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INTERNATIONAL INPUT-OUTPUT ASSOCIATION

Welcome from the Editor

Dear **IIOA** member,

I am delighted to present the latest issue of the *International Input-Output Association Newsletter*. My sincere thanks go to all contributors who have provided invaluable inputs for this and previous editions.

In this issue, you will find a message from the IIOA President Sanjiv Mahajan, the latest ESR articles and some highlights in journals. It also contains information about an updated database and details about an upcoming conference.

This marks my first issue as the editor of the *IIOA Newsletter*, following the excellent job done by Andre Carrascal Incera since November 2020. I hope you find this issue enjoyable, and I appreciate any feedback, comments or suggestions. Your contributions to future issues are very welcome.

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In this issue

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A message from the IIOA President – Sanjiv Mahajan

Dear **IIOA** member,
Hope you and your families are all well.

Some general IIOA matters

It is worth mentioning that the **IIOA membership recently passed 850 members** for the first time ever, our future remains bright and expansive.

Since the beginning of the year various personnel changes have taken place:

- Elections to the IIOA Council were completed at the end of 2023. Congratulations to the successful members: **Satoshi Inomata** (former IIOA President), **Jing Meng** (new member) and **Zhifu Mi** (new member). I would also like to say thank you to the contributions made by the three exiting members: **Rossella Bardazzi**, **Heinz Kurz** and **Vinicius Vale**.
- The process to select two new Vice-Presidents was completed in January 2024, congratulations to **Kuishuang Feng** and **Jose Rueda-Cantuche**.
- Congratulations to **Francesca Severini**, who will take over the role of Council Liaison Officer on the IIOA Historical Archives work from **Rossella Bardazzi**. A big thank you to Rossella for the notable work done and achievements to date.
- Last but not least, congratulations to **Jing Meng**, who has taken over as the Editor of the IIOA Newsletter from **Andre Carrascal Incera**, (Editor since November 2020). Again, a big thank you to Andre and congratulations on becoming a father again.

2024 IIOA Conference

As you know, the 30th IIOA Conference will be in Santiago, Chile from 30th June to 5th July 2024.

This will hold the 12th Edition of the International School of Input-Output Analysis – five training modules will be available.

The LOC Chair is **José E. Durán Lima** (UN ECLAC) and the SPC Chair is **Luis Enrique Pedauga** (European Commission and Universidad de León). There is a new role liaising between the LOC and SPC, a Conference Liaison Officer (CLO), this is **Kuishuang Feng** (University of Maryland).

The three keynote speakers have been confirmed: **Thijs ten Raa**; **Ya Yen Sun**; and **Sebastien Miroudot**.

For further details of the Conference and the various events that will be taking place, please check out the Conference Website ….

The 30th IIOA conference - The Conference

I look forward to seeing as many of you there as possible.

Atentamente

Sanjiv

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Databases

GLORIA MRIO

A new release of the GLORIA global MRIO database is available from the *Industrial Ecology Virtual Laboratory* at https://ielab.info/resources/gloria/about, with data downloads at https://ielab.info/resources/gloria/supportingdocs.

Improvements were made compared to the prior release in that:

- **MRIO transactions are now much smoother over time.**
- **GLORIA is now available as a 1990-2028 time series, including accompanying standard deviation and price data, complying to UN Main Aggregates, FAO food balances, and OECD ICIO data.**

Download is free for academic research. For a commercial license, contact Prof Tommy Wiedmann <t.wiedmann@unsw.edu.au>.

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Conferences

(I-O)10 10th Conference on Input-Output Analysis

The 10th Spanish Conference on Input-Output Analysis of the Hispanic-American Input-Output Society (SHAIO) will take place in Gijón, Spain, on the 4th and 6th of September 2024.

It will be a great honor for SHAIO to return to the University of Oviedo. The seed of what is now SHAIO was planted at this university. Back in 2005, they organised the first Conference of our association. Ten editions later, we come back to Asturias. The colleagues from the University of Oviedo and the REGIOlab will organize this event, which will be held at the School of Commerce and Tourism of the University of Oviedo, located on the Gijon campus. Gijon is the most populated city in Asturias and offers a wide range of hotels and a vibrant social and cultural life, especially during the summer season. The School of Commerce and Tourism is within the stunning Laboral-Ciudad de la Cultura and offers an excellent setting to host the Conference.

The Conference's official languages will be English and Spanish. The program will include the fifth edition of the Spanish School of Input-Output Analysis (ESAIO), plenary and parallel sessions, the Emilio Fontela Award ceremony, and some other amazing surprises that will make this event a perfect opportunity to visit the region of Asturias, one of the multiple Spanish's cultural and natural jewels.

More information at: https://io10.shaio.es/en/

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

Economic Systems Research
Journal of the IIOA
Volume 36, Issue 1, 2024

Volkan Recai Cetin

When do public transport investments really matter? A CGE analysis for Türkiye

In this study, the economic impact of public transport investments which have been extensively used as an investment policy tool in Türkiye is analysed from different fiscal policy and financing perspectives by employing a dynamic computable general equilibrium (CGE) model. The impact of public transport investments on key economic performance indicators of real GDP growth and unemployment and macroeconomic vulnerability indicators were investigated in alternative scenarios involving such different financing mechanisms as tax revenues, external borrowing, and public–private partnerships. The results assert that public transport investments stimulate economic growth and employment. Nevertheless, the financing mechanism is an essential factor that determines the level of the impact, its sustainability and in some cases its direction.

Mohammad Masudur Rahman & Anna Strutt

Costs of LDC graduation on market access: evidence from emerging Bangladesh

We empirically estimate the costs of LDC graduation on market access for Bangladesh using a computable general equilibrium modelling framework. If developed countries impose standard generalized system of preferences (GSP) tariffs while importing from Bangladesh and at the same time Bangladesh eliminates its export subsidies, our modelling suggests that real gross domestic product (GDP) may drop by about 0.38 per cent and exports could fall by about six percent for Bangladesh. The ready-made garment sector could be affected severely, with results suggesting exports could decline by about 14 per cent. Our analysis indicates that the income of urban households could decrease by three per cent, and household consumption may shrink by about four per cent. To minimize these potentially adverse impacts, Bangladesh should aim to ensure market access continues through signing preferential trade agreements. In addition, streamlined subsidy policies, enhanced domestic productivity, export diversification, and increased foreign investment, are likely to be important areas of focus for a smooth LDC graduation.

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.

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Claudio Socci, Marcello Signorelli, Silvia D'Andrea, Stefano Deriu & Francesca Severini
The three plans by Biden: effects on economic growth and income inequality

The three budgetary plans under Biden's presidency—the American Rescue Plan, the American Families Plan, and the American Job Plan–encompass a set of measures meant to expand investments, support production processes, stimulate private consumption, and protect the labor market through transfers, tax credits, production subsidies, and federal unemployment benefits. Thus, besides relieving the economic system, these plans aim to drastically reduce poverty. This study attempts to disentangle the direct, indirect, and induced economic effects generated by these plans in a well-defined time-lapse through a dynamic computable general equilibrium model based on the social accounting matrix for the US. This approach enables the simulation of shocks from both the demand and supply sides, as well as policies for income redistribution. The simulation scenarios' results prove the plans' effectiveness vis-à-vis economic growth and support to households, as well as the peculiar effects on income inequality.

Severin Reissl, Alessandro Caiani, Francesco Lamperti, Tommaso Ferraresi & Leonardo Ghezzi
A regional input-output model of the COVID-19 crisis in Italy: decomposing demand and supply factors

We propose an empirically estimated inter-regional input-output model of the Italian economy designed for COVID-19 impact assessment, intended as a tool for public authorities facing comparable adverse events and requiring timely estimates of sectoral and regional economic impacts. We evaluate the contributions of demand- and supply-side factors to output losses in Italy during the pandemic, providing insights on the suitability of demand- and supply-side policies. Supply-side shocks, as a consequence of mandated closures, are the primary driver of output losses only during the nationwide lockdown of spring 2020. During the following stages, changes in final demand due to income losses and changes in mobility play a pivotal role at the aggregate, regional, and sectoral levels. While this result supports demand-side policies, the efficacy of such policies may be hampered when final consumption demand is low chiefly due to reduced mobility rather than income losses.

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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Ran Huang & Haixin Wang

Asymmetric tail risk contagion across China's automotive industrial chain: a study based on input–output network

The input-output network of an industrial chain provides a channel for risk transmission. Using Smooth-Transition Vector Autoregression model (STVAR) and Diebold-Yilmaz directional connectedness measures, we explore tail risk (extreme risk) contagion across China's automotive industrial chain. We find significant spillover effects that are asymmetric in different phases of China's business cycle, monetary cycle, and policy uncertainty. When China's economy is in a recession, under a monetary expansion, or at a high level of policy uncertainty, the total risk spillover across the chain is higher. We also find apparent risk spillover from the financial services industries to the automotive industrial chain as China's economy is in a recession or a monetary expansion period. Still, a reverse spillover is found as policy uncertainty is at a high level. Meanwhile, the direction of risk propagation across the automotive industrial chain may change with the transition in the economic state or policy uncertainty state.

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Economic Systems Research

Journal of the IIOA

Volume 36, Issue 2, 2024

Jan Oosterhaven

Price re-interpretations of the basic IO quantity models result in the ultimate input-output equations

This note shows that Leontief's well-known demand-driven input–output (IO) quantity model may also be interpreted as the almost unknown revenue-pull IO price model, but measured in value terms instead of in prices. It is also shown how these two demand-driven models may be combined into a single ultimate demand-driven IO equation. An analogous result holds for the supply-driven quantity model and the cost-push price model, which results in a single ultimate supply-driven IO equation. The new price interpretation of the Leontief quantity model opens up hitherto unused possibilities to simulate interindustry demand-driven inflation processes, just as the price interpretation of the Ghosh quantity model enables simulations of supply-driven inflation processes.

Louis de Mesnard

Input-output price indexes: forgoing the Leontief and Ghosh models

In input-output analysis, the Leontief and Ghosh models can be used to determine the price indexes of goods, which is convenient for analyzing inter-industry inflation. Their respective merits are debated, but both provide the same solution. We demonstrate that, contrary to common belief, it is superfluous to use the Leontief or Ghosh model to calculate price indexes: the price index vector alone satisfies the accounting identities without assuming constant coefficients. So, in contrast to the Leontief and Ghosh models, price indexes can be derived 'instantly', without a round-by-round process. Conducting research on price indexes deduce from the Leontief or Ghosh model becomes pointless: it suffices to study price indexes deduced from the data. We illustrate these findings with an application for France 2018. The same is demonstrated for prices with the data given in physical quantities.

Kurt Kratena

Effective demand, wages and prices, and the multiplier

The calculation of multipliers is the core of impact analysis with input–output (IO) models. Given this focus of IO modeling on the multiplier, it is remarkable that IO analysis has not contributed to the recent macroeconomic debate on fiscal multiplier heterogeneity. This heterogeneity stems from differences in consumption reactions to income shocks and from downward wage rigidity. Both features are absent in most IO models. In this paper, a macroeconomic IO model with a wage function is set up, where at high unemployment rates, downward wage rigidity allows for large real income and multiplier effects. At full employment, demand shocks mainly induce price adjustments. The model reveals GDP multiplier heterogeneity in line with the recent macroeconomic literature, ranging from 0.3 (boom) to 1.4 (recession). The GDP multiplier result of the standard type II model even outperforms the multiplier in the recession case and therefore is most probably biased.

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Aleix Altimiras-Martin

A supply-driven model consuming simultaneously all primary inputs: unfolding analytical potential beyond the Ghosh model

The Ghosh model fails to endogenise the simultaneous consumption of primary inputs and, consequently, is unused. It is argued that this limitation stems from being specified mirroring the Leontief model. In particular, primary inputs are considered homogeneous and independent despite being heterogeneous and (intersectorally) dependent. A new supply-driven model endogenising the consumption of all primary inputs except the one driving the model is developed. It displays new features: structural linearity and structural variability. An input multiplier analysis illustrates that the new model's total requirements matrix represents the actual structure of the economy, overcoming the Ghosh model's 'limitation'. Also, it is exemplified how to use complementary information from the Ghosh model to deepen structural analyses. Thus, this paper solves a long-lasting theoretical inconsistency in IO modelling and unfolds new analytical potential, hopefully rekindling the interest in supply-driven analyses.

Fernando de la Torre Cuevas, Xesús Pereira & Edelmiro López-Iglesias

A new alternative for matrix balancing under conflicting information

Balancing input–output tables using iterative proportional fitting techniques can be prevented due to conflicting information. What is to be done in such cases? Literature suggests a wide variety of alternative methods. Within iterative proportional fitting techniques, modifying the constraint set to circumvent conflicting information problems has been suggested as a promising avenue. Following this approach, we identify some opportunities for improvement not yet been addressed. As a result of this research, we present an iterative proportional fitting variant. Our algorithm uses information contained in the matrix to be balanced for dynamically modifying our constraint set. We ensure economically meaningful solutions, avoiding unsought sign flips. We also respect all macroeconomic aggregates. To illustrate our findings, we provide an empirical example based on the supply-use tables for the region of Galicia (Northwest Spain). Results suggest that our methodological proposal can yield estimates almost as accurate as other alternatives while avoiding undesired outcomes.

Luis Tormo García, Paz Rico Belda, Francisco Morillas Jurado & Bernardí Cabrer-Borrás

A new approach to the hypothetical extraction method: regional full extraction

This paper proposes a generalisation of the regional extraction method used by Dietzenbacher at el. [(1993). The regional extraction method: EC input–output comparisons. Economic System Research, 5(2), 185–206. https://doi.org/10.1080/09535319300000017]. The production system represented by an input–output table is broken down into three flow matrices: intermediate input, final demand, and value added. The approach of Dietzenbacher et al. (1993) focuses on the input matrix to obtain both the backward and forward dependencies. The present paper, offers an alternative approach includes the final demand matrix to calculate the backward dependencies, while the value-added matrix is included for the forward dependencies. These two approaches are then compared by applying them to the empirical data based on the EUREGIO database. The results indicate that the Dietzenbacher et al. approach underestimates the dependencies, and the difference between these two approaches could lead to a different ranking of the dependence of the regions.

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Ana-Isabel Guerra & Ferran Sancho

An extension of the hypothetical extraction method: endogenous consumption and the armington treatment of imports

The hypothetical extraction method (HEM) is the tool of choice for identifying underlying economic interdependencies. It provides critical information to policymakers regarding the strategic role of different sectors. However, the standard implementation of the HEM does not include the impact that falls on the price structure as a result of the substitution between domestic and imported products that takes place after the extraction of a sector or industry, in this case. We propose to overcome this limitation by extending the HEM using an Armington-Leontief model with endogenous consumption. Unlike the perfect substitution assumption typical of the standard HEM, the Armington assumption with endogenous consumption implies that the shift from domestic inputs to imports affects the cost functions. Therefore, both quantities and prices become endogenous in the 'post-extraction' equilibrium. We also argue that HEM indicators should be expanded beyond the typical output-related indicators, i.e. value-added, employment, or pollutant levels, so that summary indices of the type more commonly used in economics, such as welfare indicators, are used. We implement this novel approach using the latest input–output data for Spain in 2016.

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Latest ESR articles

Economic Systems Research

Journal of the IIOA

Latest articles (up to 16 April)

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.

Guomei Zhao, Rui Xie, Bin Su & Qunwei Wang

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

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

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.

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Manuel Alejandro Cardenete, M. Carmen Lima & Ferran Sancho

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

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

Sora Matsushima, Shigemi Kagawa, Keisuke Nansai & Jinjun Xue

A comparison of deflation methods for carbon footprint calculations using Japanese data

An embodied CO_2 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_2 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.

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Highlights in journals

Ya-Fang Sun, Bin Su, Sheng Zhong, Junyi He & Shiwei Yu

Determinants of aggregate embodied carbon intensity in global bilateral exports by firm heterogeneity

Ecological Economics

Reduction of carbon emissions embodied in trade is essential in the context of economic globalization. However, studies have not yet measured the aggregated embodied carbon intensity (AEI) in global bilateral exports from the perspective of heterogeneous ownership firms and its key determinants such as environmental and trade policies. Using the hypothesis extraction method and gravity model, the study examines these issues with the data of domestic and multinational firms from 44 regions throughout the world between 2005 and 2016. The findings indicate the following: (1) The AEI in global bilateral exports of multinational firms generally outperforms domestic firms around the world, with the exception of some European Union member states. (2) Carbon pricing policy can better improve the bilateral AEI of domestic and multinational firms than environmental tax policy. Moreover, compared with multinational firms, carbon pricing policy can better reduce the carbon emissions of domestic firms but bring them much greater economic loss. (3) A common language favors domestic and multinational firms' environmental surplus in global bilateral exports, while a colonial relationship leads to their environmental deficit. (4) Compared with bilateral tariffs policy, improving economic growth is more helpful to reduce the bilateral AEI of domestic and multinational firms.

Srishti Goyal & Maria Llop

The shipping industry under the EU Green Deal: An Input-Output impact analysis

Transportation Research Part A: Policy and Practice

In 2021, the European Commission introduced the 'Fit for 55' package, a set of policies aimed at reducing greenhouse gas (GHG) emissions by at least 55% by the year 2030. This initiative, aligned with the European Green Deal, seeks to make Europe a climate-neutral continent by 2050. A pivotal aspect of 'Fit for 55' is the proposed extension of the European Union Emissions Trading System (EU ETS) to the shipping industry. According to the European Commission, water transport accounts for 2.5% of global GHG emissions, while the shipping industry accounts for 13% of the EU's GHG emissions from transportation. This stringent new shipping policy makes it imperative to determine how the world's economy will respond, considering three distinct implementation proposals with different rates of policy introduction. Evaluating the short-term impacts of the policy is crucial to ensuring that the sustainability initiative is not only ambitious but also pragmatic and adaptable to the realities. To assess the implications, this paper uses the Leontief price model, the environmental input–output (EIO) model, and the OECD Inter-Country Input-Output (ICIO) Table for 2018, which contains information for 45 sectors. The focus is on EU countries and its Top 10 Trading Countries. Our findings show that a short-term trade-off exists between economic and environmental goals and that environmental gains incur economic losses for key stakeholders. They also show that the impact of this policy is felt more by producers in the EU and consumers in non-EU countries than by other agents in the respective countries. Lastly, a recommendation from our study is that the policy should be phased in progressively to provide economic agents with the necessary adjustment time and thus minimize economic losses.

Betty Agnani, Ana-Isabel Guerra & Ferran Sancho

An index of static resilience in interindustry economics

Journal of Economic Structures

We introduce a novel static indicator of economy-wide resilience that assesses an economy's ability to adapt and recover from negative shocks originating from either the demand or supply side. This metric is counterfactual and, through simulation, reveals the extent of adjustments required to maintain total income at or above the initial pre-shock level while preserving the initial economic structure. The larger the scale of adjustments needed in response to the shock, the lower the resilience of the economic system. The methodology we propose for this assessment relies on the concept of constrained input–output multipliers embedded within a linear programming problem. We demonstrate the applicability of our approach by calculating and comparing demand and supply resilience indices for a group of ten large OECD economies. In all these economies, the results indicate that manufacturing industries exhibit higher resilience to demand shocks than service sectors and that economic resilience regarding negative supply shocks is higher than that of demand shocks.

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Shuping Li, Jing Meng, Klaus Hubacek, Shaikh M. S. U. Eskander, Yuan Li, Peipei Chen & Dabo Guan

Revisiting Copenhagen climate mitigation targets

Nature Climate Change

Many economies set climate mitigation targets for 2020 at the 2009 15th Conference of the Parties conference of the United Nations Framework Convention on Climate Change in Copenhagen. Yet no retrospective review of the implementation and actual mitigation associated with these targets has materialized. Here we track the national CO2 emissions from both territory and consumption (trade adjusted) perspectives to assess socioeconomic factors affecting changes in emissions. Among the 34 countries analysed, 12 failed to meet their targets (among them Portugal, Spain and Japan) and 7 achieved the target for territorial emissions, albeit with carbon leakage through international trade to meet domestic demand while increasing emissions in other countries. Key factors in meeting targets were intensity reduction of energy and the improvement of the energy mix. However, many countries efforts fell short of their latest nationally determined contributions. Timely tracking and review of mitigation efforts are critical for meeting the Paris Agreement targets.

Ananya Ajatasatru, Vishnu Prabhu, Barun Deb Pal & Kakali Mukhopadhyay

Economy-wide impact of climate smart agriculture in India: a SAM framework

Journal of Economic Structures

In the context of climate change, the Indian agricultural sector treads in a certain duality between promoting food security in response to the increasing population, but at the same time in ensuring environmental sustainability, and sustained economic growth, especially in developing countries like India. The concept of Climate Smart Agriculture (CSA) emerged from the recognition of this duality. Using the Indian Social Accounting Matrix (SAM) 2017–18, the economy-wide effects arising out of agricultural interventions were estimated, keeping accord with the impacts on sectoral outputs and household incomes from the adoption of varying CSA interventions such as Conservation Agriculture, System of Rice and Wheat Intensification (SRI-SWI) and Natural Farming, fitting the three-pillared criterion of CSA—(1) Productivity (2) Adaptation and (3) Mitigation. Additionally, a shift in cropping patterns from Paddy and Wheat to less emission-intensive crops was also studied. Results show that SRI-SWI provides the highest economy-wide impacts while accounting for lower GHG and water footprint. Alternative crops such as Maize, Sorghum, and Millet have minimal increase in income and output effects while having lower water and carbon intensity compared to rice and wheat. The current study would sensitize policymakers to prioritize suitable policy and institutional measures for upscaling climate smart interventions in India.

Luiz Carlos de Santana Ribeiro, Eder Johnson de Area Leão Pereira, Roberto Luiz Souza Monteiro, Valter de Senna, Amir Borges Ferreira Neto & Hernane Borges de Barros Pereira

Assessing Productive Structures in Brazil With Dynamic Time Varying Graphs

International Regional Science Review

This paper uses time varying graphs to evaluate the Brazilian production structures, assessing the relationship across economic sectors overtime given important macroeconomic shocks in the country. We use the annual Brazilian input-output matrices from the World Input–Output Database for the period 1995–2011. Our results show possible positive impacts of macroeconomic policies and higher commodity prices on increased network connectivity between 2002 and 2003, the negative influence of the 2008 crisis resulting in decreased network connectivity, and the intensification of the connectivity of the food, petrochemical and metals, and machinery sectors. These results provide insights on how potential macroeconomic exogenous shocks and policies propagates through the national production structure.

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Kailan Tian, Zhuoying Zhang, Lingxiu Zhu, Cuihong Yang, Jianwu He & Shantong Li

Economic exposure to regional value chain disruptions: evidence from Wuhan's lockdown in China

Regional Studies

Production fragmentation across multiple regions can result in a regional shock propagating along value chains to a wider array of regions. We propose a methodological framework to measure the economic exposure to regional value chain disruptions due to city lockdown during Covid-19. The exposure index is evaluated by applying a hypothetical extraction method to a regionally extended inter-country input–output framework incorporating China's interregional input–output table. Our methodology can be adapted to conduct disaster impact analyses at city, state and country levels. It provides a tool for the immediate assessment of the economic risks of value chain disruptions, enabling quick policy responses.

Nikolaos Rodousakis, Giuliano Toshiro Yajima & George Soklis

The Economic and Environmental Effects of a Green Employer of Last Resort: A Sectoral Multiplier Analysis for the United States

International Journal of Political Economy

We assess the sectoral impact of the implementation of a "green" employer of last resort (ELR) program in the US, based on an environmental modification of an extended Kurz's (1985) multiplier framework and data from OECD Input-Output tables. We use these multipliers to estimate the impact of an "optimal" ELR, designed to maximize the impact on both output and employment while minimizing both imports and carbon emissions. We then test several alternative policy scenarios based upon different compositions of US government expenditure. We provide evidence that (1) investing in the optimal sectors in terms of output, employment, CO2, and import multipliers does not always deliver optimal results in the aggregate; (2) ecological sustainability for the US economy also fosters import sustainability; (3) a rebounding effect in CO2 emissions may be tamed if the ELR satisfies the abovementioned optimality condition, though this undermines its success in terms of output and employment.

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Leveraging opportunity of low carbon transition by super-emitter cities in China

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Chinese cities are core in the national carbon mitigation and largely affect global decarbonisation initiatives, yet disparities between cities challenge country-wide progress. Low-carbon transition should preferably lead to a convergence of both equity and mitigation targets among cities. Inter-city supply chains that link the production and consumption of cities are a factor in shaping inequality and mitigation but less considered aggregately. Here, we modelled supply chains of 309 Chinese cities for 2012 to quantify carbon footprint inequality, as well as explored a leverage opportunity to achieve an inclusive low-carbon transition. We revealed significant carbon inequalities: the 10 richest cities in China have per capita carbon footprints comparable to the US level, while half of the Chinese cities sit below the global average. Inter-city supply chains in China, which are associated with 80% of carbon emissions, imply substantial carbon leakage risks and also contribute to socioeconomic disparities. However, the significant carbon inequality implies a leveraging opportunity that substantial mitigation can be achieved by 32 super-emitting cities. If the super-emitting cities adopt their differentiated mitigation pathway based on affluence, industrial structure, and role of supply chains, up to 1.4 Gt carbon quota can be created, raising 30% of the projected carbon quota to carbon peak. The additional carbon quota allows the average living standard of the other 60% of Chinese people to reach an upper-middle-income level, highlighting collaborative mechanism at the city level has a great potential to lead to a convergence of both equity and mitigation targets.