment that if anyone is of the opinion that we are violating his or her rights to the content of these contributions, then please do not hesitate to contact us. We will respond accordingly and, if you wish, no longer make this content available.

The access to IIOA's Archive is granted to IIOA members only and is limited to scholarship, research and non-profit purposes. Any use of this website and the content presented therein is subject to the Terms of Use. Members have to agree with these to proceed. On the website users can also raise questions and provide general or specific feedback.

### Available documents

At present the Archive offers access to the contributions to the IO Conferences of 1971, 1974, 1979, 1986 and 1989. Again this concerns contributions that were not published in proceedings or in journals afterwards. The contributions to the 1993 IIOA Conference in Seville will be available before the end of the year. By the end of the year more than 630 contributions will be covered by the Archive.

We are pleased to say that more than 215 visits to the Archive have already been registered, and that members have already made use of the possibility to download documents directly from the IO Archive.

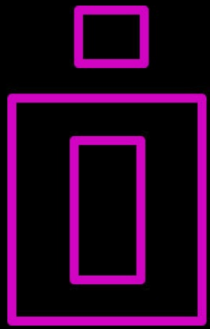
### NEXT STEPS

The next step will be to integrate the available contributions to the 1995 Conference. Once this is done, all IO Conferences since 1971 will be documented on the IIOA website. The contributions to the even earlier conferences have been published in Proceedings.

We will then begin to gradually add to the IO Archive the many other valuable early contributions to IO analysis that are already available in digitized form.

We hope to make a relevant contribution to the utilization of the rich intellectual heritage of IO analysis.

Josef Richter, Bert Steenge, (Archive planners)



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Awards, Promotions, and Recognitions

### NTNU's Outstanding Researcher Award to Edgar Hertwich

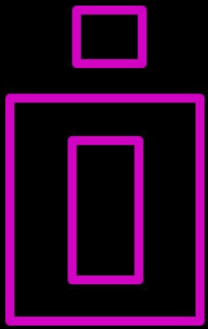
The Norwegian University of Science and Technology employee award for outstanding research and artistic activities in 2023 was awarded to Edgar Hertwich, Professor of Industrial Ecology. Previous awardees are the Nobel laureates May-Britt and Edvard Moser, center-of-excellence leader Bengt-Erik Sæther, and the founder of a logistics company, Kristin Ytterstad Pettersen.

The jury emphasized the international contributions of Hertwich to the work of policy interface organization, including the International Resource Panel, the Intergovernmental Panel on Climate Change, and his recent appointment to the European Scientific Advisory Board on Climate Change.

[Link](#)



Rector Anne Borg, Edgar Hertwich, Prorektor for research Tor Grande



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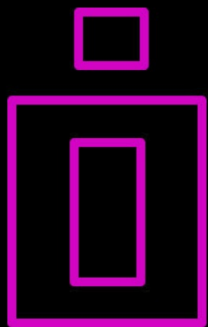
## Awards, Promotions, and Recognitions

### **Kashiyama-Junzo Prize to Satoshi Inomata**

Dr. Satoshi Inomata was recently awarded one of the prestigious academic prizes in Japan, Kashiyama-Junzo Prize, for his latest book "Geopolitics of Global Value Chains (Nikkei Publishing, 2023)".

[Link](#) (Japanese Only)





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# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

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

**Economic Systems Research**

**Journal of the IIOA**

**Volume 35, Issue 4, 2023**



**Luis Enrique Pedauga, Agustin Velazquez & 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.

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

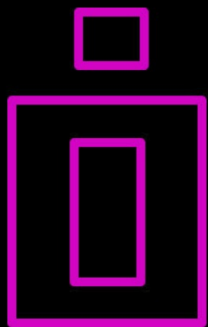
**The business accounting matrix: a proposal with an application**

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.

**Raúl Vázquez-López**

**Assessing employment benefits from trade: US-Mexico trade under NAFTA**

Recent tendencies in the operation of Global Value Chains (GVC) have indicated an increasingly asymmetric distribution of benefits in terms of the participating countries and different layers of workers. This paper employs the World Input-Output Database to calculate the working hours and wages embodied in manufacturing exports between the US and Mexico, by country of origin and skill level, from 1995 to 2008. In purchasing power, the increase in total wages paid in the US, generated by the bilateral trade, was significantly higher than that of wages paid in Mexico, even though the additional number of hours worked in Mexico was seven times higher. For the US, the results ratify the loss of jobs after 2001, but with an upgrade of the skill structure. We conclude that the trend towards replacement of low-skilled labour by more capital-intensive systems occurs within GVC to the detriment of the incomes of low-skilled workers.



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**Yuwan 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.

**Alessandro Borin & Michele Mancini**

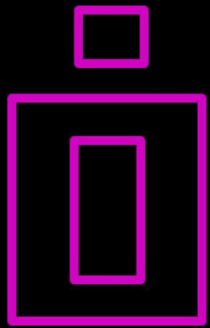
**[Measuring what matters in value-added trade](#)**

The spread of global value chains (GVCs) has given rise to new statistical tools, the inter-country input–output tables, and new analytical frameworks aimed at properly identifying production linkages between and within economies. However, several important questions remain unaddressed. This paper proposes a new toolkit for value-added accounting of trade flows at the aggregate, bilateral, and sectoral levels. The paper shows how different empirical issues require distinct accounting perspectives and maps these methodologies onto the economic questions they are best suited to address. We provide novel accounting perspectives that allow us to properly address important empirical issues. With respect to other accounting methodologies previously proposed in the literature, we offer more accurate or, in some cases, more exhaustive value-added decompositions of trade flows (e.g. by covering both domestic and foreign value-added). In addition, the paper gathers a significant amount of the related literature under one comprehensive framework.

**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.



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**Pablo R. Liboreiro**

**[Estimating disguised unemployment in major middle-income countries by means of non-linear input-output analysis, 2000–2014](#)**

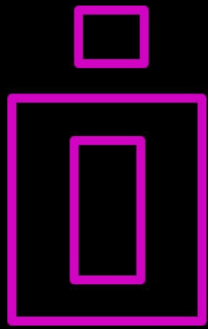
According to the disguised-unemployment hypothesis, significant wage differences between sectors in less-developed countries result from segmented labour markets and overcrowding of the flexible market segment. So stated, this hypothesis implies a way to measure non-open unemployment: by the amount of labour that must be withdrawn from the market for relative wages to change. Indeed, it is possible to undertake the exercise of comparing the actual employment of a country with a simulated 'non-dualistic' employment by means of a non-linear input-output model and taking the US wage structure as a benchmark. This simulation experiment was carried out for seven middle-income countries (Brazil, China, Indonesia, India, Russia, Mexico, and Turkey) using data from the 2016 Release of the World Input-Output Database. The results of the study are consistent with the disguised-unemployment hypothesis, as well as with related literature.

**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

## Latest ESR articles

### Economic Systems Research

Journal of the IIOA

Latest articles (up to 7<sup>th</sup> of Jan)



**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.

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

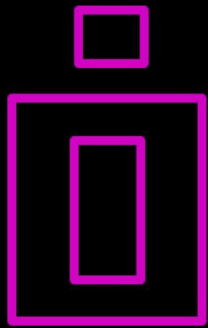
[Integrated assessment modelling of degrowth scenarios for Australia](#)

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.

**Nina Knittel, Max Tesselaar, W. J. Wouter Botzen, Gabriel Bachner & Timothy Tiggeloven**

[Who bears the indirect costs of flood risk? An economy-wide assessment of different insurance systems in Europe under climate change](#)

Anticipated increase in future river flood risk highlights the need for effective flood insurance, as it enables hedging against this risk. However, its design varies significantly across countries. This study contributes to the debate on designing flood insurance mechanisms from an economy-wide perspective, considering both socioeconomic and climate changes. We apply a multi-regional computable general equilibrium (CGE) model for 2050 and find that, under current insurance market systems, flood risk causes regional GDP losses of up to -0.5%, societal welfare losses of up to -1%, and private and public consumption losses of up to -0.5% and -2.4%, respectively. These estimates are all relative to a scenario without flood risk. Our results indicate that flood risk intensifies pressure on public budgets. We find that insurance market reforms, including a higher degree of risk-sharing, mandatory purchase requirements, and public reinsurance, can alleviate adverse welfare effects and the burden on public budgets.



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**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.

**Naci Dilekli, Ignacio Cazcarro & Julio Sánchez-Chóliz**

[Regions may share factors of production, too: Implementation of topologies within the World Trade Model](#)

The World Trade Model (WTM), which incorporates input - output data and minimizes global factor costs subject to satisfying demands while being constrained by each region's factor endowments, is one of models based on the principle of comparative advantage. These factor endowments are not necessarily fixed in each region as traditionally posed in most theories, but rather can or de facto be shared across regions. We highlight the importance of this feature for economic modeling, and then introduce an extension for the integration of topological rules into WTM to facilitate the sharing of factors with directionality (one-way or two-way) across regions. A series of numerical examples illustrating a range of sharing scenarios is demonstrated to facilitate an examination of this extension's features. Finally, we discuss the most interesting cases in which this topology can be used, as well as the additional challenges or implementations that can be derived from this work.

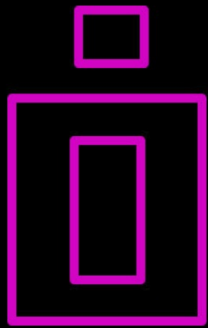
**Irlan A. Rum, Arjan de Koning, Arnold Tukker & Arief A. Yusuf**

[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.

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# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Highlights in journals

**Fabrício Pitombo Leite**

**Multipliers and Supermultipliers in a Multisectoral Framework: Macroeconomic Tools After All?**

*Review of Political Economy*

The paper starts showing that the common mistake of considering Keynesian income and/or employment multipliers as sector-specific, in a multisectoral framework, is taking its way back into economics. The phenomenon coincides with the recent debate about the macroeconomic Sraffian supermultiplier and generates some new miscommunication by using similar terminology to sectoral multipliers. Thus, the aim of bringing forward the understanding that Keynesian multipliers and Sraffian supermultipliers constitute macroeconomic relations even in multisectoral models is pursued by emphasising the differences between the traditional input-output multipliers and their Keynesian counterparts and by showing the required adaptations for supermultiplier representations. Once aggregate multipliers and supermultipliers are obtained, there is no need for further multisectoral operations and all the differences in impact between economic activities must be attributed to the simple input-output multipliers. Some estimates are presented using data from the World Input-Output Database (WIOD).

**Rômulo N. Ely & Michael L. Lahr**

**How far should we go to sugarcoat the path to global energy security?**

*Annals of Operations Research*

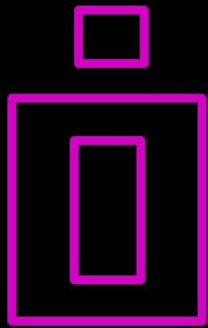
Since the 1970s, Brazil has carried out the most successful world program of commercial biomass for use and production of energy by stimulating its sugarcane industry and promoting the large-scale production of ethanol nationwide in response to the first oil shock. Today, the technologies behind ethanol production are well established. Brazil is the world's largest sugarcane supplier, producing its ethanol at a competitive price. If other sugarcane producing countries decided to join Brazil's move toward the production of this biofuel, what impacts might there be for each country's economy and employment? This is what we investigate in this paper. Prime candidates for ethanol production include Australia, China, Colombia, India, Indonesia, Mexico, Pakistan, the Philippines, Thailand, and the United States of America. We evaluated the potential socioeconomic impacts of developing this promising industry by using an input-output approach. More specifically, we adapted the Brazilian method of producing ethanol to these countries' distinct economies. We augmented the input-output table of each country, inserting a new ethanol industry based on the Brazilian ethanol production model. We also augmented their new ethanol industry's sales following a hypothetical hydrous and anhydrous ethanol consumption scenario. Thereafter, we reconcile the national accounts, concluding our analysis by quantifying and comparing the different net effects of this new industry for each of the assessed countries for the year of 2009. We demonstrate which industries would be expected to be positively or negatively impacted by this substitution in each country; and find that not all of the countries we assessed would experience positive socioeconomic results from emulating Brazil's production of ethanol.

**Bin Su & B.W. Ang**

**Structural decomposition analysis applied to energy and emissions: Frameworks for monthly data**

*Energy Economics*

Structural decomposition analysis (SDA) is a well-known approach to studying factors contributing to changes of an aggregate indicator in energy and emissions studies. Such studies normally rely on yearly data since input-output (I-O) tables are needed. With energy and economic transitions and seasonal factors, variations in renewable energy supply and in final demands of goods and services are becoming more prominent within a year in many countries. If monthly data are incorporated, some temporal dynamics within a year can be investigated in SDA application. In this paper, we propose an additive SDA framework and a multiplicative SDA framework that include monthly data to respectively reveal the drivers of temporal dynamics associated with energy/emissions embodiments and aggregate embodied intensity indicators. Based on China's 2018 and 2020 I-O tables, an empirical study is conducted using the proposed frameworks. The results obtained show that the increased granularity helps to reveal temporal dynamics mechanisms which will otherwise be overlooked. We discuss the findings and present areas for future research.



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**Heran Zheng, Richard Wood, Daniel Moran,  
Kuishuang Feng, Alexandre Tisserant, Meng  
Jiang & Edgar G. Hertwich**

**Rising carbon inequality and its driving factors  
from 2005 to 2015**

*Global Environmental Change*

Carbon inequality is the gap in carbon footprints between the rich and the poor, reflecting an uneven distribution of wealth and mitigation responsibility. Whilst much is known about the level of inequality surrounding responsibility for greenhouse gas (GHG) emissions, little is known about the evolution in carbon inequality and how the carbon footprints of socio-economic groups have developed over time. Inequality can be reduced either by improving the living standards of the poor or by reducing the overconsumption of the rich, but the choice has very different implications for climate change mitigation. Here, we investigate the carbon footprints of income quintile groups for major 43 economies from 2005 to 2015. We find that most developed economies had declining carbon footprints but expanding carbon inequality, whereas most developing economies had rising footprints but divergent trends in carbon inequality. The top income group in developing economies grew fastest, with its carbon footprint surpassing the top group in developed economies in 2014. Developments are driven by a reduction in GHG intensity in all regions, which is partly offset by income growth in developed countries but more than offset by the rapid growth in selected emerging economies. The top income group in developed economies has achieved the least progress in climate change mitigation, in terms of decline rate, showing resistance of the rich. It shows mitigation efforts could raise carbon inequality. We highlight the necessity of raising the living standard of the poor and consistent mitigation effort is the core of achieving two targets.

**Meng Jiang, Paul Behrens, Le Lyu, Zhipeng Tang,  
Dingjiang Chen, Yuheng Cao, Pu Gong, Wenji Zhou,  
Yongheng Yang, Arnold Tukker, Edgar Hertwich &  
Bing Zhu**

**Additional north-south differences in China  
revealed by the Planetary Pressure-Adjusted  
Human Development Index**

*Resources, Conservation and Recycling*

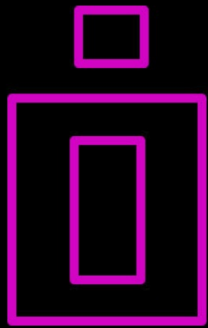
The UN's Planetary Pressure-Adjusted Human Development Index (PHDI) incorporates environmental footprints into development indicators. If footprints are high, PHDI is reduced compared to HDI. Many nations have seen stagnating HDI and declining PHDI. When using PHDI, >50 countries drop below the very-high development category. China has seen unprecedented development but with large inequalities. We investigate PHDI across provinces and put this in global contexts. While there is a well-known east-west regional divide, we reveal an additional significant north-south divide by PHDI. Environmental inequalities across provinces are larger than development inequalities. China reflects global extremes where under-developed provinces can have continuingly declining PHDI due to extractive activities, similar to oil- or mining-focused nations. Innovation-oriented provinces, such as Guangdong, have high PHDIs similar to European nations. We explore metric choice issues for PHDI and the need for approaches that incorporate the lag between capital stock accumulation and HDI – the stock-development problem.

**Michael Grubb, Nino David Jordan, Edgar  
Hertwich, Karsten Neuhoff, Kasturi Das, Kaushik  
Ranjan Bandyopadhyay, Harro van Asselt,  
Misato Sato, Ranran Wang, William A. Pizer &  
Hyungna Oh**

**Carbon Leakage, Consumption, and Trade**

*Annual Review of Environment and Resources*

We review the state of knowledge concerning international CO<sub>2</sub> emission transfers associated particularly with trade in energy-intensive goods and concerns about carbon leakage arising from climate policies. The historical increase in aggregate emission transfers from developing to developed countries peaked around 2006 and declined since. Studies find no evidence that climate policies lead to carbon leakage, but this is partly due to shielding of key industrial sectors, which is incompatible with deep decarbonization. Alternative or complementary consumption-based approaches are needed. Private sector initiatives to trace and address carbon emissions throughout supply chains have grown substantially but cannot compensate for inadequate policy. Three main price-based approaches to tackling carbon leakage are potentially compatible with international trade rules: border adjustments on imports, carbon consumption charges, and climate excise contributions combined with emissions trading. We also consider standards and public procurement options to tackle embodied emissions. Finally, we discuss proposals for carbon clubs involving cooperation among a limited set of countries.



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**Grant Allan, Kevin Connolly & Aditya Maurya**

**[The city within the global: A framework for the simultaneous estimation of city emissions metrics](#)**

*Journal of Cleaner Production*

In line with national targets, sub-national governments – including cities – are introducing targets to reduce the emissions associated with economic activity within or associated with a particular geography. Cities are important drivers of not only emissions but also economic activity and are embedded into complex economic systems which reach beyond their boundaries, which can raise major issues in identifying whether a city is assisting in promoting sustainability across a wider spatial level. This paper sets out a methodology to downscale global Input Output tables to city-level and use these to calculate production- (territorial) and consumption-based carbon accounts at the city level simultaneously. Illustrating this for the case of Glasgow, Scotland, we show that the city's territorial emissions are significantly lower than its consumption-based carbon footprint (considering both the Areal and Personal Carbon Footprint), but that both metrics are sensitive to assumptions about the emissions intensity of individual sectors. Our results highlight the importance of data quality and accuracy, and the benefits of local knowledge, rather than the unquestioned use of national metrics.

**Xesús Pereira López & Fernando de la Torre Cuevas**

**[An alternative for tracing the path between supply and use tables in current and constant prices](#)**

*Structural Change and Economic Dynamics*

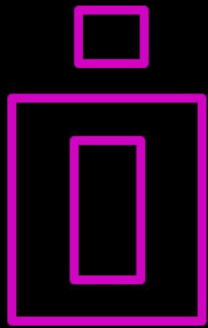
Supply and use tables (SUT) in constant prices ensure coherent volume and price information across economic accounts. They are needed to appropriately measure technological change and connect physical and monetary models. To estimate SUTs in constant prices, researchers normally apply commodity-specific deflators to SUTs. From an economics perspective, deflators are undoubtedly cell-specific since exchanges of a commodity occur in different markets and institutional contexts. RAS can be used to calculate such cell-specific deflators. But deflating SUTs via RAS can become impossible due to excessive information requirements. This article revisits Path-RAS and applies it to build SUTs in constant prices. Our methodology lowers information requirements, enables cell-specific deflators, and avoids ad hoc adjustments. Additional information about specific industries or products can be included if existing and non-conflicting. We provide an empirical application based on the current 27 European Union countries to explore the accuracy of our estimations considering different information scenarios.

**Luis Antonio López, Guadalupe Arce & Pilar Osorio**

**[Foreign multinationals affiliates and countries' carbon upstreamness. How could these firms support the fulfilment of emissions reduction targets?](#)**

*Journal of Environmental Management*

Climate emergency requires urgent actions to reduce carbon emissions. In this paper we calculate the countries' carbon upstreamness and evaluate its linkage to the presence of foreign MNE affiliates, by using a multiregional input-output model with firm heterogeneity. We find a mismatch between carbon upstreamness, emissions reduction targets and income per capita between countries. OECD countries, which are located in the final stages of carbon production, have lower carbon intensity than the world average and have committed strongly to reducing their total emissions. On the contrary, non-OECD countries, which are located mainly in the initial stages of carbon production, maintain higher carbon intensity than the world average and they are less ambitiously committed, as they have lower per capita income. In that context, multinational enterprises (MNEs) could play a key role in supporting the fulfilment of emission reduction targets in host countries, so we propose a simulation to evaluate this role. Specifically, if the MNE affiliates adopt the Intended Nationally Determined Contributions (INDC) set by the controlling country regardless of where they are located, the emissions of MNEs would be reduced by 15.6% (395,864 KtCO<sub>2</sub>), 4% more than they would be reduced under current emission reduction targets in 2016. However, if MNEs apply the more ambitious INDC, regardless of origin or destination, the emissions would be reduced by 18% (455,910 KtCO<sub>2</sub>), 7% more than scenario 1 and 1.7% of global emissions in 2016.



**Newsletter**  
**Number 57, December 2023**

# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**Pilar Osorio, María-Ángeles Cadarso, María-Ángeles Tobarra & Ángela García-Alaminos**

**[Carbon footprint of tourism in Spain: Covid-19 impact and a look forward to recovery](#)**

*Structural Change and Economic Dynamics*

Tourism is very vulnerable to climate change and the disruption of Covid-19, facing two challenges: fighting climate change pursuing its carbon emissions goals, and recovering from the complex pandemic effects. We contribute to the incomplete understanding of tourism emissions pandemic impact and in different post-covid recovery scenarios. Using official data on tourists' consumption, we calculate the carbon footprint of tourism in Spain in 2019 and 2020 under different recovery pathways, including changes in consumption patterns and emissions efficiency, using a multiregional input-output model. Results show that the carbon footprint of tourism in Spain fell by 63% in 2020 compared to pre-pandemic levels, which would be aligned with the current sectoral decarbonisation target. However, the new tourists' consumption patterns resulting from the pandemic are insufficient to increase tourism sustainability if they imply pre-pandemic consumption levels. The results provide empirical ground for the binary debate on "recovery or reform".

**Luis-Antonio López, Guadalupe Arce, María-Ángeles Cadarso, Mateo Ortiz & Jorge Zafrilla**

**[The global dissemination to multinationals of the carbon emissions ruling on Shell](#)**

*Structural Change and Economic Dynamics*

Shell's landmark ruling ordered to reduce the CO<sub>2</sub> emissions to the Shell group by a net 45% by 2030, compared to 2019 levels. In this paper, we analyze the effects of extending Shell's sentence to all the foreign affiliates of multinational enterprises (MNEs) in the world and find that it would result in a 2.85 GtCO<sub>2</sub> reduction in global emissions. This amount represents a contribution of between 27% and 40% of the emissions reduction required to meet the 2030 global emissions level for not exceeding 2°C. We focus on MNEs in the automotive industry (such as Volkswagen, Toyota, Nissan, and Ford) and combine the information of their sustainability reports with multiregional input-output data of MNEs' affiliates. We find that the current targets disclosed by those companies represent 8%-22% of the required reductions in their upstream emissions if the Shell sentence were extended to the automotive industry.

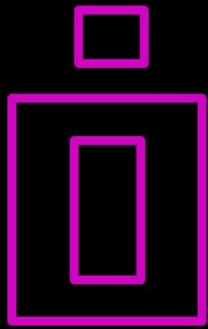
**Carmen Córcoles, Luis Antonio López, Pilar Osorio & Jorge Zafrilla**

**[The carbon footprint of the empty Castilla-La Mancha](#)**

*Energy Policy*

In this paper, we analyze the carbon footprint of Castilla-La Mancha households, a region of the so-called "empty Spain," and their mitigation potential. For this purpose, we use the environmentally extended multiregional input-output model and the Spanish Households Budget Survey to extract expenditure microdata by municipality size. We find that households in smaller municipalities have a larger total carbon footprint due to their higher direct emissions. Although their consumption is lower than other municipalities, they have a more intensive pattern of embedded carbon consumption. Households in smaller municipalities spend a higher share in private transport and housing-related activities, emitting almost an additional ton of direct carbon emissions.

Regarding their mitigation potential, results show that for every euro that municipalities with less than 10,000 inhabitants reduce their consumption, they would reduce emissions by 0.796 kgCO<sub>2</sub>. However, while the size of the municipality increases, the mitigation potential decreases (0.378 kgCO<sub>2</sub> for more than 100,000 inhabitants). This highest mitigation potential will only be achieved if mitigation policies especially favor their inhabitants and if infrastructures and social services are developed to facilitate a change in their consumption patterns.



**Newsletter**  
**Number 57, December 2023**

# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

**Bui Trinh & Bui Gia**

[An extended variant of the IO model for the study on indirect and direct taxes](#)

*International Journal of Management Studies and Social Science Research*

Since the input - output (I.O) system was created by W. Leontief, there have been many models expanding from the I.O model such as inter-regional I.O model, international I.O model, social accounting matrix (SAM), demographic - economic model... The I.O model describes and analyzes the flow of products through inter-industrial relationships or the initial distribution process of the economy. The inter-regional I.O model not only reflects inter-industry relationships but also reflects inter-regional relationships, it allows determining the advantage of one region over another in which industries? The social accounting matrix and economic demographic model not only model describes the initial distribution process but also describes the redistribution process. This study extends the I.O model with a harmonious blend of the concept of social accounting matrix and economic demographic model to see that the economy is like a cycle of reincarnation in Buddhism about "no beginning and no end"; any change (Cause) at any stage directly or indirectly affects (Consequences) on the rest.

**Tsujimura, Kazusuke & Tsujimura, Masako**

[War and Peace: Structural changes in the U.S. industries 1939–1958](#)

*Statistical Journal of the IAOS*

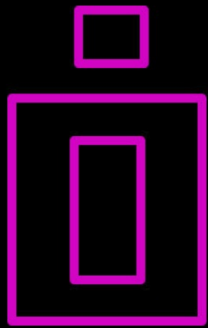
In his memoir published in 2002, George Dantzig, who had invented the simplex algorithm to solve linear programming problems, praised Wassily Leontief as a great pioneer for proposing a large but simple matrix model that represents the interindustry input-output structure of an economy. Input-output tables, which depict the transactions of goods and services between industries, have been intensively used to prepare the U.S. economy for World War II, and to eventually liberate Europe. This paper not only revisits the early development of structural analysis but also applies it to the 1939, 1947 and 1958 U.S. input-output tables using triangulation and dispersion indices as fundamental tools. The degree of integrity represented in the Leontief inverse significantly increased as the division of work progressed in the time of war to achieve maximum productivity. The structural changes ensured a smooth transition of the American economy from peacetime to wartime, and later, the fast rebuilding of European economies that had been completely devastated during the war.

**Satoshi Inomata & Tesshu Hanaka**

[Measuring exposure to network concentration risk in global supply chains: Volume versus frequency](#)

*Structural Change and Economic Dynamics*

In this paper, we present new referential statistics for the degree of supply chain exposure to network concentration risk. The study's contribution rests on the development of a metric that indicates network concentration in terms of the frequency of supply chain engagement with the regions of analytical concern, alongside the traditional approach based on volume measurement of value-added concentration. Japan, a country with a high propensity to encounter natural hazards, and China, under mounting geopolitical tension with the United States, are chosen as the target regions for the assessment of network concentration. In addition, the highly asymmetric structure of mutual economic dependency in the US-China relations is identified.



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

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

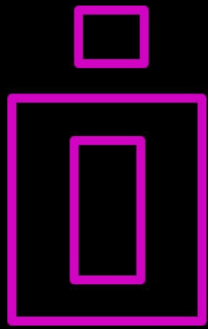
[Disentangling social impacts in global value chains through structural path analysis: Investigating forced labor in the cotton industry](#)

*Journal of Industrial Ecology*

This analysis proposes an analytical method to trace the precise pathways through which impacts from a specific origin are disseminated worldwide and embodied in high-income nations' consumption. Our methodological approach is based on a multi-regional input-output model developed using EXIOBASE data for 2019. The model is extended with the structural path analysis (SPA) methodology, which allows us to trace and quantify the critical interactions in the impacts' dissemination process from their origin until reaching their destination as final demand in a specific industry and region. The SPA method is explored both in gross and net terms as complementary perspectives to disentangle the complexity of global value chains, which is the main contribution of our approach. The net assessment accounts just for interindustry transactions, whereas the gross analysis considers all steps of the value chain, even those occurring at an intraindustry level. In this work, we analyze a case study to expose the features of this proposal, which focuses on assessing the global reach of forced labor in the cotton industry in the two leading worldwide cotton producers. Textile global value chains are intricate and complex, making it hard to trace the negative social impacts linked to them. Therefore, a deeper understanding of how forced labor is disseminated worldwide until reaching developed nations is necessary to shed light on the social sustainability debate.

Although this kind of forced labor seems to be a regional affair, our results show that more than 13% of the estimated forced workers are attributed to the European Union and the United States consumption, respectively, with apparel, footwear, and textiles as key goods embodying these workers. After analyzing the specific paths of dissemination linked to the fashion demand of the European Union and the United States, our key findings show the predominant role of the Chinese and Indian textile industries in most paths given the high number of intrasectoral transformations inside this sector. We also show that forced labor in the Chinese cotton industry is even more distant to the final consumer than usual unskilled labor, which is an additional obstacle to its traceability.





# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Recent I-O Books and related

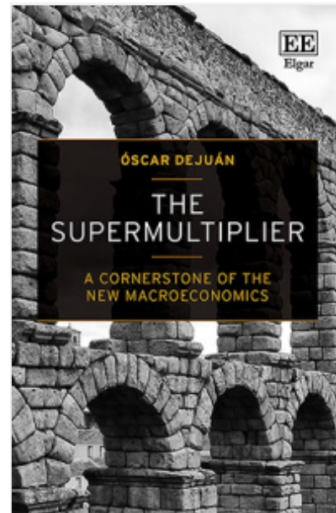
### The Supermultiplier. A Corner Stone of the New Macroeconomics

**Óscar Dejuán**, Professor of Economics,  
Department of Economics and Finance,  
University of Castilla-La Mancha, Spain

Publication Date: 2023  
ISBN: 978 1 80088 954 5  
Extent: 226 pp

#### [Link](#)

An aqueduct is a good illustration of the functioning of an economy according to the supermultiplier (SM) model. The water extracted and transported in the aqueduct's upper channel could be identified with the economic surplus triggered by (proper) autonomous demand. It includes exports, public expenditure, credit-based consumption, residential investment, and modernization investment aimed at transforming productive capacity instead of enlarging it. The ashlar stones reflect the productive structure of the economy. The millions of people engaged in economic activity are like little ants working through the stones. The supermultiplier (SM) is evoked by the cornerstones that support the arches of the aqueduct and distribute the charges derived from the changes in autonomous demand (the water flow).

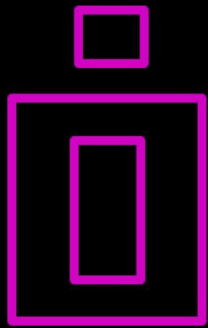


When the expected growth of persistent autonomous demand accelerates, it is necessary to enlarge and reinforce the productive capacity. This is achieved by accelerating expansionary or induced investment. Employment and induced consumption will also expand. The structure of the economy is bound to change.

In aggregate models, the SM appears as a simple ratio. Our book follows this tradition since we are interested in revising Keynesian macroeconomics. Yet, from the first chapter, we share with input-output analysis the importance of the economic structure based on fixed coefficients of production. We also remark that such a structure is altered whenever any element of the vector of autonomous demand changes. In the book's last chapter, we compute and use a matrix SM to simulate the worldwide impact on employment and emissions derived from the decarbonization of electricity production in the EU.

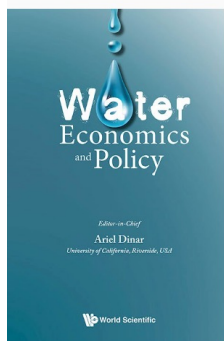
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1. Introduction.
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4. The demand side. The nucleus of the SM model.
5. The financial side. Endogenous money and SM-cum-finance.
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8. Distribution, inflation, and growth in the SM model.
9. Technical change and the structure of production in the SM growth model.
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# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Special Issues



### **Water Economics and Policy**

ISSN (print): 2382-624X | ISSN (online): 2382-6258

Supports Open Access

### **Special Issue on Integrated Approaches for Water Management: Multisectoral Models and Applications**

#### **Guest Editors:**

Ana Serrano (University of Zaragoza, Spain)

Angels Xabadia (University of Girona, Spain)

The focus of this special issue is on exploring the challenges and limitations of using multisectoral models for water management.

These challenges and limitations include the complexity of modelling interdependencies among different sectors, data availability and uncertainty. The ultimate goal is to identify potential solutions to overcome these barriers and enhance the use of multisectoral models for sustainable water management practices.

We invite submissions of original research articles that explore the use of multisectoral models in water resource management. This includes the use of Input-Output Tables, Social Accounting Matrices, Computable General Equilibrium Models and/or Multisectoral Optimization Models applied to water resources.

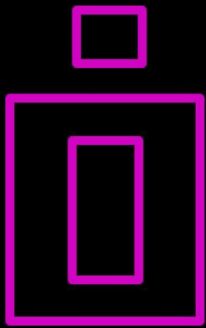
#### **Timeline and submissions**

Manuscript submission deadline (via Editorial Manager): **March 31, 2024**

All submitted papers are expected to fully comply with journal standards and are subject to regular review procedures. Papers should not have been published previously in any other journal (print or electronic format) or be under consideration by any other outlet. All submissions should follow the journal's Submission Guidelines found here:

<https://www.worldscientific.com/page/wep/submission-guidelines>

We look forward to receiving your contributions!



# INTERNATIONAL INPUT-OUTPUT ASSOCIATION

## Job Positions



### Post-Docs

Global value chains, digitalisation and polarisation in Europe

Prof. Maria Savona

**Deadline: January 25, 2024 – 2 p.m. – Central European Time (CET)**

[More info](#)



### PhD position on sustainable environmental footprints at the Basque Centre for Climate Change

a fully-funded PhD position on sustainable environmental footprints to be carried out at the Basque Centre for Climate Change (BC3). The PhD position will be funded through Fundación La Caixa's INPHINIT Incoming programme.

of the PhD will be to define environmental sustainability conditions for a range of footprints and to monitor progress towards them. If you are interested in increasing the policy relevance of environmental footprints through a range a tools used in industrial ecology, this position is for you!

Deadline for application: 24 January 2024, 2 pm (CET)

Information about the program: <https://t.ly/ZRfOI>

Information about the position: <https://t.ly/kSj4d>