Input-Output 2010

18th International Input-Output Conference
20-25 June 2010 • Sydney Australia

Conference Book

Left: Sydney Harbour Bridge during the September 2009 dust storm

Right: Aerial view of Broken Bay, directly north of Sydney

WELCOME MESSAGE

On behalf of the University of Sydney, I welcome you to the 18th International Conference on Input-Output Economics to be held in Sydney from 20-25 June 2010.

The theme of this conference will be "Re-thinking economic growth towards sustainability and wellbeing"; it reflects important concerns that many people harboured throughout the past few years, but also reflects a major challenge we are facing: To avert dangerous environmental change whilst being able to ensure well-being for the world's people.

Input-output techniques have proven extremely versatile and powerful tools for decision-makers. In particular, environmental applications of input-output models have enjoyed enormous popularity in recent years. However, we still have a lot to do in making input-output tools more widely known across non-expert circles, and remove barriers to the development of understanding and appreciation of, and trust in the results that input-output models provide.

This conference provides great opportunities. To the researcher, it brings an environment in which exciting new ideas can be aired and discussed. For the practitioner, it provides a forum in which the strengths of our input-output technique can be demonstrated to people searching for solutions to their problems. For students, it is perhaps the best opportunity to get to know well-known academics, and look for exchange programmes and scholarships. For members of the corporate and governance worlds, it may even represent a hunting ground from which to pluck young bright talents.

I invite you to read our attractive programme, register your participation, and experience for yourself the friendly and stimulating atmosphere that is so typical of every input-output conference.

I also invite you to take the opportunity of your visit to look beyond the conference. The University of Sydney is Australia's first university, and features a beautiful campus as well as world-class research and education. The city of Sydney with its blue shining harbour and golden beaches is a true jewel that one should see once in a lifetime. And why not spend a few more weeks and travel around the amazing Australian continent that is home to unique wonders one cannot experience anywhere else.

I look forward to seeing you in Sydney in 2010.

Manfred Lenzen
Professor of Sustainability Research
Chair of the Local Organising Committee

THE HOST TEAM

THE VENUE

THE UNIVERSITY OF SYDNEY

SCHOOL OF PHYSICS

www.isa.org.usyd.edu.au

www.physics.usyd.edu.au

THE PRINCIPAL SPONSOR

Australian Bureau of Statistics

www.abs.gov.au

THE OFFICIAL TRAVEL AND CONFERENCE ORGANISER

the EVENTS AUTHORITY
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A member of the Travel Authority Group

www.theeventsauthority.com.au

OUR ASSOCIATION

www.iioa.org

OUR JOURNAL

Economic Systems Research

Economics Systems Research

The 18th International Input-Output Conference in Sydney took more than 2 years to organise, starting from the initial bid to the International input-output Association (IIOA), to finally putting in place all procedures required for a successful event.

This conference would not have happened without the support of volunteers in the Local Organising Committee (LOC), and members of the Scientific Program Committee (SPC). On behalf of the LOC and SPC Chairs, the IIOA and all conference delegates, a heartfelt thank-you to a dedicated and effective team!

Local Organising Committee

Chair: Manfred Lenzen

Acting Chairs: Jodie Gonzalez Jennings and Elaine Fillie

Committee members:

Christopher Dey
Winton Evers
Lachlan Feggans
Barney Foran
Alejandro García
Arne Geschke
Bonnie McBain
Daniel Moran
Joy Murray
Shelly Page
Marguerite Pettit
Fabian Sack

For your assistance, local committee members will be recognisable at the conference in a white shirt with the main conference logo printed on the back.

The members of the Scientific Program Committee are listed in the Book of Abstracts.

With many thanks

Printing for the conference provided by Fuji Xerox Australia on responsibly procured paper.

The LOC is also very grateful for the support of Winton Evers:

OUR PRINCIPAL SPONSOR

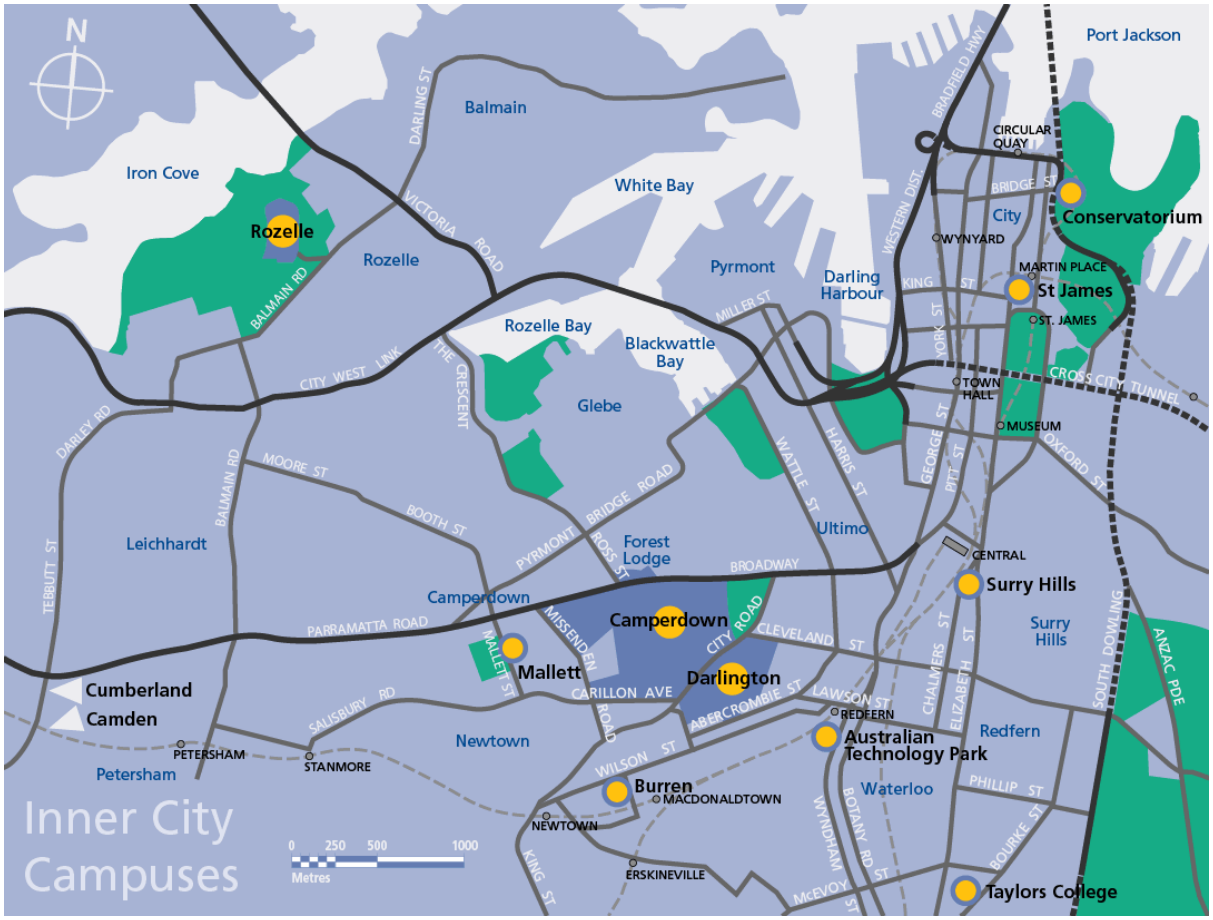
Australian Bureau of Statistics

www.abs.gov.au

The Australian Bureau of Statistics (ABS) is Australia's official statistical organisation and is committed to assisting and encouraging informed decision-making, research and discussion within governments, business and the community. The ABS strives to remain relevant to national needs by collecting the right sort of data, processing it to world-leading standards and delivering information solutions to our many clients. The ABS produces a broad range of social and economic statistics including Input-Output tables for Australia which are part of the Australian national accounts, complementing the quarterly and annual series of national income, expenditure and product aggregates.

The Australian IO Tables provide detailed information about the supply and use of products in the Australian economy and about the structure of and inter-relationships between Australian industries. With the release of the 2005-06 IO Tables the ABS has completed 21 input-output tables for Australia with the first set of tables produced for 1958-59. The ABS now produces the IO tables on an annual basis with a release date approximately three years after the reference period. The 2006-07 IO tables for Australia are expected to be released in November 2010 and will be the first set of tables to incorporate changes to the System of National Accounts (SNA08) and a new industry classification (ANZSIC06).

ABS House in Canberra, Australia's Capital City



The University of Sydney **Camperdown campus** is located south of the centre of Sydney, wedged between Broadway and City Road. It can be reached from central Station by foot (15 min), and from the city hotels by numerous bus lines, and of course taxi.

Input-Output 2010 | Australian Bureau of Statistics | The University of Sydney | The Events Authority

18th International Input-Output Conference

20-25 June 2010 • Sydney Australia

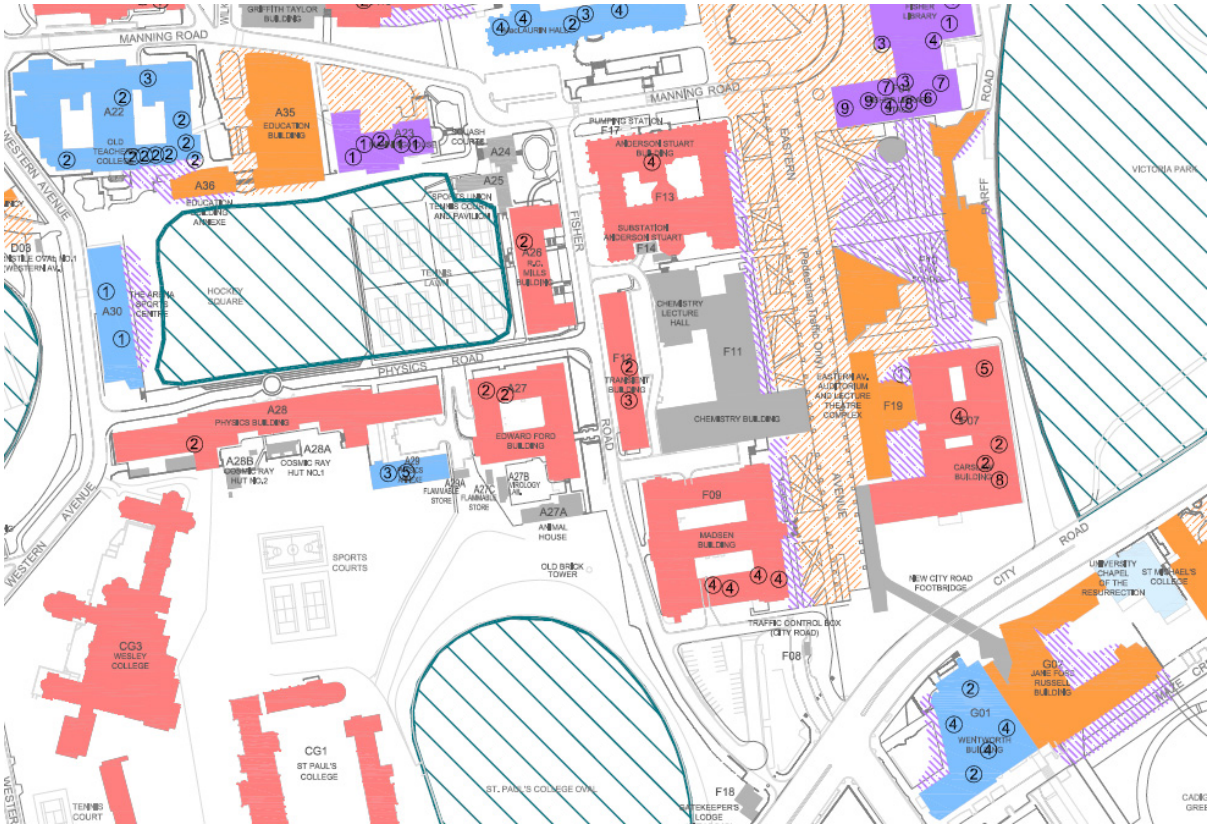
The **School of Physics** is located right in the centre of the University campus referenced on the gird **(G5).** The **Plenaries** will take place at the **Eastern Avenue Lecture Theatre (K5).** Coffee breaks and lunch are at **Manning House (H4).**

Guest Wireless Internet Access

The University wireless network will be accessible during the conference (see coverage on next page):

- Choose USyd Guest on your wireless networks
- Username: inputoutput
- Password: conf2010

Wireless Network Coverage on Central Campus



Indoor Coverage	Outdoor Coverage
100% Indoor Coverage	Good - Excellent Outdoor Coverage
<100% >70% Indoor Coverage	Fair - Good Outdoor Coverage
<70% >30% Indoor Coverage	Non University Building
<30% Indoor Coverage	
Building Not Covered	
	③ Wireless Hot spot (Number indicates floor)

The Welcome Reception and conference registration will take place Sunday 20 June, 17:00 – 20:00, in the Town Hall Room, Level 2, Mercure Hotel, 818-820 George Street. There will only be limited opportunity for late registrations Monday morning 08:30 – 09:00 before the Opening Ceremony.

Mercure

SYDNEY

ACCOR Hospitality

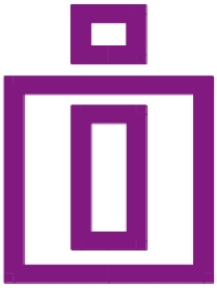
Input-Output 2010

18th International Input-Output Conference
20-25 June 2010 - Sidney Australia

18th International Input-Output Conference

CONFERENCE PROGRAM

20/Jun/2010 - 25/Jun/2010



International Input-Output Association
Vienna, AUSTRIA
www.iioa.org

PROGRAM OVERVIEW

Time	Sun, 20/Jun/2010	Mon, 21/Jun/2010	Tue, 22/Jun/2010	Wed, 23/Jun/2010	Thu, 24/Jun/2010	Fri, 25/Jun/2010
08:30 - 09:00		Late registrations only				
09:00 - 09:30		Opening Ceremony and Welcome to Country	Parallel Session 4	Special sessions organized by the Australian Bureau of Statistics / Teaching sessions II	Parallel Session 5	Parallel Session 6
09:30 - 10:00		Plenary Session 1				
10:00 - 10:30						
10:30 - 11:00		Coffee Break	Coffee Break	Morning Tea	Coffee Break	Coffee Break
11:00 - 11:30		Parallel Session 1	Plenary Session 2	Special sessions organized by the Australian Bureau of Statistics / Special session for young scholars	Plenary session 3: Leontief Prize 2010	Parallel Session 7
11:30 - 12:00						
12:00 - 12:30						
12:30 - 13:00		Lunch	Lunch		Lunch	Lunch
13:00 - 13:30						
13:30 - 14:00						
14:00 - 14:30		Parallel Session 2	Teaching Sessions I	Half-day Excursion	Teaching Sessions III	Plenary Session 4
14:30 - 15:00						
15:00 - 15:30						
15:30 - 16:00		Coffee Break	Coffee Break		Coffee Break	New release of a Guide Book on Input-Output
16:00 - 16:30		Parallel Session 3	ESR Editorial Board (invitation only)		General Assembly (all IIOA members)	Closing Ceremony and Aboriginal Story Telling
16:30 - 17:00						
17:00 - 17:30	Welcome Reception and Registration					
17:30 - 18:00		Council Meeting (invitation only)				
18:00 - 18:30						
18:30 - 19:00				Conference Dinner		
19:00 - 19:30						
19:30 - 20:00						
20:00 - 20:30						
20:30 - 21:00						
21:00 - 21:30						
21:30 - 22:00						
22:00 - 22:30						
22:30 - 23:00						

SESSION PLAN

Sun, 20/Jun/2010

17:00 - 20:00 *Welcome Reception and Registration*

Mon, 21/Jun/2010

08:30 - 09:00 *Late registrations only*

09:00 - 09:30 *Opening Ceremony and Welcome to Country*
Eastern Avenue Lecture Theatre
Geoffrey J. D. Hewings (President of the IIOA),
José M. Rueda-Cantuche (Chair of the SPC),
Klaus Hubacek (Co-chair of the SPC),
Manfred Lenzen (Chair of the LOC),
Jodie González Jennings (Co-chair of the LOC)

09:30 - 10:30 Plenary Session 1

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **Sustainability in Economics**
  Chair: Joerg Beutel

1. Is there entropy in an economy? Revisiting an early concept of sustainability introduced by Nicholas Georgescu-Roegen
   by *Utz Peter Reich*

10:30 - 11:00 *Coffee Break*

11:00 - 12:30 Parallel Session 1

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **World Input-Output Database I: Contruction issues**
  Chair: Erik Dietzenbacher

1. Joint Estimation of Supply and Use Tables
   by *Umed Temurshoev, Marcel P. Timmer*

2. An Empirical Evaluation of Methods to Estimate Use Tables of Imports
   by *Bart Los*

3. The construction of input-output tables and the use of supply-use tables in input-output analyses: a review
   by *José Manuel Rueda-Cantuche, Joerg Beutel*

- Location: **Lecture Theatre 1, School of Physics**
  Topic: **CGE and econometric input-output modeling**
  Chair: Jakub Boratynski

  1. An AGE assessment of external and domestic shocks in Spain
     by *Maria Teresa Alvarez-Martinez, Clemente Polo Andrés*

  2. Developments in the use of Mathematica for Computable General Equilibrium analysis
     by *Stuart John Nettleton*

  3. Sensitivity analysis in the inter-temporal CGE model framework
     by *Jakub Boratynski*

- Location: **Lecture Theatre 2, School of Physics**
  Topic: **Environmentally extended input-output analysis**
  Chair: Cuihong Yang

  1. A complete overview of environmental input-output articles
     by *Rutger Hoekstra*

  2. Environmentally Extended Input-Output Analysis of the UK Economy: Multicriteria Approach
     by *Stanislav Edward Shmelev*

  3. Study on China's Energy-Economy-Environment System Based on Sustainable Economic Growth
     by *Yan Xia, Cuihong Yang, Xikang Chen*

- Location: **Lecture Theatre 5, School of Physics**
  Topic: **Enterprise input-output approach, environment issues and policy making I**
  Chair: Vito Albino

  1. Constructing Joint Production Chains: An Enterprise Input-Output Approach
     by *Devrim Murat Yazan*

  2. The Design and Coordination of Joint Production Chains Incorporating Waste Recycling
     by *Devrim Murat Yazan, Dirk Pieter van Donk, Erik Dietzenbacher*

  3. Cooperation in reverse supply chains: environmental and economic impacts of actor decisions
     by *Vito Albino, Rosa Maria Dangelico, Devrim Murat Yazan*

- Location: **Room 414, School of Physics**
  Topic: **Input-output applied to social issues I**
  Chair: Susana Santos

  1. Urbanicity and rurality - Islands economies, social accounting within sub-municipality framework
     by *Bjarne Madsen*

2. Social Equity versus the Environment Dilemma: Evaluating the GHG Impact of Poverty Alleviation in India
   by *Kazushige Shimpo, Amrita Goldar, Jaya Bhanot*

3. A quantitative approach to the effects of social policy measures. Application to Portugal, using Social Accounting Matrices.
   by *Susana Santos*

- Location: **Slade Lecture Theatre, School of Physics**
  Topic: **Productivity and efficiency I**
  Chair: Thijs ten Raa

1. A theory for measuring productivity change in the system with fixed capital
   by *Takashi Yagi*

2. Liberalization and Productivity Growth in Nepal: A case of FDI firms
   by *Raghu Bista*

3. Benchmarking of Sectoral Productivity Changes in Iran
   by *Fatemeh Bazzazan*

4. Benchmarking and Industry Performance
   by *Thijs ten Raa*

12:30 - 14:00 *Lunch*

14:00 - 15:30 Parallel Session 2

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **World Input-Output Database II: Methods and applications**
  Chair: Bart Los

1. The Choice of Type of Input-Output Table Revisited: Moving Towards the Use of Supply-Use Tables in Impact Analysis
   by *José Manuel Rueda-Cantuche, Joerg Beutel*

2. A Preliminary Series of Worldwide Intercountry Input-Output Tables
   by *Bart Los, Robert Stehrer*

- Location: **Lecture Theatre 1, School of Physics**
  Topic: **Energy input-output analyis I**
  Chair: Kakaly Mukhopadhyay

1. Analyzing Impacts of Fuel Constraints on Freight Transport and Economy of New Zealand: an Input-Output Analysis
   by *Aline Eloyse Lang, Andre Dantas*

2. Assessing the Potential Sudden Reduction of the Supply of Oil and Gas on the Different Sectors of the Iranian Economy
   by *Ali Asghar Banouei, Jillian Banouei, Mehdi Karami, Seyed Iman Azad*

3. Macroeconomic impacts of the bio-fuel sector in Canada
   by *Kakali Mukhopadhyay, P. Thomassin*

- Location: **Lecture Theatre 2, School of Physics**
  Topic: **Input-output applied to social issues II**
  Chair: Cristela Goce Dakila

1. A non-linear input-output model for measuring the employment effect of changes in final demand: an approach based on the employment elasticity
   by *Bin Wang, Jian Xu*

2. Evaluating Chinese Household Consumption Potential, Their Export Replacement Capacity and Pulling Effect on Chinese Economic System amid the 2008 World Financial Crisis
   by *Xiuli Liu*

3. Welfare Effects of Regional Transport Infrastructure Improvement in a Developing Economy : SCGE Approach
   by *Cristela Goce Dakila*

- Location: **Lecture Theatre 5, School of Physics**
  Topic: **Sector specific analyses: manufacturing**
  Chair: Yuan Jianwen

1. The Effects of Nanotechnology Implementation on Production Costs and Employment: An Input-Output Simulation
   by *Nooraddin Sharify, Abdolreza Sharifi, Fatemeh Sharify*

2. The industry similarity in input-output system of China in 1981-1995: Application of dual scaling and fuzzy clustering
   by *Xue Fu*

3. Market Access, Supply Access and Geographic Concentration of Manufactures in China: A Interregional Input-output Approach
   by *Zhao Zhao, Shi Minjun, Jing Yang*

- Location: **Room 414, School of Physics**
  Topic: **Historical perspective of input-output analysis**
  Chair: Fidel Aroche

1. Recent controversies in neoclassical modelling and developments in Evidence-Driven Policy
   by *Stuart John Nettleton*

2. Wassily Leontief's The Structure of the American Economy. The early reactions: 1940-1950
   by *Fidel Aroche*

- Location: **Slade Lecture Theatre, School of Physics**
  Topic: **Environmantal Life Cycle Assessment analyses**
  Chair: Thomas O. Wiedmann

1. Technology Scenarios, Economic Modeling and Life-Cycle Inventories
   by *Richard Wood, Edgar Hertwich*

2. A Construction of Energy Input-Output Tables based on a Life Cycle Approach: A Case Study of Korea Transportation Economy
   by *Phirada Pruitichaiwiboon, Kim Yong-Ki, Lee Cheul-Kyu, Lee Kun-Mo*

3. Hybrid LCA of a new technology for design of disassembly based on smart materials
   by *Shinichiro Nakamura, Eiji Yamasue*

4. Hybrid methods for incorporating changes in energy technologies in an input-output framework
   by *Thomas Oliver Wiedmann, John Barrett, Kuishuang Feng, Manfred Lenzen*

15:30 - 16:00 *Coffee Break*

16:00 - 17:30 Parallel Session 3

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **Asia beyond the crisis: visions from international input-output analysis**
  Chair: Satoshi Inomata

1. Impact of the Global Economic Crisis on Employment in the Asia-Pacific Region
   by *Bo Meng, Satoshi Inomata*

2. How much will the Shock get alleviated? –The evaluation of China's counter-crisis fiscal expansion –
   by *Nobuhiro Okamoto*

3. The oil and gas sector in Russian Supply and Use Tables
   by *Natalia Ustinova*

- Location: **Lecture Theatre 1, School of Physics**
  Topic: **Input-output studies on tourism issues I**
  Chair: Albert E. Steenge

1. Experiences in estimating the macroeconomic impact of mega tourism events – the case of hosting the FIFA Football Word Cup Germany 2006
   by *Gerd Ahlert, Holger Preuss*

2. Structural changes in the Balearic Islands
   by *Clemente Andrés Polo, Elisabeth Valle*

3. An Economic Analysis of the Mekong Tourism Brand in the Economic Corridors of the Greater Mekong Subregion: A Case Study of Lao PDR
   by *Bhoj Khanal*

- Location: **Lecture Theatre 2, School of Physics**
  Topic: **Physical input-output tables**
  Chair: Makiko Tsukui

1. Technical choice problem of wastewater treatment input output model
   by *Chen Lin*

2. The impact and effects of modal shift of waste transportation by IR-WIO (interregional waste input-output) analysis
   by *Makiko Tsukui, Keisuke Nakamura*

- Location: **Lecture Theatre 5, School of Physics**
  Topic: **National Economic and Environmental Accounts**
  Chair: Paola Anna Antonello

1. Green Growth Accounting with Combined Use of Hybrid Input-Output Tables and Supply - Use Matrix
   by *Hak K. Pyo, Dong Koo Kim, Keun Hee Rhee*

2. Russian and Regional Input-Output Tables
   by *Alsu Sayapova*

3. An optimisation approach for updating product data in supply and use tables
   by *Jeroen Kole*

4. Estimation and balancing of constant-price quarterly I-O tables with autoregressive conditional heteroskedastic errors
   by *Paola Anna Antonello*

- Location: **Room 414, School of Physics**
  Topic: **Sector specific analyses: services I**
  Chair: Xuemei Jiang

1. Building the Future: An analysis of the Change in Carbon Emissions from Adopting Building Codes
   by *Kartik Krishna Ganju, Gaurav Taneja, Hina Zia, Kazushige Shimpo*

2. Study on Modern Service Industry of Guangdong Province Based on Input-output Analysis
   by *Jianwen Yuan*

3. Accounting for Differences in ICT-Specialization across China: a New Aspect of Spatial Structral Decomposition
   by *Xuemei Jiang, Bart Los, Erik Dietzenbacher*

- Location: **Slade Lecture Theatre, School of Physics**
  Topic: **International trade and environment**
  Chair: Bruce Yabsley

1. Greenhouse Gas Emissions Embodied in New Zealand's Trade
   by *Robbie Andrew, James Lennox, Glen P. Peters*

2. A time series of global carbon footprints at high country and sector detail
   by *Keiichiro Kanemoto, Arne Geschke, Daniel Moran, Julien Ugon, Keiichiro Kanemoto, Manfred Lenzen, Pablo Munoz, Ting Yu*

3. A global multi-region input-output time series at high country and sector detail
   by *Manfred Lenzen, Arne Geschke, Daniel Moran, Julien Ugon, Keiichiro Kanemoto, Pablo Munoz, Richard Wood, Ting Yu*

17:30 - 19:30 *Council Meeting (invitation only)*
Lecture Theatre 4, School of Physics

Tue, 22/Jun/2010

09:00 - 10:30 Parallel Session 4

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **EXIOPOL: Latest progress and preliminary results of work on a global, detailed MR EE SUT/IOT database**
  Chair: Arnold Tukker

1. EXIOPOL: Philosophy and Main Approach
   by *Arnold Tukker*

2. Generic methods for estimating input-output models under partial information
   by *Richard Wood*

3. Consumption-based environmental accounting of CO2 emissions and water use in a multi-regional input-output framework
   by *Maaike Corinne Bouwmeester, Jan Oosterhaven*

4. Introducing Physical Constraints into Economic Models
   by *Faye Duchin, Stephan Lutter, Nathaniel Springer, Stefan Giljum*

- Location: **Lecture Theatre 1, School of Physics**
  Topic: **Multipliers and income distribution**
  Chair: Albert E. Steenge

  1. Calculating wage-profit frontiers and supporting prices in Leontief-Sraffa models
     by *Albert Steenge, Mònica Serrano*

  2. Endogenous explanation of activities' levels and the exploding multiplier
     by *Albert Steenge*

  3. Towards a New Economic Geography based Estimate of Cross-Hauling in Regional Supply and Use Tables
     by *Mark Thissen, Dario Diodato*

- Location: **Lecture Theatre 2, School of Physics**
  Topic: **Multirregional input-output modelling**
  Chair: Bjarne Madsen

  1. Towards multiproducts production model: analysis from harmonized multinational supply and use database
     by *Norihiko Yamano*

  2. A trilateral input-output table for North America
     by *Fidel Aroche, Marco Antonio Marquez Mendoza*

  3. Physical input-output tables: developments and future
     by *Rutger Hoekstra*

  4. Uncertainty and sensitivity analysis in MRIO modelling – some empirical results with regard to the carbon footprint of the Netherlands
     by *Harry C Wilting*

  5. The general interregional quantity model - multiplier experiments with a sub-regional model for Denmark
     by *Bjarne Madsen*

- Location: **Lecture Theatre 5, School of Physics**
  Topic: **Final demand in input-output analysis**
  Chair: Rutger Hoekstra

  1. Partially endogenized consumption: a new method to incorporate the household sector into input-output models
     by *Quanrun Chen, Bart Los, Cuihong Yang, Erik Dietzenbacher*

  2. Attribution of GDP and Imports to Final Demand Components for Germany
     by *Liane Ritter*

  3. Attributing GDP growth to final demand categories
     by *Rutger Hoekstra, Ruben van der Helm*

- Location: **Room 414, School of Physics**
  Topic: **Sector specific analyses: services II**
  Chair: Martin Soeren Lindner

  1. Quantitative Analysis of Services & Sub- Service Sectors in the Iranian Economy
     by *Seyed Iman Azad, Ali Asghar Banouei, Narges Moradkhani*

  2. Application of the Input-Output Model to the Analysis of the Economic Impacts of Transport Infrastructure Investment in Australia
     by *Jian Wang, Michael B. Charles*

  3. Measuring Embodied Emission Flows for the Interdependent Economies within China
     by *Martin Soeren Lindner, Dabo Guan, Klaus Hubacek*

- Location: **Slade Lecture Theatre, School of Physics**
  Topic: **Productivity and efficiency II**
  Chair: Antonio F. Amores

  1. Invention, Entrepreneurship and Prosperity: The Dutch Golden Age
     by *Thijs ten Raa, Bas van Leeuwen, Jan Luiten van Zanden, Pierre Mohnen*

  2. Impact of trade liberalization on productivity growth of manufacturing sector: evidence from a non-parametric approach with Indian data
     by *Arpita Ghose, Paramita Roy Biswas*

  3. Three way decomposition of the Efficiency of Andalusian Economy
     by *Antonio F. Amores, Thijs ten Raa*

10:30 - 11:00 *Coffee Break*

11:00 - 12:30 Plenary Session 2

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **Asia beyond the crisis**
  Chair: Cuihong Yang

  1. Asia beyond the Crisis: visions from international input-output analyses
     by *Satoshi Inomata*

12:30 - 14:00 *Lunch*

14:00 - 15:30 Teaching Sessions I

- Location: **Lecture Theatre 1, School of Physics**
  Topic: **Supply and Use Tables and links to Symmetric Input-Output Tables (session organized by the Input-Output Statistics Group of the IIOA)**
  Chair: Sanjiv Mahajan

  1. Teaching Session 1: Supply and Use Tables and links to Symmetric Input-Output Tables
     by *Sanjiv Mahajan*

- Location: **Lecture Theatre 2, School of Physics**
  Topic: **Linear programming in input-output analysis**
  Chair: Thijs ten Raa

  1. Teaching Session 1: Linear programming in input-output analysis
     by *Thijs ten Raa*

- Location: **Lecture Theatre 5, School of Physics**
  Topic: **SimSIP SAM**
  Chair: Juan Carlos Parra

  1. Teaching Session 1: SimSIP SAM
     by *Juan Carlos Parra*

15:30 - 16:00 *Coffee Break*

16:00 - 17:30 *ESR Editorial Board (invitation only)*
Lecture Theatre 4, School of Physics

Wed, 23/Jun/2010

09:00 - 10:30 Special sessions organized by the Australian Bureau of Statistics / Teaching sessions II

- Location: **Lecture Theatre 1, School of Physics**
  Topic: **Supply and Use Tables and links to Symmetric Input-Output Tables (session organized by the Input-Output Statistics Group of the IIOA)**
  Chair: Sanjiv Mahajan

  1. Teaching Session 2: Supply and Use Tables and links to Symmetric Input-Output Tables
     by *Sanjiv Mahajan*

- Location: **Lecture Theatre 2, School of Physics**
  Topic: **Linear Programming in Input-Output Analysis**
  Chair: Thijs ten Raa

  1. Teaching Session 2: Linear programming in input-output analysis
     by *Thijs ten Raa*

- Location: **Lecture Theatre 5, School of Physics**
  Topic: **SimSIP SAM**
  Chair: Juan Carlos Parra

  1. Teaching Session 2: SimSIP SAM
     by *Juan Carlos Parra*

- Location: **Slade Lecture Theatre, School of Physics**
  Topic: **Australian Bureau of Statistics Special Session I**
  Chair: Branko Vitas

  1. The compilation of the Australian input-output tables
     by *Ross Alexander, Terry McGrath*

  2. GHG emissions embodied in international trade (intercountry-interindustry framework)
     by *Norihiko Yamano*

  3. CO2 emissions embodied in the Australian international trade in goods
     by *Gregory Legoff*

10:30 - 11:00 *Morning Tea*
Manning Building

11:00 - 12:30 Special sessions organized by the Australian Bureau of Statistics / Special session for young scholars

- Location: **Slade Lecture Theatre, School of Physics**
  Topic: **Australian Bureau of Statistics Special Session II**
  Chair: Branko Vitas

  1. Use of input-output tables in assessing national economic reform - Australian Productivity Commission experience
     by *Paul Gretton*

  2. Indian development paths and long run impacts on Australia
     by *Tom Skladzien*

14:00 - 17:00 *Half-day Excursion*

18:30 - 23:00 *Conference Dinner*
Nomination of new IIOA Fellows: Geoffrey J. D. Hewings (University of Illinois, US) and Chen Xikang (Chinese Academy of Sciences, China)

Thu, 24/Jun/2010

09:00 - 10:30 Parallel Session 5

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **Supply-use tables and National Accounts (Special session organized by the IOSG-IIOA)**
  Chair: Jiemin Guo

  1. Emissions Embodied in Danish Import. An Unidirectional Trade Model With 51 Countries.
     by *Peter Rørmose Jensen, Thomas Olsen, Dennis Hansen*

  2. R&D and Other Intangible Assets in an Input-Output Framework: A First look with U.S. Data
     by *Carol A Robbins, Mary Streitwieser, Robert Corea, William Joliff*

  3. Using an Input-Output Framework for Double-Deflated Quarterly U.S. Gross Domestic Product by Industry: Methods, Initial Results, and Future Plans
     by *Brian C Moyer, Carol A. Robbins, Thomas F. Howells III*

- Location: **Lecture Theatre 1, School of Physics**
  Topic: **Energy input-output analysis II**
  Chair: M. Alejandro Cardenete

  1. Changing Gross Output Elasticities in the Energy Sector: A Comparative Study in the Economies of India and Pakistan in the I-O Framework
     by *Dipti Prakas Pal, Swati Pal*

  2. Effect of Changing Energy Prices on Household Expenditure with Emphasis on Industry and Transportation: Preliminary Evidence from Malaysia
     by *Narges Moradkhani, Anuuar Md Nassir, Taufiq Hassan, Zakariah Abd Rashid*

  3. Environmental impacts of generating electricity by substituting lignite with photovoltaic technology. An analysis based on a NAMEA-table for the Greek economy.
     by *Charalampos Economidis, Anastasia Basina, Athanasios Sfetsos*

  4. Energy intensities and CO2 emissions in a SAM model of the Andalusian economy
     by *Patricia D. Fuentes Saguar, Clemente Polo Andrés, M. Alejandro Cardenete*

- Location: **Lecture Theatre 2, School of Physics**
  Topic: **Economy-wide impacts and forecasts**
  Chair: Mohd Yusof Saari

  1. Effective Full Time Employment for Location Quotients – A Proposal
     by *Julianne Christie, Maria Varua*

  2. Models for the correction of input-output forecasts: experiments with Sri Lankan input-output data
     by *Arpita Ghose, Debesh Chakraborty, Partha Pratim Ghosh*

  3. Economy-wide impacts of higher energy prices on household cost of living: an extended SAM price model
     by *Mohd Yusof Saari, Bart Los, Erik Dietzenbacher*

- Location: **Lecture Theatre 5, School of Physics**
  Topic: **Crisis and disaster analyses**
  Chair: Yasuhide Okuyama

  1. How Much Does the International Financial Crisis Affect China's GDP and Employment?
     by *Huijuan Wang, Cuihong Yang, Xikang Chen*

  2. Globalization and Localization of Disaster Impact: An Empirical Examination
     by *Yasuhide Okuyama*

- Location: **Slade Lecture Theatre, School of Physics**
  Topic: **Supply chains**
  Chair: Shigemi Kagawa

  1. Fragmentation in an Inter-country Input-Output Framework
     by *Erik Dietzenbacher*

  2. Detecting Energy Clusters from the Automobile Supply Chain: Spectral Clustering Approach
     by *Shigemi Kagawa, K. Nansai, S. Suh, Y. Kondo*

  3. Alternative Measurement of Vertical Specialization using a Ghosh Supply-driven Input-Output Model
     by *Bo Meng, N. Yamano*

  4. Finding a Global Energy and Resource Network in a Product Supply Chain using a Global Link Input–Output Model
     by *Keisuke Nansai, Kenichi Nakajima, Rokuta Inaba, S. Suh, Shigemi Kagawa, Y. Kondo*

10:30 - 11:00 *Coffee Break*

11:00 - 12:30 Plenary session 3: Leontief Prize 2010

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **Leontief Prize 2010 Awards**
  Chair: Geoffrey J. D. Hewings

  1. A Structural Growth Model and its Applications to Sraffa's System
     by *Wu Li*

  2. Underestimation of the performance of the EU carbon dioxide emission reductions via external trade
     by *José Manuel Rueda-Cantuche*

12:30 - 14:00 *Lunch*

14:00 - 15:30 Teaching Sessions III

- Location: **Lecture Theatre 1, School of Physics**
  Topic: **Supply and Use Tables and links to Symmetric Input-Output Tables (session organized by the Input-Output Statistics Group of the IIOA)**
  Chair: Sanjiv Mahajan

  1. Teaching Session 3: Supply and Use Tables and links to Symmetric Input-Output Tables
     by *Sanjiv Mahajan*

- Location: **Lecture Theatre 2, School of Physics**
  Topic: **Linear Programming in Input-Output Analysis**
  Chair: Thijs ten Raa

  1. Teaching Session 3: Linear programming in input-output analysis
     by *Thijs ten Raa*

- Location: **Lecture Theatre 5, School of Physics**
  Topic: **SimSIP SAM**
  Chair: Juan Carlos Parra

  1. Teaching Session 3: SimSIP SAM
     by *Juan Carlos Parra*

15:30 - 16:00 *Coffee Break*

16:00 - 17:30 *General Assembly (all IIOA members)*
Eastern Avenue Lecture Theatre

Fri, 25/Jun/2010

09:00 - 10:30 Parallel Session 6

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **Classical-Keynesian input-output models**
  Chair: Tobias H. Kronenberg

  1. Economic growth from a CLAKESCH AGE model
     by *Óscar Dejuán*

  2. Monetary Economy of Production. Attempting to integrate financial accounts in an Input-Output framework.
     by *Eladio Febrero*

  3. Approximate Surrogate Production Functions
     by *Bertram Schefold*

  4. What can post-Keynesian input-output models tell us about social sustainability?
     by *Tobias Heinrich Kronenberg*

- Location: **Lecture Theatre 1, School of Physics**
  Topic: **Enterprise input-output approach, environmental issues and policy making II**
  Chair: Devrim Murat Yazan

  1. Input-Output Analysis for Business Planning: A Case Study of the University of Sydney
     by *Manfred Lenzen, Stefan Wisniowski, Tess Howes, Joy Murray, Chris Dey, Linda Schofield, Geoff Barton, Don Taylor, Charlie Benrimoj, Bob Kotic*

  2. Input-Output Relation and Distribution of Emission-Recycling-Final Disposal Coefficients of Japanese Industrial Wastes at the Establishment Level
     by *Hitoshi Hayami, Masao Nakamura*

  3. Industrial symbiosis between production chains: an enterprise input-output analysis
     by *Vito Albino, Rosa Maria Dangelico, Erik Dietzenbacher, Devrim Murat Yazan*

- Location: **Lecture Theatre 2, School of Physics**
  Topic: **Climate policy issues: analyses**
  Chair: Kuishuang Feng

  1. The Sources of Carbon Intensity Change in China: 1997-2007
     by *Hongxia Zhang, Zheng Xinye, Xiuli Liu*

  2. How do we manage our local environment in the face of global uncertainty and complexity?
     by *Bonnie McBain, Manfred Lenzen*

  3. The role of infrastructure in meeting UK climate change targets: a case study of wind energies
     by *Kuishuang Feng, Jan Minx, John Barrett, Kate Scott, Klaus Hubacek, Thomas Wiedmann*

- Location: **Lecture Theatre 5, School of Physics**
  Topic: **Key sectors and multiplier analysis**
  Chair: Ferran Sancho

  1. Comparative Assessment of Application of Gross and Net Multipliers for the Determination of Iranian Economy
     by *Mohammadgholi Yousefi, Mohammad Hussain Ghelbash*

  2. The Role of Supply Constraints in Detecting Keysectors
     by *Manuel Alejandro Cardenete Flores, Ferran Sancho*

  3. A Comparison of Input-Output Models: Ghosh reduced to Leontief
     by *Ferran Sancho, Ana-Isabel Guerra*

  4. Merging the Hypothetical Extraction Method and the Classical Multiplier Approach: A Hybrid Possibility
     by *Ana-Isabel Guerra, Ferran Sancho*

- Location: **Room 414, School of Physics**
  Topic: **Sector specific analyses: agriculture**
  Chair: Geng Xianhui

  1. The Changing Structure of Indian Agriculture During the Post-Reform Period: A Study in the I-O Framework
     by *Dipti Prakas Pal, Mausumi Datta Biswas Ghosh*

  2. Chinese Agribusiness: Structure, Linkage and Development - A Comparative Analysis Based on Input-Output Model
     by *Geng Xianhui, Zhou Yingheng*

- Location: **Slade Lecture Theatre, School of Physics**
  Topic: **Bias and estimation methods in input-output tables**
  Chair: Kakali Mukhopadhyay

  1. Bias and variability in the estimation of multipliers: an experiment with supply and use tables
     by *Esteban Fernandez-Vazquez, Antonio F. Amores, Jose Manuel Rueda-Cantuche*

  2. Study on Multi-objective Optimization of Export Commodity Structure Based on Non-competitive Input-Output Analysis
     by *Zhirui Mu, Cuihong Yang*

  3. Aggregation bias: An experiment with input-output data of Canada
     by *Debesh Chakraborty, K. Mukhopadhyay, P. Thomassin*

10:30 - 11:00 *Coffee Break*

11:00 - 12:30 Parallel Session 7

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **Input-output studies of tourism issues II**
  Chair: Bart Los

  1. Stability of I-O technical coefficients by capacity utilization: A case study of the hotel sector in Taiwan
     by *Ya-Yen Sun*

  2. Zanzibar Tourism Accounts: A research proposal to strengthen their present status
     by *Mr. Hamil Bakari Amour*

  3. Regional Environmental Impact of Tourism – Linking the regional tourism satellite accounts and the regional environmental accounts within the Danish regional model framework
     by *Jie Zhang*

- Location: **Lecture Theatre 1, School of Physics**
  Topic: **Water input-output analysis**
  Chair: Cristina Sarasa

  1. A regional inventory of water demand and water pollutant discharge in the Yangtze River and China as a whole based on an inter-regional input-output analysis model
     by *Tomohiro Okadera, Masataka Watanabe, Nobuhiro Okamoto*

  2. Interregional Virtual Water Trading in Japan: the applied idea to identify the characteristics of Virtual Water Trading using the Input-Output Approach.
     by *Hideo Fukuishi*

  3. Water Rates and Responsibilities of Direct, Indirect and End-Users in Spain
     by *Cristina Sarasa, Julio Sánchez Chóliz, Rosa Duarte Pac*

- Location: **Lecture Theatre 2, School of Physics**
  Topic: **Analysis of factor inputs**
  Chair: Joost Reyes Santos

  1. The change of the capital and labor input for China's economy
     by *Duan Yu Wan, Cuihong Yang*

  2. The bias in accounting for national income changes when pervasive processing trade is present
     by *Jiansuo Pei, Erik Dietzenbacher, Jan Oosterhaven*

  3. Extension of Input-Output Analysis to Portfolio Diversification
     by *Joost Reyes Santos*

- Location: **Lecture Theatre 5, School of Physics**
  Topic: **Climate policy issues: tools**
  Chair: Stuart John Nettleton

  1. A micro-founded Hybrid Input-Output framework
     by *Stefano Merciai*

  2. Alternative Approaches to Designing Climate Policy Response: An Australian Case Study
     by *Suwin Sandu*

  3. The Service Science of Climate Change Policy Analysis: applying the Spatial Climate Economic Policy Tool for Regional Equilibria
     by *Stuart John Nettleton*

- Location: **Room 414, School of Physics**
  Topic: **Input-output and prices**
  Chair: Ye Zuo Yi

  1. An Input-output Interpretation of Price Relationships in China
     by *Xu Jian, Tong Rencheng*

  2. The Effect of Raising Compensation of Employees on the Prices in China
     by *Xikang Chen*

  3. Price and revenue effect of Japan's VAT reform
     by *Ye Zuo Yi, Kiyoshi Fujikawa, Mitsuru Shimoda, Takashi Watanabe*

- Location: **Slade Lecture Theatre, School of Physics**
  Topic: **Structural change**
  Chair: Keisuke Nansai

  1. Economic growth, structural change and environmental pressures: The case of the Netherlands, 1950-2009
     by *Rutger Hoekstra, Jan Pieter Smits, Ruben van der Helm*

  2. Structural Changes In The Indian Economy During The Pre-Reform And Reform Periods: An Analysis In The Input-Output Framework
     by *Partha Pratim Ghosh, Debesh Chakraborty*

  3. Structural Decomposition Analysis Using Spectral Graph Theory and Its Application to the Energy Issue in Japan
     by *Yuko Oshita, K. Nansai, Shigemi Kagawa*

12:30 - 14:00 *Lunch*

14:00 - 15:30 Plenary Session 4

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **CGE modelling**
  Chair: Bart Los

  1. Input-output tables for use in Computable General Equilibrium (CGE) models: the case of the USAGE model of the United States
     by *Maureen Rimmer*

15:30 - 16:00 New release of a Guide Book on Input-Output Analysis

- Location: **Eastern Avenue Lecture Theatre**
  Topic: **Input-Output Guides**
  Chair: Richard Wood

  1. The Sustainability Practitioner's Guide to Input-Output Analysis
     by *Joy Murray, Richard Wood*

16:00 - 16:30 *Closing Ceremony and Aboriginal Story Telling*
Eastern Avenue Lecture Theatre

IMPORTANT NOTE ON THE CHAIRMAN OF THE SESSIONS:

The sessions are generally chaired by the main author of the last paper of each session. Just in case this author does not show up, the general rule will be that the main author of the second presentation will act as the chairman.

IMPORTANT NOTE ON TEACHING SESSIONS:

The Scientific Programme Committee (SPC) has organized at this Conference teaching sessions on specific topics of interest for input-output practitioners, i.e.: on the compilation of supply, use and input-output tables (lectured by Sanjiv Mahajan, from the Office for National Statistics, United Kingdom), on specific input-output software (SimSIP SAM, lectured by Juan Carlos Parra, from the World Bank) and on linear programming in input-output analysis (lectured by Thijs ten Raa, from Tilburg University, the Netherlands). The IIOA and the SPC have put a great effort in providing a set of parallel courses with renowned speakers so we hope you find them interesting. Please, in case you were interested in attending one of these three sets of teaching sessions **DO NOT FORGET TO GIVE YOUR NAME ON SUNDAY AT THE REGISTRATION DESK INDICATING YOUR PREFERENCE!!!**

The sessions will be located in rooms with wireless connection to internet and in which the attendants will be able to use their own laptops to follow the lectures. Participants are encouraged to bring their own laptop. The sessions will be hands-on, and many examples and applications will be used so that participants become familiar with the way the tools work and the outputs they produce. At this Conference, the teaching sessions will consist of three sessions of one hour and a half each, which hopefully manage the attendants to get a deeper knowledge of the contents rather than just a one session talk, preferably using as much as possible computer hands-on exercises. The sessions are scheduled for Tuesday, Wednesday and Thursday.

Input-Output 2010

18th International Input-Output Conference
20-25 June 2010 - Sidney Australia

18th International Input-Output Conference

BOOK OF ABSTRACTS

AND LIST OF PARTICIPANTS

20/Jun/2010 - 25/Jun/2010

International Input-Output Association
Vienna, AUSTRIA
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Institute for Prospective and Technological Studies
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Members of the Scientific Programme Committee:
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Experiences in estimating the macroeconomic impact of mega tourism events – the case of hosting the FIFA Football Word Cup Germany 2006

Topic: Input-output studies on tourism issues I
Author: Gerd Ahlert
Co-Authors: Holger Preuss

Estimating the macroeconomic impact of tourism events has been discussed manifold in economic literature. Besides the assessment of the additional event related investment expenditures during the pre-event phase one of the most striking challenges is the estimation of the event related consumption expenditures during the event phase. Furthermore for estimating the net economy-wide impact it is also important to apply an adequate macroeconomic model, which takes into account all indirect intermediate consumption effects and induced income effects of the event-specific primary stimulus as well as the adjustments of prices and interest rates.
The paper describes the experiences in estimating the macroeconomic impact of hosting the FIFA Football World Cup Germany 2006 more precisely. Therefore various aspects concerning impact assessment will be discussed against the backdrop of the applied macro-econometric intersectoral model INFORGE. A special focus is put on the consumption related effects. Within the various pre-event studies the primary consumption stimulus has been estimated by plausibility based considerations or information coming from the German Tourism Satellite Account (TSA) whereas the final ex-post assessment study is based on a primary empirical measurement of the consumption patterns of tourists at the FIFA Football World Cup 2006 in Germany. Thus this measurement is explained in detail.
Using this new data base, the calculated net economy-wide impact induced by the surveyed consumer spending at the World Cup has increased the German GDP by 3.2 billion € and created 34,800 “man years” of additional employment.

Industrial symbiosis between production chains: an enterprise input-output analysis

Topic: Enterprise input-output approach, environmental issues and policy making II
Author: Vito Albino
Co-Authors: Rosa Maria Dangelico, Erik Dietzenbacher, Devrim Murat Yazan

Industrial symbiosis and roundput systems represent a significant approach to mitigate the environmental impact of production chains. Then, two or more production chains can explore how to exploit such an opportunity through materials and energy exchange.
In this paper, we propose an enterprise input-output (EIO) approach to model industrial symbiosis between two production chains and to evaluate the resulting environmental benefits.
Different combinations of input-output flows between chains correspond to a variety of industrial symbiotic systems. Specific models are developed and the environmental benefits for each chain and for both chains as a whole are calculated. The economic benefits are also evaluated to determine under which conditions each symbiotic system is suitable.
Some case examples related to the bio-energy production chain and to the end of life tyres recovery and recycle are presented and discussed.

Keywords: Industrial symbiosis, Production chains, Enterprise input-output

Cooperation in reverse supply chains: environmental and economic impacts of actor decisions

Topic: Enterprise input-output approach, environment issues and policy making I
Author: Vito Albino
Co-Authors: Rosa Maria Dangelico, Devrim Murat Yazan

The objective of this paper is to evaluate the opportunities related to reverse supply chains. Two or more supply chains' actors, one of which operating in waste collection and discharge, can cooperate through waste reuse. This cooperation, while reducing the environmental impacts caused by waste disposal and traditional material purchasing, can also lead to economic benefits for the chain actors.

However, such reverse supply chains can result in various main product exchange scenarios not only among the actors involved but also among them and their upward and backward chain partners. Thus, emerging scenarios should be evaluated taking into account the direct, indirect, and induced impacts of the decisions taken by the cooperating actors.
Even though adopting a classic enterprise input-output (EIO) approach could be useful to foresee potential benefits of such a cooperation, the actual situation is influenced by the behaviours of all chain actors. In such a case the technical coefficients representing intermediate main output and primary input flows can not be considered as constant. In fact, the assumption of constant technology is not valid any more considering that each actor's supply or purchasing policies are influenced by the presence of alternative suppliers or customers.
This paper analyzes the economic return and environmental benefits obtained by chain cooperation through an EIO approach. Some particular cases, such as roundput systems, are investigated through numerical case examples. Managerial implications can be drawn enabling companies to predict the future impacts of their actions.

Keywords: Reverse supply chains, Cooperation, Enterprise input-output

The compilation of the Australian input-output tables

Topic: Australian Bureau of Statistics Special Session I
Author: Ross Alexander
Co-Authors: Terry McGrath

This paper outlines the process for compiling the annual Input-Output tables for Australia. The paper describes an end-to-end process, covering key data sources such as ABS survey data, use of administrative data and industry-specific data. It addresses the link between annual Supply Use benchmarks (used to compile the National Accounts) and key I-O aggregates. The paper will also discuss some of the current challenges facing the ABS in compiling the 2006-07 IO tables, including the introduction of SNA08, Industry classification changes and data quality issues.

An AGE assessment of external and domestic shocks in Spain

Topic: CGE and econometric input-output modeling
Author: Maria Teresa Alvarez-Martinez
Co-Authors: Clemente Polo Andrés

After many years of growth, the Spanish economy is suffering the most severe and prolonged

recession since there is reliable national accounts records. 2009 ended up with an unemployment rate over 18 % and a public deficit GDP ratio above 11 %. The main goal of this paper is to simulate the effects of external (fall in exports and tourism flows) and internal shocks (fall in construction investment) on the Spanish economy. The simulations are carried with a disaggregated applied general equilibrium model calibrated to a 2000 social accounting matrix (SAM) elaborated by authors under the neoclassical and the Keynesian closure rule.

Three way decomposition of the Efficiency of Andalusian Economy

Topic: Productivity and efficiency II
Author: Antonio F. Amores
Co-Authors: Thijs ten Raa

Recent contributions to input-output analysis (ten Raa, 2006) propose a scheme for the efficiency evaluation of an industrial organization by the benchmarking of both, the firms and the industry as a whole as well. We extent this scheme to include the firms' supply and use micro-data for the computation of a measure of the efficiency of the whole economy. Additionally, we show how it can be decomposed in three components: firm efficiencies, industrial organizational efficiencies and allocative efficiency of the economy. The empirical work is carried out for the Andalusian Economy.

Greenhouse Gas Emissions Embodied in New Zealand's Trade

Topic: International trade and environment
Author: Robbie Andrew
Co-Authors: James Lennox, Glen P. Peters

Domestic and international policies for GHG mitigation have focussed on reducing emissions within territorial boundaries, following the 'polluter-pays principle', which underpins many modern environmental policies. However, international trade in goods and services partially decouples activities of production and consumption, which may occur in different countries.
We report on work in progress and preliminary results from a project using multi-regional input-output analysis to quantify the GHG balance of trade for New Zealand. We start with the readily available GTAP database, produce a new IOT and imports matrix for New Zealand, combine and balance the GTAP database with the new IOT for New Zealand and major trading partners, introduce a new global database for non-CO2 emissions, calculate international maritime emissions and air passenger transport emissions using a detailed bottom-up model specific to New Zealand, and project these emissions over 2001–2009.
Estimating the GHGs embodied in New Zealand's imports, exports and final consumption will provide important information that complements that currently available in the Government's National Greenhouse Gas Inventory Report. The methods used to generate historical estimates of these embodied emissions can also be applied to analyse the impacts of different scenarios for future global demand and trade patterns. These estimates will allow the Government to assess the implications of New Zealand's international trade for emissions targets and general and sector-specific accounting rules that may be negotiated for a post- Kyoto regime.

Estimation and balancing of constant-price quarterly I-O tables with autoregressive conditional heteroskedastic errors

Topic: National Economic and Environmental Accounts
Author: Paola Anna Antonello

This paper enhances the results of the methodology already presented by the same author in an article on the application of EM algorithm to analyse and forecast long-run I-O coefficient changes (Antonello, P., 2009). In that article it was assumed that the long run dynamics of the demand coefficients of a set of yearly, constant-price I-O tables could be represented by a multinomial logistic function, parameterized in terms of time and of the gross output of the input sector. It was shown that, under these assumptions, by applying the EM algorithm, it was possible to produce Bayesian estimates of long-run input and demand coefficients as well as estimates of the corresponding inter-sectoral flows and of their variance-covariance matrix. In this paper the same methodology and the same data set, supplied by G. Rampa (Economic Systems Research, 20, 3, 259-276), are combined with the GLS balancing method, initially suggested R. Stone, D. G. Champernowne and J. E. Meade (1942), to produce estimates of seasonally adjusted quarterly I-O tables at constant prices. It is assumed that the systematic and random errors affecting the unbalanced quarterly estimated are generated by an ARCH process, i.e. that the conditional distribution of their variance-covariance matrix is AR(1). As an example, the results of an experimental application to the years 1950-2000 are presented.

A trilateral input-output table for North America

Topic: Multirregional input-output modelling
Author: Fidel Aroche
Co-Authors: Marco Antonio Marquez Mendoza

In the last few years, economic integration has become a reality in North America. That calls for constructing trilateral statistical data that has not always been provided by the official institutions. This paper presents a Trilateral North American Input-Output table for 2005, explaining also the process to construct it. The table derives from the OCDE database and estimates intraregional trade matrices, as well as the imports/exports tables between North America and the rest of the World. As a by-product, an aggregated North American matrix derives from this construction. Such a trilateral matrix will be useful to study the integration phenomenon achieved in this region.

Wassily Leontief's The Structure of the American Economy. The early reactions: 1940-1950

Topic: Historical perspective of input-output analysis
Author: Fidel Aroche

In 1941 Wassily W. Leontief published his seminal book The Structure of the American Economy 1919-1929; ten years later, in 1951, a second edition appeared as The Structure of the American Economy 1919-1939, containing four further chapters that first had appeared as journal articles, three of them between 1944 and 1946 and the fourth one in 1949. The author states that this book contains an applied study of interdependence between sectors in an economy, within the general equilibrium framework (interdependence and general equilibrium are taken as equivalent). The Tableau Économique by François Quesnay is taken as example and precedent. Interestingly, the

issues discussed in Leontief's book can easily be linked to the series or papers the author had published during the 1930's. This paper revises some of the salient features of Leontief's The Structure of the American Economy in relation to the –then- current discussions, as well as the reactions the book generated by the time it appeared. In fact there are a number of comments published in various journals during the 1940's and 1950's that make it evident the importance its contemporaries gave to the book.

Quantitative Analysis of Services & Sub- Service Sectors in the Iranian Economy

Topic: Sector specific analyses: services II
Author: Seyed Iman Azad
Co-Authors: Ali Asghar Banouei, Narges Moradkhani

Despite the giant share of services sector in the world economy, its importance appears to be different in the process of development. Although, this sector has a very high share in the Iranian economy, some researchers and policy makers look at it as being non-productive. In this article, we maintain that such thinking regarding this sector cannot reveal the real picture of the importance of the services sector in the fast structural changes of the global economy. In order to analyse the role of services sector, one needs new classifications and concepts which are currently used by many analysts. In this article, we classify the services sector to in four sub-sectors such as: Producer Services, Distributive Services, Social Services and Personal Services and then use two approaches to quantitatively analyse the structural changes of the Iranian economy with respected to new classifications. The first is comparative static approach based on national accounts of SCI during 1961-2006 and the second is static approach based on 2001 I-O Table of Iran. The results which are presented and analyse in the sixth consecutive periods, show that the Iranian economy signified as a services economy from the fifth and sixth periods (1997-2004 and 2005-2006). The structural changes whit respects to the four sub-sector of services reveal that except the second and third periods where the social services has dominant share, the distributive services appears to have giant shares in other periods. Using IO model as a static approach, we find that key sectors are mainly sub-industrial sectors in traditional linkages where as sub-service sectors are propellant in modern linkages.

Keywords: Tertiary Sector, Distributive Services, Producer Services, Personal Services, Social Services, Traditional & Modern Approaches.

Zanzibar Tourism Accounts: A research proposal to strengthen their present status

Topic: Input-output studies of tourism issues II
Author: Mr. Hamil Bakari Amour

In recent years, tourism industry emerges as a potential sector in Zanzibar economy in terms of foreign exchange earnings, employment creation; stimulate the development of other economic sectors. Currently, the benefit of tourism activities to the country economy is difficult to measure because it is implicitly included in various industries of the economy.The development of Tourism Account (TSA) is an attempt to provide a clearer picture of the relative importance of tourism as an economic activity and to trace its interrelationship with traditional industry sectors in national accounts. Therefore, this study will explore the significance and feasibility of developing the Tourism

Account in Macro level, and provides useful insights on its potentiality. All along, this study is intended to provide a detailed look at the Tourism Account, which has a significant implication for the development and strengthening of the tourism statistics and at large.

Assessing the Potential Sudden Reduction of the Supply of Oil and Gas on the Different Sectors of the Iranian Economy

Topic: Energy input-output analyis I
Author: Ali Asghar Banouei
Co-Authors: Jillian Banouei, Mehdi Karami, Seyed Iman Azad

The import of oil gas which constitutes more than 40 percent of total supply and drains more than 8 billion Dollars of the foreign exchange of the country per year. In order to reduce the import dependence and also reduce the burden of the drained annual foreign exchange, the Government has recently resorted the quota system. But this is not the end of story: the potential initiation of oil gas embargo is another issue facing the Iranian economy. To what extent such potential treat would damage the different sectors of the Iranian economy is the main concern of this paper. Since the standard Leontief and Ghosh type models are not suitable to deal with such issue, a combination of the two in the framework of mixed variables or mixed model is used. For this purpose, we use a 147x147 I-O table of Iran.

Benchmarking of Sectoral Productivity Changes in Iran

Topic: Productivity and efficiency I
Author: Fatemeh Bazzazan

ABSTRACT

According to the APO (Asian Productivity Organization) report in 2008 production per capita in Iran has been experienced relatively well growth during last two decades. One of the reasons of this growth might relates to the total factor productivity growth that figures show slow rise at the macro level. To estimate the share of factor productivity requires more investigation on the source of the factor productivity growth at national, sectoral, and industry levels. Few investigations have been carried out on estimating total factor productivity growth at the national or manufacturing sector and excluded all sectors or industry levels. However, policy makers and economic planners are interested to know thoroughly the total factor productivity growth at sector or industry levels. To do so, the objective of this paper is to measure the growth of TFP by industries and the whole of the economy during 1988–2004 by using detailed sectoral data that are adjusted in order to account for input–output tables. Three input-output tables of Central Bank of Iran, 1988, 1999, and 2004 are going to be employed. The main restriction in Iran, like many other countries, would be data on employment by industry.

Key word: TFP productivity, labor and capital productivity, input-output, Iran

Paper to be presented at the 18th International Input-Output Conference will be held on 20-25 June, 2010 at the University of Sydney, Australia.

Liberalization and Productivity Growth in Nepal: A case of FDI firms

Topic: Productivity and efficiency I
Author: Raghu Bista

This study investigates empirically what is TFP growth of FDI firms in Nepal in 1990 after economic liberalization process. We use econometric model based on Cobb Douglas production function and theoretical model of TFP growth accounting method. The econometric and non parametric TFP estimation provides negative TFP growth of FDI firms in Nepal. The result indicates negative effect of inferior labor (lower quality labor), under utilization of FDI capacity, no significant technology and financial transfer and poor business environment on TFP growth in FDI firms.

Sensitivity analysis in the inter-temporal CGE model framework

Topic: CGE and econometric input-output modeling
Author: Jakub Boratynski

One of the key issues related to application of computable general equilibrium models is the sensitivity of results to a priori assumptions. In this paper we perform simulations of public infrastructure investment under different closures and with varying parameter values, and analyze the dispersion of the outcomes. The investigation employs, inter alia, the systematic sensitivity analysis method. We use, as a framework, an inter-temporal CGE model of the Polish economy, assuming investors' decisions to be based on forward-looking expectations.

Consumption-based environmental accounting of CO2 emissions and water use in a multi-regional input-output framework

Topic: EXIOPOL: Latest progress and preliminary results of work on a global, detailed MR EE SUT/IOT database
Author: Maaike Corinne Bouwmeester
Co-Authors: Jan Oosterhaven

Over the last decade an increasing awareness regarding embodied emissions and resources in traded products has resulted in attempts to track emissions and natural resource use along the international supply chain. A multi-regional input-output (MRIO) model is an appropriate methodological framework to undertake this type of environmental analyses, because direct and indirect, domestic and international environmental impacts are considered simultaneously. However, an extensive MRIO model capturing most of world trade has a vast data requirement. As indicated by [Wiedmann, Ecological Economics, 2009] there is still room for improvements in data availability and quality. The EU-funded EXIOPOL project will create a multi-regional environmentally extended input-output database. This database, containing domestic and international trade flows of 43 countries, is essential for estimating the actual environmental impacts of international production and consumption. The project has an important role in delivering the desired improvements.
In this study we investigate the value added of the EXIOPOL database by partially replicating the analysis of Lenzen (Economic Systems Research, 2004]. The analysis performed in Lenzen (2004) focuses on four individual countries that are rather alike (Denmark, Germany, Sweden and Norway). The EXIOPOL database allows for a far more extended test of MRIO models. The deviations in environmental accounting that result from (1) assuming that domestic CO2 emissions coefficients can be used to calculate the emission embodied in international trade and (2) using a uni-directional

framework instead of a multi-directional framework are reported.
In addition, the EIOPOL project devotes much work to detailing the sectors that are important from an environmental point of view. The database includes, for all 43 countries, tables that feature around 125 sectors/products. The tables are collapsed to 60 products and 30 sectors to investigate the value added of the increase in detail. Due to the extent of the database we can provide distributions of the deviations instead of point-estimates. This allows us to investigate whether deviations are larger depending on the specific country or sector that is analyzed.
Our focus will be on CO2 emissions and water use. Investigating both a by-product and a natural resource will uncover the differences between these types of environmental extensions propagated through the international linkages. Different sectors will be responsible for the bulk of CO2 emissions and the use of water, most likely located in different countries. Analyzing both emissions and a natural resource while adhering to the concept of consumer responsibility under the different assumptions provides for a check of the methodology that has been identified as the most desirable methodology.

The Role of Supply Constraints in Detecting Keysectors

Topic: Key sectors and multiplier analysis
Author: Manuel Alejandro Cardenete Flores
Co-Authors: Ferran Sancho

Abstract

Multiplier analysis based upon the information contained in Leontief's inverse is undoubtedly part of the core of the input-output methodology and numerous applications an extensions have been developed that exploit its informational content. Nonetheless there are some implicit theoretical assumptions whose implications have perhaps not been fully assessed. This is the case of the 'excess capacity' assumption. Because of this assumption resources are available as needed to adjust production to new equilibrium states. In real world applications, however, new resources are scarce and costly. Supply constraints kick in and hence resource allocation needs to take them into account to really assess the effect of government policies. Using a closed general equilibrium model that incorporates supply constraints, we perform some simple numerical exercises and proceed to derive a 'constrained' multiplier matrix that can be compared with the standard 'unrestricted' multiplier matrix. Results show that the effectiveness of expenditure policies hinges critically on whether or not supply constraints are considered.

Keywords: Key sectors, Economic linkages, Policy evaluation, Economy-wide modeling, General equilibrium.

JEL: C63, C68, D58

Aggregation bias: An experiment with input-output data of Canada

Topic: Bias and estimation methods in input-output tables
Author: Debesh Chakraborty
Co-Authors: K. Mukhopadhyay, P. Thomassin

The Problem of aggregation in the input-output analysis is an important issue. Aggregation can be defined as a process of operation by which detailed sectors are consolidated into broad sectors,

thus reducing the total number of original sectors, no doubt, serves certain purposes. However, the gains obtained from consolidation have to be weighted against the disadvantages (for example, an increase in errors, loss of information of the original sectors) due to aggregation.

Since the early 1950s considerable attention has been given in the literature to formulate aggregation criteria and measure the effects of aggregation of sectors in input-output models. A large amount of theoretical and empirical work has been done to find good aggregation. The present paper examines several measures of the bias or error introduced by aggregation in input-output model. The paper uses the input-output table of Canada for the year 2003 as an example to measure the basis effects of aggregation.

Originally the use and make table of Canada consists of 697 commodities, 16 primary inputs, 286 industries, and 168 final demand categories at worksheet level. For the purpose of the aggregation error study, we have aggregated 697 commodities into 125 including 25 detail agricultural commodities. 16 primary inputs have been aggregated to 11. Like commodities, the scheme of detailed agricultural sector has also been applied to industry aggregation in make and use table of Canada. The industries are aggregated to 84 from 286, and final demand to 7 categories from 168 including private consumption, investment, change in stock, govt. expenditure, export, re-export and import. Thus use matrix consists of 125 commodities and 84 industries, 11 primary inputs and 7 final demand categories; and make matrix consists of 84 industries and 125 commodities. Next the paper estimates the bias due to the aggregation scheme in the input-output table of Canada.

The results show that the estimation of the bias due to the aggregation of input-output table varies across the sectors. For most of the sectors the error is marginal, though for same the size is not negligible. The paper also discusses the implication of the result for the use of the input-output model.

Partially endogenized consumption: a new method to incorporate the household sector into input-output models

Topic: Final demand in input-output analysis
Author: Quanrun Chen
Co-Authors: Bart Los, Cuihong Yang, Erik Dietzenbacher

The partially closed input-output model with endogenous consumption is applied to many fields, both on national level and regional level, for it takes into account
the linkage between the household sector and the production sector. In our study, we find that the household consumption behavior captured by this model is not consistent with the consumption theory, because in this model the current consumption is only determined by the current income. However, from the point views of related consumption behavior hypotheses, such as the relative income hypothesis and the life cycle-permanent income hypothesis, the household consumption is also determined by many other factors such as past consumption level and future income. In that case, the linkage between the household sector and the production sector would be overestimated by this model. To address this problem, we proposed a new method to incorporate the household sector into the input-output model, which can reconcile the input-output analysis with the consumption theory. The endogenous consumption coefficients of eight categories of commodities in China from 1989 to 2008 are estimated by the time varying parameter method. Using these results, we construct our new model, partially closed input-output model with partially endogenized consumption, based on China’s input-output table of 2007. Finally employing our new model, the short-term impact of the 4 trillion yuan stimulus package announced by the Chinese government on

the GDP of China under different scenarios is investigated.

The Effect of Raising Compensation of Employees on the Prices in China

Topic: Input-output and prices
Author: Xikang Chen

The amount of compensation of employees in China has developed quickly since China launched its opening-up policy in 1978. From input-output tables of China we could find that the compensation of employees in 1997 is 415.4 billion yuan, and that in 2007 is 1100.5 billion yuan . In 10 years the annual growth rate of compensation of employees is 9.02%. Because the annual growth rate of GDP in period from 1997 to 2007 is 9.64%, increased more quickly than compensation of employees, then the proportion of compensation of employees in GDP is decreased. It is 54.87% in 1997, and 41.36% in 2007. From input-output tables of 1997 and 2007, we also find that the proportion of operating surplus is up very quickly, from 17.97% in 1979 to 30.15% in 2007. In 10 years the proportion rose about 68%. It is important to raising compensation of employees more quickly.

Using input-output table of non-competitive type of 2007, constructed by National Bureau of Statistics of China, we calculated that if compensation of employees raises 10% and other conditions are not be changed, then the prices of each sector will change as follows: agriculture, forestry, animal husbandry & fishery-7.52%, education-5.63%, manufacture of foods and tobacco-4.69%,mining and washing of coal-3.72%,processing of petroleum, coking, processing of nuclear fuel-1.87%, real estate-1.33%.
We also find that if compensation of employees raises 10%, that the household consumer price indices will raise 3.77%, and producer price index for manufactured goods will raise 2.68%

China’s exports can be split up into two categories: processing exports and non-processing exports. According to statistics released by China Customs, in recent 5 years the ratio of processing exports in total exports is about 50%. The characteristic of processing exports is that the ratio of value added in gross output is very low. It is 20.19% in 2007 and 16.62% in 2002. Using a non-competitive input-occupancy-output table that captures the characteristics of China’s processing exports in 2007, constructed by National Bureau of Statistics of China and Academy of Mathematics and Systems Science, we could calculate, if compensation of employees raises 10%, how much the prices of processing exports and non-processing exports will be changed. The results are as follows: the average price change of processing exports will be raised 1.40%, and the average price change of non-processing exports will be raised 3.03%. There is big difference in processing exports and non-processing exports, for example, manufacture of textile, the price change in non-processing exports is 3.88%, and that in processing exports is 1.92%.

If the amount of compensation of employees raised 10%, and other conditions are not be changed, then the structure of value added will be changed as follows, first, the proportion of compensation of employees will be changed from 41.36 % to 43.69%, the proportion of operating surplus will be changed from 30.15% to 28.95%. By the way, the proportion of GDP in total gross output will be changed from 32.49 to 33.38%.

In order to raise the proportion of compensation of employees in GDP from 41.39% (2007) to 54.87% (1997), it is necessary to raise compensation of employees 72.35%. Then, the proportion of GDP in total output will be changed from 32.49% to 38.47%, and the proportion of Value added will be changed as follows: ratio of compensation of employees in GDP will be 54.87%, Taxes-11.14,

Depreciation of fixed assets-10.78% and operating surplus-23.21%.

The saving rate of China is very high. It is 47.5% in 2005, 49.9% in 2009 and 54.3% in 2009. The Gross Domestic Savings are consists of household savings, enterprises savings, and government savings. From distribution of value added we could find that the proportion of enterprise income in value added, including depreciation of fixed assets and operating surplus, is too high in China, it is 44.15% in 2007. The saving rate of enterprises is very high and most savings come from enterprises. In 2008 the total investment in fixed assets is 17283 billion yuan, which comes from government budget is 796 billion yuan, foreign investment-531 billion yuan, enterprise self raising funds-11851 billion yuan. Raising the amount of compensation of employees will be much benefit to decrease savings rates and raises the consumption rate.

Effective Full Time Employment for Location Quotients – A Proposal

Topic: Economy-wide impacts and forecasts
Author: Julianne Christie
Co-Authors: Maria Varua

Disaggregated input-output tables are increasingly used by regional planners at the national, state and sub-state level. Although there are various non-survey techniques employed to produce disaggregated Input-Output tables within top-down or hybrid methods, this paper develops a disaggregated model using location quotients. Unlike other studies which uses total number of people employed as per the traditional location quotient method, this paper uses Effective Full Time (EFT) employment instead. This means that employment data is manipulated before being utilised within location quotients that in turn, disaggregate the national table. The study proposes that the total number of people employed using the traditional method has the potential to inflate the results of regional Input-Output table generation.

Welfare Effects of Regional Transport Infrastructure Improvement in a Developing Economy : SCGE Approach

Topic: Input-output applied to social issues II
Author: Cristela Goce Dakila

This paper looks into the impact on welfare of alternative improvements in water, air and land transport infrastructure in a low-income region in the Philippines like Mindanao, using a general equilibrium model. The welfare index used will be equivalent variation. It utilizes a five-region social accounting matrix as database for a spatial general equilibrium (SCGE) model of the Philippine economy subdivided among five regions with Mindanao as focal point The four other regions are Northern Luzon, National Capital Region, Southern Luzon, Visayas and Mindanao. Each regional economy contains seven production sectors and three household income groups. The paper examines the impact of a 10% increase in capital inputs in Mindanao land transport services sector on welfare, income distribution and transport-intensity of production sectors. These are then compared with an alternative 10% increase in capital inputs in Mindanao water transport services sector and air transport services sector. After which, the Mindanao results are compared with other regions in the rest of the Philippines. In the end, the empirical results will serve as benchmarks in the optimal allocation of resources for transport infrastructure investment within Mindanao and also between Mindanao and the rest of the Philippines.

Economic growth from a CLAKESCH AGE model

Topic: Classical-Keynesian input-output models
Author: Óscar Dejuán

The paper develops an applied general equilibrium (AGE) model, that is rooted in classical, Keynesian and Schumpeterian traditions. (Thus the acronym “CLA-KE-SCH”). From Classical political economy, properly updated by Sraffa, we take the theory of value and distribution leading to a system of “prices of production”. Commodities leave the factory with a label indicating the cost of production (which includes a “normal” rate of profit on the capital invested). The “social accounting matrix” implicit in our AGE model, does also remind Classical economics. From Keynes we take the principle of effective demand which explains the equilibrium level of final output as a multiple of autonomous demand. (Actually the model determines both the level and composition of output). Autonomous demand encompasses exports, real public expenditures and private investment (the last one, partially explained in the model). Residential investment of households is limited by the burden of debt. Productive investment of the expansionary type is explained by the accelerator principle. Productive investment of the modernization type (which reminds Schupeterian entrepreneurs) is the proper motor of the model and the vehicle of technical change. With the help of Spanish Input-Output Table for year 2005, we explain the dynamics of the Spanish economy in the last decade.

Fragmentation in an Inter-country Input-Output Framework

Topic: Supply chains
Author: Erik Dietzenbacher

Fragmentation was introduced by Jones and Kierzkowski (1990, 2005) to describe the organization of production processes. More and more, production processes are split into subsequent phases, which are carried out separately and in different countries. As a consequence, the trade of intermediate products becomes more important and vertical trading chains exhibit an increasing interconnectedness of industries across countries. Vertical specialization occurs when each country specializes in certain stages of the sequence of production. In an influential paper, Hummels et al. (2001) narrowed the concept of vertical specialization by focusing on the imported inputs that are necessary for producing the exports. Vertical specialization for a country was measured by the export weighted average direct import coefficient or by the export weighted average import multiplier (including also the indirect import requirements). Essentially, what this measures is the import content of the exports. The empirical results were obtained from applying these measures to national input-output tables.
The present paper extends the analysis by taking inter-country input-output tables as the starting-point. These tables are of the interregional type with countries acting as regions. Inter-country tables provide a detailed description of the interdependencies of industries between countries and thus reflect exactly what we are interested in. It may thus be expected that the results obtained from inter-country tables measure vertical specialization better than national tables do.
In this paper, it is rigorously proven that this is not the case. Distinguishing between intra-country effects, inter-country spillovers and inter-country feedback effects it is shown that vertical specialization when measured with an inter-country table is the same as when measured with a national table.
This result has far-reaching consequences because inter-country input-output tables are not readily available and need to be constructed (which is a painstaking and time-consuming process). In contrast, national input-output tables are now widely available and do not require much additional

work if one aims at a comparison of national vertical specialization across countries.

Introducing Physical Constraints into Economic Models

Topic: EXIOPOL: Latest progress and preliminary results of work on a global, detailed MR EE SUT/IOT database
Author: Faye Duchin
Co-Authors: Stephan Lutter, Nathaniel Springer, Stefan Giljum

During the last decade, environmentally extended methods for multi-regional input-output (MRIO) analysis have advanced significantly. One important limitation, however, has been the absence of a comprehensive database of factor flows for industrial use and especially of factor stocks – of not only labour and capital, but also natural resources, namely arable land, fresh water, biomass, fossil fuels, and minerals such as phosphates. As the stock data become available, they can be put immediately to use in models of the world economy as physical constraints on factor flows.

The state of the art regarding accounting methodologies for quantifying these categories of environmental flows and stocks varies considerably. For instance, while there are extensive data on worldwide resource extraction and use, information on stocks of materials and arable land are substantially incomplete. By contrast, data on available water reserves are far more comprehensive than data on water withdrawals. However, even when stock data are available, as in the case of water, consistent definitions and conventions for making these data useful for economic modelling are often lacking.

This present paper describes the most critical challenges to the compilation of factor stock and flow data for economic modelling purposes. We describe existing data sources and identify the key assumptions necessary to systematically quantify stocks and flows of natural resources. The paper shows how standardising such definitions and conventions can facilitate the integration of both resource flow and stock data into MRIO models using the example of the World Trade Model (WTM). The WTM is an MRIO model developed for scenario analysis in the context of global sustainable development. One of its distinctive features is that it requires estimates of factor stocks and flows in physical units, utilising the size of endowments to constrain the volumes of sectoral production and to calculate scarcity rents on fully utilised factors of production.

Environmental impacts of generating electricity by substituting lignite with photovoltaic technology. An analysis based on a NAMEA-table for the Greek economy.

Topic: Energy input-output analysis II
Author: Charalampos Economidis
Co-Authors: Anastasia Basina, Athanasios Sfetsos

This paper investigates the environmental impacts (emissions) caused by conventional energy production methods and specifically by the combustion of lignite for the generation of electricity. In addition, it looks at the possibility of substituting lignite with solar energy for the production of electricity, and specifically the use of photovoltaic technology, with the aim of reducing emissions and particularly CO2, which accounts for 80% of all greenhouse gas emissions and is thus considered to be primarily responsible for climate change.
According to recent data of the European Commission, 94.50% of electricity in Greece is produced

from conventional energy sources, the main fuel being lignite. It is noted that two of the electricity generation facilities of the Public Power Corporation SA are the most polluting electricity production plants in Europe, since they release the highest levels of CO2 with the lowest production yield among the 25 EU member states. According to a report of the European Environment Agency, Greece is projected to show a 46% increase in greenhouse gases in 2012 relative to 1990 emission levels.

The necessary calculations will be made on the basis of the 2005 NAMEA-table for the Greek economy, as well as the PPC's operational program for the period 2007-2012, which takes into consideration the country's compliance with the requirements of the Kyoto Protocol. Greece has undertaken the commitment to ensure that the increase in emissions does not exceed 25%.

The use of photovoltaic technology provides a number of important advantages for Greece at an environmental level (reduction in emissions of gases responsible for the greenhouse effect), since the country has sunshine most months of the year. In addition, a more general reference will be made to the measures aimed at limiting the increase in emissions of greenhouse effect gases.

Monetary Economy of Production. Attempting to integrate financial accounts in an Input-Output framework.

Topic: Classical-Keynesian input-output models
Author: Eladio Febrero

A monetary economy of production is, contrary to a barter economy, one in which (i) production takes the central place of analysis and (ii) production decissions are taken by agents with a view to end up with more money than they started with (Keynes, 1999, p. 79).

In the present research, our central purpose is to focus on the influence of financial variables on output and employment. We aim to develop a synthesis of the basic tenets of the Theory of the Monetary Circuit (TMC onwards), as developed, amongst others, by Graziani, 1989, 2003, and the linear theory of production, as revived by Sraffa, 1960, under the umbrella of the Keynesian principle of effective demand (Keynes, 1936).

As it is well known, the TMC provides a coherent account of how money puts the wheels of production in motion. However, this approach is highly aggregated and misses a theory of relative prices. On the other side, the Classical approach explicitly deals with production and prices at a dissaggregate level. Notwithstanding, here monetary and financial variables are almost utterly absent.

Edward Nell, 1998, 2004, has hinted at an integration, under the assumption that money circulates after production has taken place, and before the next production period starts (as in the Marxian spheres of production and circulation), and it runs through certain given channels.

We shall follow Nell's lead and then encapsulate the outcome in a balance sheet and transaction matrices, as in Stock-Flow Consistent Accounting, à la Godley-Lavoie, 2007. However, and contrary to the aforementioned authors, we shall try to develop a disaggregate scheme for the Stock-Flow accounts. The final output consists of an input-output table which is expanded to make room for industry liabilities, as a consequence of the funding of transactions (particularly, investment).

This is a theoretical proposal. Nevertheless, we shal try to build the required bridges in order to make it possible to apply this approach to an input-output table.

The role of infrastructure in meeting UK climate change targets: a case study of wind energies

Topic: Climate policy issues: analyses
Author: Kuishuang Feng
Co-Authors: Jan Minx, John Barrett, Kate Scott, Klaus Hubacek, Thomas Wiedmann

Whichever scenario of the future energy system in the UK materialises there will be a need for large-cale infrastructure changes in its delivery. At present, none of the scenario modelling used in the UK Government's Low Carbon Transition Plan takes into consideration the carbon implications of building a new energy system, albeit nuclear, wind or carbon capture and storage (CCS). However, building a new energy system is an energy-intensive process, which reduces the overall energy and carbon efficiency of the power generation. Although a new energy system can reduce direct emissions from the energy generation itself, the indirect emissions related to capital investment are very significant and have to be taken into account.
In addtion to the need to account for the embodied carbon in energy systems, there is also a limitation with the current approach associated with these calculations. Process Life Cycle Analysis (PLCA) has often been employed to establish the indirect emissions associated with energy systems and this can lead to significant truncation errors in the calculations of up to 50%. Input-output based Life Cycle Analysis (IO-LCA) on the other hand suffers from some shortcomings such as aggregation and allocation errors. Hybrid analysis methods combining the strengths of PLCA and IO-LCA have therefore been developed to reduce the limitations of both approaches and have been successfully applied in many studies.

In this study we establish a comprehensive and comparable methodology by which to assess the indirect GHG emissions of four key energy technologies (wind power, nuclear power, Combined-cycle Gas Turbine and CCS). We then build these results into the UK MARKAL model developed for the 2003 UK Energy White Paper to establish the significance of UK carbon scenarios outlined in the UK energy research council (UKERC) Scenario 2050 report.

Bias and variability in the estimation of multipliers: an experiment with supply and use tables

Topic: Bias and estimation methods in input-output tables
Author: Esteban Fernandez-Vazquez
Co-Authors: Antonio F. Amores, Jose Manuel Rueda-Cantuche

The general idea when input-output multipliers are estimated is that traditional Leontief inversion produces little bias in the results. In this paper we suggest changing the way of approaching the multiplier estimation problem, imposing the effect of a stochastic term on the supply and use tables. The results obtained by a Monte-Carlo experiment indicate that, in some cases, it would be preferable to obtain econometric estimate rather than traditionally computed multipliers

The industry similarity in input-output system of China in 1981-1995: Application of dual scaling and fuzzy clustering

Topic: Sector specific analyses: manufacturing
Author: Xue Fu

This paper address the evolution of the similarities between industries from 1981 to 1995 in China by applying dual scaling and fuzzy clustering to input-output systems. The dual scaling is applied to set simultaneously in row and column direction to the simple structure of demand and supply by row and column eigenvector as their weights. The distances of weight between rows reflects the similarity of the industries in sales profile between, and that between columns reflects that in purchases profiles. Because of overlap of cluster of industries, network graph analysis and the fuzzy clustering is applied to find the complex similarity between industries. The consistent findings are as follows: (1) There are increasing overlap or fuzzy in the similarity both in supply and demand with the development of economy in 1981-1995. (2) Supply industries were rapidly specialized and demand was divergence stable over this period; (3) Supply industries were rapidly specialized and demand was divergence stable over this period; while heavy industry, such as Machinery and Equipment, became the industry with the most similar to other industries both from supply profiles and demand profiles.

Energy intensities and CO2 emissions in a SAM model of the Andalusian economy

Topic: Energy input-output analysis II
Author: Patricia D. Fuentes Saguar
Co-Authors: Clemente Polo Andrés, M. Alejandro Cardenete

The aim of this paper is to calculate energy intensities and CO2 emissions in Andalusia, one of the most important regions of the Spanish economy, in 1995.
Energy intensities for five energy commodities are calculated using a social accounting matrix constructed for the region (SAMAND95) which is used under different endogeneity scenarios. We present also a methodology to estimate CO2 emissions, starting from the SAMAND95.
This contribution provides the first estimates of energy intensities and CO2 emissions for Andalusia using SAM models for three different levels of endogeneity. Moreover, this method provides a simulation tool of different scenarios which allows us for evaluating the impact in the regional economy of changes in some components of final demand or energy efficiency improvement in the period 1995-2005, We use the vector of final demand of the Social Accounting Matrix of Andalusia for 2005 (SAMAND05) built recently by the authors.
The results show the high interdependence between the energy branches, the importance of private consumption in the net of interrelations, and how necessary is to improve the efficiency in their usages.

Interregional Virtual Water Trading in Japan: the applied idea to identify the characteristics of Virtual Water Trading using the Input-Output Approach.

Topic: Water input-output analysis
Author: Hideo Fukuishi

The objective of this paper is to construct the methods and identify the characteristics of Japanese

Virtual Water Trading, through applying various concepts and indicators derived from the input-output analysis. The interregional input-output table which is installed satellite water account is employed to identify the characteristics of the Interregional Virtual Water Trading of Japan. We not only calculate the moving amount of virtual water, but we also define the Regional Balance of Virtual Water and Virtual Water Regional Trade Specialization Index.
Finally, water dependency and water contribution of each region is calculated and summarized in the map. The information that is obtained provides a sound basis for possible improvements of the water resource problem within regional environmental policy.

Building the Future: An analysis of the Change in Carbon Emissions from Adopting Building Codes

Topic: Sector specific analyses: services I
Author: Kartik Krishna Ganju
Co-Authors: Gaurav Taneja, Hina Zia, Kazushige Shimpo

In 2006-07, commercial buildings in India occupied approximately 300 million sq. m. of area and consumed 38 TWh of electricity or 8.7% of the electricity supplied by utilities. Over the last two decades, the rapid growth in the Indian economy has had a two-pronged effect on the demand for commercial space in India. Firstly, as the boom was experienced in the services sector, there has been an increase in the demand for commercial space especially near urban areas. Also, the growth in the economy has lead to an increase in the per capita income in such a way that the disposable income particularly in urban areas has seen a rise. This has attracted a number of companies in the organized and unorganized retail sectors that has also brought about an increase in the demand for commercial space. In addition, the energy used in commercial buildings is expected to grow in the coming years as a number of commercial areas adopt appliances for lighting, space conditioning and other processes that had previously been uneconomical due to their high cost.

The Ministry of Power launched the Energy Conservation Building Code (ECBC) developed by the Bureau of Energy Efficiency (BEE) in May 2007 for its voluntary adoption in the country. The Code is an attempt to provide minimum requirements for energy-efficient design and construction of buildings and their systems for all the five climatic zones of the country. The provisions of this code apply to: Building envelopes, except for unconditioned storage spaces or warehouses, Mechanical systems and equipment, including heating ventilating, and air conditioning, Service hot water heating, Interior and exterior lighting, and Electrical power and motors. It is applicable to all new buildings that have a connected load of 500 kW or greater or a contract demand of 600 kVA or greater. The code is also applicable to all buildings with a conditioned floor area of 1,000 m2 (10,000 ft2) or greater. Estimates suggest that ECBC compliant buildings can use 40 to 60% less energy than conventional buildings.

The paper will attempt to identify a typical commercial building built before 2009 and estimate the annualized carbon emissions from the building and compare it to the emissions if the building had been built using ECBC guidelines. This will be achieved using an Input Output Methodology, to fully understand the economy wide impact of emissions from using these materials and products for commercial buildings. These findings will be used to estimate the increase or decrease in the Carbon Dioxide emitted under ECBC and the cost of mitigating Carbon Dioxide in the commercial building sector in India. The paper will utilize the Indian Environmental Input Output Matrix for 2003/04 that has been jointly developed by researchers from Keio University, Japan and The Energy and Resources Institute (TERI), New Delhi.

Models for the correction of input-output forecasts: experiments with Sri Lankan input-output data

Topic: Economy-wide impacts and forecasts
Author: Arpita Ghose
Co-Authors: Debesh Chakraborty, Partha Pratim Ghosh

In recent times, there has been a proliferation of studies on national economies as also the world economy, for future global trends in economic variables such as output of various commodities, environmental variables including GHG emissions and so on, especially in the light of the recently declared Millennium Development Goals. For this purpose, researchers have applied various methods such as Input-Output models, Macro-Econometric models, CGE models and their like. In particular, Input-Output modeling has been used earlier too, for the purpose of forecasting Sector level outputs. The method of forecasting sector level outputs by using Input-Output Tables in conjunction with Macro-Econometric Models can give rise to errors on account of final demand, changes in input-output coefficients or a mixture of both. However, the literature on error correction for changes in the input-output coefficients is not very large. The current paper addresses the issue of errors arising out of Input-Output forecasts. Various methods to estimate such errors have been developed and formalized in this paper. An attempt has been made to calculate the projection errors for various sectors of the developing economy of Srilanka, by using the Input-Output Tables of 1986, 1994 and 2000. Results show that the size of the errors varies according to the methods adopted. The estimates of forecasting errors have been used to make corrections for the sector level output forecasts for Srilanka for the year 2010 and 2015.

Impact of trade liberalization on productivity growth of manufacturing sector: evidence from a non-parametric approach with Indian data

Topic: Productivity and efficiency II
Author: Arpita Ghose
Co-Authors: Paramita Roy Biswas

This paper explains the impacts of trade liberalization and some technological-socio-economic variables on total factor productivity growth of 18 Indian manufacturing industries. Productivity growth is measured by Malmquist Productivity Index, using non-parametric Data Envelopment Analysis. The study highlights intra-industrial differences in total factor productivity growth and reports annual average growth rate as3.90%, considering all the industry groups together under the period 1980 to 2001. Decomposition of Malmquist Productivity Index reveals that technical change is the prime source of productivity increase. Lowering of tariff and relative adjustment of real effective exchange rate has contributed positively to productivity growth. Out of 18 industries favorable effects of effective protection, import penetration ratio and real effective exchange rate were vividly felt on productivity growth of two, three and three industries respectively. Increase in productivity growth was also felt through increase in firm size, real wage, increasein rate of real wage and lowering of the number of employees relative to worker. The need for undertaking industry-specific policies for promoting productivity growth is thus highlighted.

Structural Changes In The Indian Economy During The Pre-Reform And Reform Periods: An Analysis In The Input-Output Framework

Topic: Structural change
Author: Partha Pratim Ghosh
Co-Authors: Debesh Chakraborty

Economic reforms, when successful, should bring about perceptible structural changes in an economy. It is now nearly two decades since India initiated reforms in its economic policy in the early 1990-s. At this point of time, it seems worthwhile to assess the extent of structural changes in the Indian economy during the pre-reform and reform periods. The present paper uses Input-Output Tables of India (1983-84, 1993-94, 1998-99, 2003-04 and 2006-07) and devises a classification of sectors based on the pattern of input-usage, to study the structural changes in the Indian economy during the period 1983-83 to 2006-07. Three groups have been identified, namely the resource-intensive or Ricardo Sectors, the technology-intensive or High-Technology Sectors and the primary-factor-intensive or Heckscher-Ohlin Sectors. This type of classification has rarely been used in the literature. Under this three-fold classification of the sectors, linkages were developed using the extended Leontief and Ghosh type of Input-Output Model. The study reveals a fluctuating but declining importance of the resource-intensive or Ricardo Sectors during the entire period of study. The High-Technology-intensive sectors gained prominence during the early years of the reform period. Although there appears to be a decline in their importance in the middle years of the reform period, they pick up again during the later years of the reform period. Overall, the importance of the High-Technology-intensive sectors has increased over the years, even if modestly. The importance of the Heckscher-Ohlin Sectors has increased in the reform period compared to the pre-reform period in terms of the Leontief Forward linkages while no overall change is observed for these sectors in terms of the Ghosh Forward or Leontief Backward linkage. The paper also attempts to investigate the reasons for these structural changes. The study concludes by observing that overall, there have been some changes but not very sharp ones, in the structure of the Indian Economy.

Use of input-output tables in assessing national economic reform - Australian Productivity Commission experience

Topic: Australian Bureau of Statistics Special Session II
Author: Paul Gretton

The Australian Productivity Commission is the Australian government’s principal review and advisory body on microeconomic policy reform and regulation. Under its Act of Parliament, the Commission undertakes public inquiries and supporting research, and publishes its advice. An important part of the Commission’s work has been to report on the potential economic benefits of national reform programs in Australia. It has also examined the implications of possible international trade and regulatory policy developments for Australia and for the broader global economy. Economic modelling based on Australian and global input-output information has been crucial to meaningful reporting on these issues. This paper uses case studies drawn from the Commission’s experience to illustrate the importance of input-output data to effective policy analysis. It also highlights areas of recent improvement in input-output data and areas for future attention.

Merging the Hypothetical Extraction Method and the Classical Multiplier Approach: A Hybrid Possibility

Topic: Key sectors and multiplier analysis
Author: Ana-Isabel Guerra
Co-Authors: Ferran Sancho

There are two methodologies within the input-output approach liberally used in applied analysis: the Hypothetical Extraction Method and the Classical Multiplier Method. Among analysts, there is neither consensus about which of them is the most appropriate tool nor about their discrepancies. This paper tries to shed some light over
these still open questions proposing a hybrid possibility. This hybrid model allows isolating the out-sectoral effects from those that merely come from self-supply. The main advantage of merging the two approaches stems from measuring sectors' forward and backward "keyness" in terms of both economy-wide impacts and their sectoral distributive effects.

Input-Output Relation and Distribution of Emission-Recycling-Final Disposal Coefficients of Japanese Industrial Wastes at the Establishment Level

Topic: Enterprise input-output approach, environmental issues and policy making II
Author: Hitoshi Hayami
Co-Authors: Masao Nakamura

Technical coefficients should be stable if the "ceteris paribus" is established. But output-waste relations vary across establishments and by type of wastes. It causes uncertainty to the controlling authority such as the local government. There are a few establishments with extremely high coefficients of some specific wastes (such as animal and vegetable remnants, coal cinder etc.), and many establishments with relatively small or zero amount of wastes, although its pattern of distribution considerably differs by type of waste. It may give some reason for the authority to regulate quantity of waste in the upstream sectors. An empirical comparison with different industrial wastes can derive implications to CO2 emission that is almost no quantity regulation and of which coefficients per output are mainly determined by fuel consumption not concentrated in a few sectors unlike some industrial wastes (such as waste paper, scrap glass, etc.).

Economic growth, structural change and environmental pressures: The case of the Netherlands, 1950-2009

Topic: Structural change
Author: Rutger Hoekstra
Co-Authors: Jan Pieter Smits, Ruben van der Helm

During the twentieth century the Netherlands transformed from a low-energy economy into an economy that is known for its high level of energy use. The bulk of this transformation occured in the period 1950-1970. This paper examines the forces that lead to this rise in energy intensity and to the increases in emissions of CO2 and SO2 that were the results of this change in energy-intensity. By means of a structural decomposition of GDP growth, which is facilitated by the use of brand-new historical input/output tables, we try to assess which industries were responsible for the increase in environmental pressure in the second half of the twentieth century. This will enable us to come to a deeper understanding of the trade-offs between economic growth and environmental damage.

Besides, based on a new methodology, we try to measure the costs of the environmental damage that was created in the long-run. From an inter-generational perspective we will quantify these costs of environmental damage and relate them to the conventional GDP and productivity growth estimates (at industry level) to come to a new and deeper understanding of the ways in which the processes of economic growth and environmental damage are inter-related.

Attributing GDP growth to final demand categories

Topic: Final demand in input-output analysis
Author: Rutger Hoekstra
Co-Authors: Ruben van der Helm

For economists to analyse economic growth it is important to understand the underlying driving forces. Particulalry in the current volatile economic climate this type of analysis is vitally important. One of the analyses which is used is the attribution of GDP growth rates to final demand components such as household consumption, gross fixed capital formation and exports. Two methods are available: Firstly, there is the “net-exports method”. In this method, the growth rate is decomposed using a net measure for exports i.e. imports are subtracted from exports. Secondly, there is the “attribution method” which adopts input-output modelling techniques to decompose the effects of changes in final demand components. In this study we show that the "attribution method" is the preferable method but has greater data requirements. Empirical applications for the Euroarea and the Netherlands are used to illustrate the relevance of this method in understanding the current economic turmoil.

Physical input-output tables: developments and future

Topic: Multirregional input-output modelling
Author: Rutger Hoekstra

Physical input-output tables (PIOT) enjoyed a certain popularity in the 1990's and beginning of the millenium. The empirical work was followed by articles on PIOT modelling and applications. However, despite the potential benefits for environmental economics, there seems to be no large scale push to produce PIOT at National Statistical Institutes or elsewhere. This paper provides an overview of the literature on physical accounts (Physical supply and use tables (PSUT) and Physical input-output tables (PIOT)). A rudimentary PSUT for the Netherlands for the year 2006 is also presented as an illustration. We conclude that momentum has been lost because the literature has generated too few (or visible) applications that justify the large investments which are involved in the production of a PIOT. This paper proposes a number of directions for future research which could help to make the PIOT more relevant and cost-effective.

A complete overview of environmental input-output articles

Topic: Environmentally extended input-output analysis
Author: Rutger Hoekstra

It is often argued that environmental applications are a major factor in explaining the resurgence of input-output modeling over the last two decades or so. The aim of this article is simple: to provide an complete overview of articles that have applied environmental IO analysis. We have however limited

ourselves to articles that have appeared in peer-reviewed journals. For these publications we review the methods, time periods and countries investigated in the literature. We also track which methods, journals and authors have contributed to the growth in this field.

Asia beyond the Crisis: visions from international input-output analyses

Topic: Asia beyond the crisis
Author: Satoshi Inomata

Satoshi Inomata is the Project Director of the International Input-Output Project and the Director of Microeconomic Analysis Group, Institute of Developing Economies (IDE-JETRO). He received his B.A. in Politics and Economics from the University of London and M.Sc. in Development Economics from the University of Oxford. He has been involved in the construction of the Asian International Input-Output Tables (AIOT) for 1990, 1995 and 2000, the tables which cover nine East Asian countries and the United States. In 2007, he initiated and organised a new project, alongside of the 2005 AIOT, for constructing the 2005 BRICs International Input-Output Table that covers (for the first time ever) BRICs economies plus Japan, the U.S.A., and the EU. These new sets of data shall be available from IDE in the summer 2011.

Satoshi's keynote presentation will be on "Asia beyond the Crisis: visions from international input-output analyses". The characteristic feature of the current Global Economic Crisis is the speed and extent of the shock transmission. The rapid development of cross-national production networks over the past several decades has significantly deepened the economic interdependency between countries, and a shock that occurs in one region, whether positive or negative in nature, will be swiftly and widely transmitted to the rest of the globe. The "Economics of the Crisis", therefore, entails a detailed examination of the mechanics of shock transmission, by probing the labyrinth of complex supply chains among the countries. The paper aims to show the relevance of international I-O data as a tool to analyse the consequences of the Global Economic Crisis, and envisages the prospect of the post-crisis production system in East Asia.

Emissions Embodied in Danish Import. An Unidirectional Trade Model With 51 Countries.

Topic: Supply-use tables and National Accounts (Special session organized by the IOSG-IIOA)
Author: Peter Rørmose Jensen
Co-Authors: Thomas Olsen, Dennis Hansen

This paper deals with the job of moving away from the assumption that the amount of emissions embodied in imports is the same as if the imported products had been produced domestically. This has been dealt with in the literature for decades, but nevertheless it has been used by Statistics Denmark until recently. It is a very convenient but rather unrealistic assumption that most likely will lead to wrong results when the economic structures represented by the domestic input-output model and the emission intensities are very different from those in the import countries. Based on conclusions in recent research a full global multi-regional input-output model (MRIO) has been approximated by a unidirectional trade model including 50 countries plus the rest of the world and 59 industries and country specific emission intensities. Most important source of emission data as well as input-output data is EUROSTAT. Results show that estimates of CO2 emissions embodied in Danish imports had to be increased by 87 percent in 2005 when applying country specific models. Not surprisingly, emissions embodied in imports from China are underestimated the most, and the

only emissions that are overestimated are the ones embodied in the Danish imports from Norway and Sweden.

An Input-output Interpretation of Price Relationships in China

Topic: Input-output and prices
Author: Xu Jian
Co-Authors: Tong Rencheng

In China, CPI indices by commodity, PPI indices by industry and other price indices are published monthly. These price indices could measure the change in price of commodities at all stages from processing to selling. From the theoretical point, the change in price of certain commodity will either be transmitted forward by cost-pushing mechanism or be transmitted backward by demand-driving mechanism. Many papers have been done to empirically examine price relationship by using econometric models as VAR, Granger casual test, cointegration analysis and so on. For this issue, a major weak point of econometric models lies in that these models could examine whether or not there be significant relationship between two price indexes and could test casual relationship and estimate lead and lag relationships but they can not explain those results. Based on the Input-output model, this paper introduces both the forward linkage coefficients and backward linkage coefficients as the explanatory variables to predict association relationship among some important price indexes. This paper also introduces APLs, a indicator of measuring lengths of product chain, as the explanatory variables to predict lead and lag relationships among some important price indices. The empirical analysis has been done by using the price indices of China and 2007 IO table.

Accounting for Differences in ICT-Specialization across China: a New Aspect of Spatial Structral Decomposition

Topic: Sector specific analyses: services I
Author: Xuemei Jiang
Co-Authors: Bart Los, Erik Dietzenbacher

This paper explores the regional disparities of ICT development in China by comparing regional specializations of ICT industry. The spatial comparisons show that regional comparative advantages of ICT industry are quite incomparable with overall economic development. The rich coastal regions only show slight advantage over central regions. The western regions, however, is far behind central and costal regions except few exceptions. Based on a series of regional input-output tables, structural decompositions techniques are adopted to explore the empirical reasons of current disparities in specializations. In the process, a methodological contribution concerning spatial structural decompositions is also achieved by introducing spanning tree, decreasing variations of outcomes derived from different decomposition forms.

Detecting Energy Clusters from the Automobile Supply Chain: Spectral Clustering Approach

Topic: Supply chains
Author: Shigemi Kagawa
Co-Authors: K. Nansai, S. Suh, Y. Kondo

In this paper, we demonstrate that a popular heuristic approach, Spectral Graph Approach is very useful in addressing the industrial cluster problem (see section 1.1 of Spielman and Teng (2007) for the short history and Chung (1997) for the mathematical properties). In fact, although there are many applied researches in the field of parallel computing (e.g., Hendrickson and Leland, 1995) and image segmentation (e.g., Shi and Malik, 2000), it seems that there are very few researches which attempt to detect the industrial clusters using the spectral graph theory in the field of applied economics. In a related study, Aroche-Reyes (2003) definitely introduced a “network cut criterion” in order to draw the border of any cluster and identified a tree of the fundamental production structure for Mexico using the input-output tables. However, Aroche-Reyes (2003) did not employ the spectral graph approach but employed the Prim’s algorithm in order to detect the spanning tree of the Mexico economy. An important feature of the spectral graph theory is that the border of any cluster can be drawn based on a criterion (cut value, normalized cut value, and so forth) (see von Luxburg, 2007; von Luxburg et al., 2008). Hence, the spectral graph theory is called a monothetic method. The well-known block triangulation methods of input-output matrix also belong to a family of the monothetic methods, because they largely depend on a criterion of maximizing the degree of linearity and check the relevance of the matrix triangulation (see Simpson and Tsukui, 1965; Fukui, 1986; Howe, 1991; Dietzenbacher, 1996). We understand that both spectral graph partitioning and block triangulation from the input-output theory belong to a family. Applying the 2000 energy input-output database to the spectral graph partitioning method, we attempted to detect the environmentally important clusters from the supply chain of automobile sector which plays a crucial role in Japanese economy. Subsequently, we argued peculiar features of the energy intensive clusters of the Japanese auto sector and policy implications of effectively saving energy by cooperating between different sectors within the clusters.

A time series of global carbon footprints at high country and sector detail

Topic: International trade and environment
Author: Keiichiro Kanemoto
Co-Authors: Arne Geschke, Daniel Moran, Julien Ugon, Keiichiro Kanemoto, Manfred Lenzen, Pablo Munoz, Ting Yu

During the past decade, our understanding of climate change has improved, but with it, the future outlook has worsened. The problem of climate change is now perceived as more severe, more urgent, and as a result more political. The latter is reflected in increasing debates about the national responsibilities for the damages expected from climate change. In particular, exporters of emissions-intensive commodities now argue more strongly than ever for a consumer-responsibility principle. This principle has recently been underpinned by the concept of a carbon footprint, which is now highly topical both in academic and policy-making circles. Especially the carbon footprint of international trade is becoming a central issue in the debate about which nations should be shouldering the main burden for reducing global emissions. Multi-Region Input-Output (MRIO) analysis has played an important role in informing this debate. In this paper, we present the current state of a new Australian project aimed at calculating the carbon footprint of the global economy. This project distinguishes itself in that a) it provides a harmonised time series, b) our results can be deployed more rapidly thus supporting decision-making becoming more and more urgent, and c) our MRIO features unrivalled country and industry sector detail.

An Economic Analysis of the Mekong Tourism Brand in the Economic Corridors of the Greater Mekong Subregion: A Case Study of Lao PDR

Topic: Input-output studies on tourism issues I
Author: Bhoj Khanal

The Greater Mekong Subregion (GMS) Economic Corridors were established to encourage trade, investment and tourism and ease the cross-border movement of people and goods. The tourism infrastructure and institutional programs including border trade facilitation and harmonization are expected to enhance tourism and tourism related business in the GMS. The GMS Tourism Sector Strategy for 2006-2015 has given priority to develop the Mekong as a single destination to promote the “Mekong Brand Tourism” (ADB, 2005). Tourism is an important economic sector of Lao PDR and is rapidly becoming the major source of foreign exchange earnings and employment. A total of 1.6 million tourists generated US$233.3 million in 2007 making tourism among the top two foreign revenue earner accouting more than 7 percent of the national GDP (NSC, 2007). The GMS economic corridors have direct impacts on visitors arrivals in Lao PDR but there are concerns that the economic corridors play the role of transport corridor for the part of Lao PDR since only minimum economic activities are taking place (Mekong Institute, 2008).
Tourism expansion in Lao PDR is judged on the basis of gross values of macro-economic factors such as number of tourist arrivals, total earnings and contribution to the country’s balance of payment (LNTA, 2006). Additionally, tourism is not a separate entity in the sectoral classification of economic activities in Lao PDR. As a result, the tourism economic data should be disaggregated from many other related economic sectors. This study applies an input-output model to examine the economic impacts of tourism, interrelationship of other economic sectors using economic multipliers and backward forward linkages of tourism sector of Lao PDR. The input-output model in this research describes how the tourism sector is distributed throughout the economy of Lao PDR. The study also identifies the problems and obstacles of the tourism industry in Lao PDR. The research findings will provide the policy makers with a framework on tourism sector planning and investments and increase the tourism activities along the economic corridors of Lao PDR.

An optimisation approach for updating product data in supply and use tables

Topic: National Economic and Environmental Accounts
Author: Jeroen Kole

Statistics New Zealand has successfully applied a linear optimisation model to support the implementation of updated input and output product breakdowns in the supply and use framework.

Statistics New Zealand applies a supply and use framework to balance the annual current price production and expenditure estimates of gross domestic product (GDP). The balancing process requires up-to-date detailed product data by industry. The most recent product data was collected via a new range of specific commodity collections in the period 2003-2008. An optimisation model was developed to support the comprehensive implementation of the new product data in the balanced annual accounts for the years ending March 2006 and 2007.

The paper will describe the data collection strategy and supply and use framework, introduce the optimisation model and discuss how this was integrated in the supply and use balancing process.

The three standard phases in the supply and use balancing process are analysis of industry and final expenditure accounts, manual commodity balancing and an automatic iterative procedure

(RAS) to complete balancing. The optimisation model has been applied in an additional phase prior to manual commodity balancing. At the start of manual commodity balancing, industry specific input and output commodity proportions from the latest balanced year are applied to the current industry accounts. The idea behind the optimisation model is to start the manual commodity balancing with an improved set of balanced proportions based on the most up-to-date product data. This is important, because a large set of new and initially inconsistent data had to be implemented in a short period of time.

The model is a linear program, in which a "distance" to values reflecting new commodity proportions is minimised. Decision variables represent income (supply) and expenditure (use) values by industry and product, bounded by values reflecting old and new proportions. The linear constraints in the model reflect fixed industry income and expenditure totals and supply-use balance for all goods and services. The model uses the latest balanced year’s data, so it has always a feasible and optimal solution. The linear program effectively re-allocates the commodity proportions for this balanced year, such that the optimal solution is closer to the new proportions. These optimised proportions are used to create an improved starting point for manual commodity balancing of next year’s accounts to be balanced.

An important part of the additional phase was a review of the new product data from an industry and product perspective. The industry review checked that the product data for each industry was representative for the years ending March 2006 and 2007. Aim of the product review was to resolve obvious consistency and plausibility issues around use and supply of goods and services. The optimisation model was used in an iterative process. Optimised proportions were applied to the years to be balanced. Review of the resulting accounts and imbalances lead to further improvements to the product data. This was repeated until no further significant reduction of imbalances could be achieved. The remaining data inconsistencies in the supply and use system have been resolved with manual balancing and RAS.

Statistics New Zealand has published annual balanced accounts up to the year ending March 2007 in November 2009. The intention is to compile and release supply and use and input-output tables in basic prices containing the updated product data.

The combination of manual and automatic balancing techniques to introduce a large amount of new data in the supply and use framework has been challenging but very successful. The model could be extended with variable industry totals and final expenditure data, and weights reflecting reliability of data sources. Intention is to continue and further develop this optimisation approach.

What can post-Keynesian input-output models tell us about social sustainability?

Topic: Classical-Keynesian input-output models
Author: Tobias Heinrich Kronenberg

Sustainable development is a multi-dimensional concept. According to the ‘three pillars model’, a distinction is made between environmental, economic, and social sustainability. Historically, most empirical models have focussed on environmental and economic aspects, while the social dimension has been somewhat marginalised. As social tensions are currently increasing in many countries, model-based studies should pay more attention to questions of social sustainability. We argue in this paper that post-Keynesian input-output models are particularly well suited for studying certain aspects of social sustainability, notably unemployment, the distribution of income,

and fiscal sustainability (i.e. public debt). From a theoretical viewpoint, our conclusion is not surprising, because the main goal of the early post-Keynesians was to understand the complex relationships between unemployment, income distribution and GDP growth. Since Keynes had highlighted the special role of government expenditure in aggregate demand, there was also a close link with fiscal policy. Moreover, post-Keynesian theory (or at least its 'Sraffian' stream) has always acknowledged the importance of structural change, leading to a preference for multisectoral input-output models over highly aggregated 'macro' models. Therefore, an empirical input-output model based on post-Keynesian theory can be a useful tool for understanding certain aspects of sustainability.
In order to illustrate this argument, we construct a post-Keynesian input-output model for the German economy and use it to analyse policy measures from a sustainability perspective. The model involves a highly disaggregated input-output structure of the German economy and a full representation of the circular flow of income between households, firms, the state and the foreign sector. In line with post-Keynesian theory, final demand consists of autonomous and induced components. In the household sector, two types of households are distinguished according to their main income source (labour or capital income). Investment is modelled as depending on capacity utilisation, giving rise to a sort of 'supermultiplier'.
The model is then used to explore the effects of two policy measures that are frequently suggested in the sustainability debate. The first is a shift from material consumption (industrial products) to immaterial consumption (services). The second is a massive investment programme in energy-saving technologies financed by the federal government. The model suggests that these policy measures do not generally improve all indicators of sustainability. In the first case, unemployment is reduced, but the income share of capital rises at the expense of labour. While the increase in employment is beneficial, the altered distribution of income may be problematic for social sustainability. Such findings provide further support for adopting a multi-dimensional approach to sustainability. Post-Keynesian input-output models can make a useful contribution to studying important aspects of social sustainability, especially those involving structural change in the distribution of consumption expenditure and income.

Analyzing Impacts of Fuel Constraints on Freight Transport and Economy of New Zealand: an Input-Output Analysis

Topic: Energy input-output analyis I
Author: Aline Eloyse Lang
Co-Authors: Andre Dantas

Our actual society is dependent on enormous amount of energy, which fuels our vehicles, heats and cools our buildings, powers our technology, enhances our agriculture, and makes possible every aspect of our extraordinary way of living. However, in the past few years, there has been convincing evidence of future fuel constraints due to supply limitations. Lately, various governments have admitted the probability of fuel restrictions in the future and others have also forecasted high likelihoods of increases in fossil fuel prices due to scarcity effects. The data suggests that Peak Oil-related shortages are likely to happen soon. There is a 85% probability of 10% shortages by 2015.

There is limited knowledge about the fuel shortages impacts on freight transport. The New Zealand economy is studied and more specifically the freight transport sector is investigated. Scenarios of 5% and 10% of fuel availability reduction are analysed. According to the supply constraint I-O model the most affected sector in relative terms would be the freight transport sector due to its high dependence on fossil fuels. Two main findings can be drawn from a comparative analysis against a

business as usual (BAU) scenario using the supply constraint input-output, the standard input-output and the so called supply driven input-output. Firstly, the state of the art of modelling techniques is likely to underestimate total impacts of fuel constraints. This is particularly concerning, giving the long implications of transport policies. Secondly, it was observed that if no actions were taken to mitigate impacts of fuel constraints, the total impacts on the fuel sector, freight transport sector and on the whole economy on middle to long term tend to be significant.

CO2 emissions embodied in the Australian international trade in goods

Topic: Australian Bureau of Statistics Special Session I
Author: Gregory Legoff

Carbon leakage through international trade has been identified as a limitation of global reduction in CO2 emissions. Indeed, the relocation of production activities from less carbon-intensive economies to more carbon intensive economies increases the global production of CO2. Because it is a major issue in climate change policies, there is an increasing interest in consumption based emissions as opposed to production based emissions. Assessing carbon emissions based on consumption provide a more accurate role of each individual country in global CO2 emissions. The Input-Output (I-O) tables provide details about the production and use of goods and services within the economy. Using I-O tables in conjunction with trade statistics allows determining the net CO2 emissions embodied in international trade. The difference of emissions embodied in exports minus imports is also the difference between production based emissions and consumption based emissions. The methodology implemented in this paper is based on the OECD approach developed by Ahmad and Wyckoff (2003) and Nakano, S et al (2009) . The latest OECD study was using 1998/99 Input-Output tables for Australia and provided a net trade balance of 16Mt CO2 meaning that Australia was a net carbon exporter. The objective of this paper is to update this estimate using the latest 2005-06 ABS Input-Output tables and when possible, to use more detailed data at the industry level.

A global multi-region input-output time series at high country and sector detail

Topic: International trade and environment
Author: Manfred Lenzen
Co-Authors: Arne Geschke, Daniel Moran, Julien Ugon, Keiichiro Kanemoto, Pablo Munoz, Richard Wood, Ting Yu

There are a number of initiatives aimed at compiling large-scale global Multi-Region Input-Output (MRIO) tables complemented with non-monetary information such as on resource flows and environmental burdens. Traditionally, MRIO construction and usage has been hampered by a lack of geographical and sectoral detail; currently the most advanced initiatives opt for a breakdown into around 50 regions and 120 sectors common to all countries. Further shortcomings are the absence of a continuous time series, margins and tax sheets, and information on reliability and uncertainty. Despite these limitations, constructing a large MRIO requires significant manual labour and many years of time. This paper describes an Australian project aimed at creating an MRIO account that: represents all countries at a detailed sectoral level, allows continuous updating, provides information on data reliability, contains table sheets expressed in basic prices as well as all margins and taxes, and contains a historical time series. We achieve these goals through a high level of procedural standardisation, automation, and data organisation. Because of the properties listed above, our research is aimed at achieving a quantum leap in MRIO compilation.

Input-Output Analysis for Business Planning: A Case Study of the University of Sydney

Topic: Enterprise input-output approach, environmental issues and policy making II
Author: Manfred Lenzen
Co-Authors: Stefan Wisniowski, Tess Howes, Joy Murray, Chris Dey, Linda Schofield, Geoff Barton, Don Taylor, Charlie Benrimoj, Bob Kotic

We present a multi-region input-output (MRIO) model functioning as an enterprise IO model, where the University of Sydney is embedded in the Australian economy. This model forms the centrepiece of a new data-driven framework for strategic forecasting and planning of the university's financial operations. It incorporates both Leontief's well-known demand-pull, as well as Ghosh's supply-push exercise. It is therefore able to estimate the immediate financial implications for the university, and the economy-wide flow-on effects, for example as a result of changes in demand for courses by students, or as a result of changes in the supply of labour such as wage increases. We report on recent scenario studies on the financial performance of the teaching and research functions of the university, and the lessons learned for management practice. Our work breaks new grounds in a number of ways. According to our knowledge, our enterprise model:

- is the largest so far in terms of its number of sectors,
- is the first subjected to the Ghosh supply-push calculus,
- is the first to investigate system closure, and
- is the first to feature an application of Structural Path Analysis.

Thus, the novelty of this work lies not so much in the techniques used, but in their application to a very large enterprise input-output model. In particular our work shows how demand-pull and supply-push exercises, as well as closed-system model results can be interpreted and used for internal decision-making.

A Structural Growth Model and its Applications to Sraffa's System

Topic: Leontief Prize 2010 Awards
Author: Wu Li

This paper presents a discrete-time growth model based on the classical growth framework to describe the disequilibrium dynamics of an m-agent, n-good economy. And an exchange function is formulated to describe the exchange process among agents, which serves as the exchange part of the growth model. For concreteness a system of Sraffa (1960) is utilized to exemplify the growth model and simulations are performed. First, business cycles in the growth model are discussed, which are found to be limit cycles in some sense. Then a method is presented to compute the equilibrium land rent in a Sraffian system including homogeneous land, and the fluctuation of land rent is also simulated. Finally, the system of Sraffa is extended to a two-country economy, and the dynamic economic effects of free trade and trade protectionism are investigated.

Technical choice problem of wastewater treatment input output model

Topic: Physical input-output tables
Author: Chen Lin

In order to discuss the technical choice problem concerning wastewater treatment, this study proposes a new linear programming extension of wastewater treatment input output model W2IO) given by Lin (Hybrid Input-output Analysis of Wastewater Treatment and Environmental Impacts: A Case Study for the Tokyo Metropolis, Ecological Economics 2009, 68(7)). By using the data from Tokyo metropolis, this model is applied to obtain the optimal wastewater treatment options under alternative scenarios. We found that different scenarios give different optimal technical combinations. Thus, there are trade-off relationships among various types of environmental load. Finally, the Pareto frontiers of environmental loads are derived to show the trade-off relationships and the effect of the introduction of high temperature incineration of dewatered sludge on the generation of environmental loads. The main conclusion of the study is when all three types of environmental load (landfill volume, CO2-equivalent, and chemistry oxygen demand) are taken into account, the introduction of the high temperature incineration causes the widening of the Pareto frontier of environmental loads and also causes it to move closer to the origin.

Measuring Embodied Emission Flows for the Interdependent Economies within China

Topic: Sector specific analyses: services II
Author: Martin Soeren Lindner
Co-Authors: Dabo Guan, Klaus Hubacek

In the past 30 years the power sector in China has undergone rapid growth. 80 percent of the capacity stems from firing coal; and since 2005 China has built approximately 1.5 GW of coal-fired power plants weekly. While energy consumption tripled between 2002 and 2008, CO2 emissions from China’s power sector currently accounts for 35 to 40% of all emissions from fossil fuel combustion and contributes to China’s high energy intensity and high emissions. Decarbonising regional power sectors would thus be a fundamental contribution to counteract global climate change and China is self-motivated as well as pressured by international communities to transform its economy towards low carbon technologies. Prior to Copenhagen the country announced to place its climate change commitment of “reducing carbon intensity by 40% to 45% by 2020 relative to 2005 level” in its forthcoming 12th and 13th ‘Five-Year’ Plan. Decarbonisation in the power sector is a key to accomplish these targets. In this paper, firstly we develop a Chinese domestic multi-regional input-output (MRIO) model, which allows us to assess key drivers of energy demand and CO2 emissions in regional power sectors in China. Secondly, we integrate a multi-regional bottom-up technology-option model into the power sector of our MRIO model, which evaluates technology differences and possible pathways to decarbonise the power sector in different Chinese regions.

Evaluating Chinese Household Consumption Potential, Their Export Replacement Capacity and Pulling Effect on Chinese Economic System amid the 2008 World Financial Crisis

Topic: Input-output applied to social issues II
Author: Xiuli Liu

To further expand domestic demand is an important and effective means of China response to the world economic and financial crisis since 2007. To expand the residents' consumption is the key of it. With the 2007 China input-output table at current price, this paper analyzed and compared the consumption structure of rural and urban residents in 42 sectors in 2007, then used 1992, 1997, 2002 and 2005 input-output tables at constant price, analyzed the change rule of the consumption structure among industries of Chinese rural and urban residents. Based on these,the model to evaluate the residents' consumption potential and their export replacement capacity of each sector is presented. Applied the model, the rural and urban residents' consumption potential in 42 sectors in 2010 and their export replacement capacity were evaluated. Then models to evaluate the pulling effect of residents' consumption potential on the value added of each sector, on the GDP and its consumption multiplier were presented. Applied these models in assumed scenario, we found that the residents' consumption potential will pull China's GDP in 2010 increase 4.1%. Finally, policy suggestions to expand residents' consumption to response to the world economic and financial crisis were provided.

An Empirical Evaluation of Methods to Estimate Use Tables of Imports

Topic: World Input-Output Database I: Contruction issues
Author: Bart Los

Nowadays, national input-output tables are usually constructed by combining supply and use tables. If this "best practice" is adopted for the construction of international input-output tables, a first necessary step is to separate use of imports from use of domestically produced products. Since most national statistical agencies do not provide such pairs of use tables at an annual basis, both tables have to be estimated. In this paper, we will introduce and evaluate some methods that could be used for this purpose. The main assumption is that at least one pair of split use tables is available, besides a complete time series of use tables for domestic products and imported products together.
The evaluated methods differ with respect to the type of coefficients that are assumed to be constant, the treatment of the columns related to changes in inventories and the choice with respect to estimating imported use and treating domestic use as a residual, or vice versa.
The relative performance of the methods is evaluated for a number of countries for which multiple benchmarks are available. We use one benchmark to estimate others, mimicking a situation in which these would not have been available. By comparing the estimates with the "true" values contained in the available tables, we obtain indications of the margins of error of the evaluated methods.

A Preliminary Series of Worldwide Intercountry Input-Output Tables

Topic: World Input-Output Database II: Methods and applications
Author: Bart Los
Co-Authors: Robert Stehrer

The construction of a time series (1995-2006) of full intercountry input-output tables is an essential part of the World Input-Output Database (WIOD) project. On the basis of a set of harmonized supply and use tables for more than 30 countries (reconciled with their national accounts data) and detailed data on international trade, such "worldwide" tables will be produced. This working paper reports on the construction of these tables and discusses solutions chosen so far to deal with the variety of problems that are encountered. Furthermore, it presents some simple descriptive input-output based indicators derived from the preliminary set of tables. Most attention will be paid to indicators related to the effects of increasing globalization at the industry level. The paper concludes with a brief look ahead, focusing on conclusions that will imply differences between the preliminary series of worldwide tables and the final series, which should be ready in 2012.

The general interregional quantity model - multiplier experiments with a sub-regional model for Denmark

Topic: Multirregional input-output modelling
Author: Bjarne Madsen

Taking the Leontief and Miyazawa formulations of the interregional economic quantity model as the point of departure the general interregional static quantity model is developed. This model, which essentially is local rather than regional, incorporates a number of conceptual and theoretical changes, which have become necessary as economies become more diverse and differentiated. There is a need to integrate essentially subregional and local/urban activities covering such areas as commuting, shopping, tourism and trade into a general interregional modelling framework. The theoretical changes examined include a set of new geographical concepts and in the context of an interregional SAM the development of the two-by-two-by-two approach, involving two sets of actors (production units and institutional units), two types of markets (commodities and factors) and two locations (origin and destination). The equations of the general interregional quantity model are presented together with the solution of the model.
Multiplier experiments with a model covering 98 Danish municipalities are presented. Size of multipliers are explained by openness of the sub-municipality areas, such as interregional import- and export shares, in- and out-commuting patterns, shopping and tourism travelling patterns etc.

Urbanicity and rurality - Islands economies, social accounting within sub-municipality framework

Topic: Input-output applied to social issues I
Author: Bjarne Madsen

Islands economies are normally analyzed within a one-region frame-work, either with islands as nations or with islands as regions within a nation. In this paper islands are seen as a multi-regional urban / rural system within a region, which in turn is a region within the nation.
In this paper islands economies are analyzed within an interregional social accounting framework based upon the two-by-two-by-two principle. Within this principle two actors (island producers and

households), two markets (island commodity and labor markets) as well as origin and destination of internal and external islands flows are identified. Normally analysis of island economies emphasizes the place of production, sectoriel as well as the rural aspects of islands economies. In this paper island economies are analyzed within a fully fledged interregional and urban/rural social accounting framework. Firstly, this involves a distinction between primary income, reflecting place of production and income in production by sector and secondary income, reflecting residential and type of household aspects of the islands economies. Secondly, it involves a distinction between place of residence and place of commodity market, where one part of consumption is external (tourism) and the other is local or island own consumption. Thirdly, production activity (primary income) and residential income (secondary income) are divided according to rural and urban location as well as the internal and external interaction between production and income.
Data from interregional social accounting matrices for Danish municipalities divided into urban and rural areas is presented. Of the 98 Danish municipalities 8 are islands. In the empirical analysis focus is on the distinction between primary and secondary income. The examination reveals that island economy reflect remoteness of islands from urban centres, transportation structure (bridges / ferries), sectoriel structure as well as structure of demand. Finally, it reflects the interest burden for agricultural production in general is high, which in turn reduces the average secondary income compared to the average primary income.
An interregional input-output quantity model for islands economies is presented. Results from multiplier analysis are presented.

Teaching Session 1: Supply and Use Tables and links to Symmetric Input-Output Tables

Topic: Supply and Use Tables and links to Symmetric Input-Output Tables (session organized by the Input-Output Statistics Group of the IIOA)
Author: Sanjiv Mahajan

Over the past 20 years, the role and use of the Input-Output (I-O) framework has developed rapidly within National Statistical Institutions (NSIs), and beyond. In particular, several NSIs produce Supply and Use Tables as the natural framework to bring together components of the three approaches to measuring Gross Domestic Product (GDP), and in turn, when balanced, determining GDP both in current prices and in volume terms. This training module arranged by Sanjiv Mahajan (Member of the IOSG Board) helps to provide an overview of Supply and Use Tables and their links to the more traditional symmetric I-O Tables.
These training sessions at the IIOA Conference form the first of a series of IOSG led teaching sessions. The training modules are being provided with the aim of developing greater understanding for both producers and users as well as developing more detailed and stretching sessions for the future.

The above aspects will lead to a practical exercise. The attendees will have a simple case study and will be requested to populate and balance a simple Supply and Use Table. Two points for attendees to note:

• Basic awareness of the national accounting framework would be desirable but not essential.
• Please bring along a pen and calculator.

This specific module aims to:
• Describe key features, identities and structure of Supply and Use Tables.
• Briefly highlight allocation of economic transactions in the framework (in line with the 2003 SNA).

Teaching Session 2: Supply and Use Tables and links to Symmetric Input-Output Tables

Topic: Supply and Use Tables and links to Symmetric Input-Output Tables (session organized by the Input-Output Statistics Group of the IIOA)
Author: Sanjiv Mahajan

This specific module aims to:
• Focus on terminology and different types of classifications, for example, industries and products.
• Provide examples of the main sources of data.

Teaching Session 3: Supply and Use Tables and links to Symmetric Input-Output Tables

Topic: Supply and Use Tables and links to Symmetric Input-Output Tables (session organized by the Input-Output Statistics Group of the IIOA)
Author: Sanjiv Mahajan

This specific module aims to:
• Illustrate how the estimate of GDP can be derived from Supply and Use Tables using the three different approaches.
• Provide a schematic showing the links between Supply and Use Tables and Symmetric I-O Tables (both in current prices and previous years' prices).

How do we manage our local environment in the face of global uncertainty and complexity?

Topic: Climate policy issues: analyses
Author: Bonnie McBain
Co-Authors: Manfred Lenzen

It is becoming clear that the environment can no longer be managed successfully as a portfolio on its own. Resilience science shows us that that the environmental, social, economic aspects of our society are interlinked not only at many different spatial scales but also over time. Such complex adaptive systems have non-linear relationships and feedback loops which means that the behaviour of the system cannot be predicted by understanding the individual mechanics of its component parts or any isolated pair of interactions. How are decision makers to make sophisticated, justifiable decisions which protect the environment in the midst of such complexity and within the context of such future global uncertainty? We investigate this predicament using the Ecological Footprint (an environmental indicator of human consumption). We investigate the repercussions of a number of global scenarios upon sub-national jurisdictions by using input-output analysis to model Ecological Footprints 50 years into the future. A global MRIO forms the core of our model, where each country is represented by final demand, gross output, and a set of satellite accounts in terms of land use, emissions, energy use, etc. The causal relationships between the variables are formulated as a system of first-order differential equations. An iterative finite-differences algorithm progresses this system over time and space, connecting environmental state variables (land use, energy consumption, etc) with economic variables. The use of global MRIO allow us to demonstrate the global considerations environmental decision makers at smaller scales need to anticipate, such as the impact of globalised trade with its complex supply chains

Impact of the Global Economic Crisis on Employment in the Asia-Pacific Region

Topic: Asia beyond the crisis: visions from international input-output analysis
Author: Bo Meng
Co-Authors: Satoshi Inomata

Paper 2 succeeds the analytical focus of Paper 1, yet shifts its attention to employment issues. It devises the indices of “employment gain potential” and “employment give-out potential”, which measure the balance of employment opportunities for each country brought about by the engagement in international trade. The combination of both indices shows that, in the Asia-Pacific region, China is the biggest receiver of job opportunities, while the U.S.A. is the most benevolent provider. From 2000 to 2008, however, there was a marked structural change in the gain/give-out relationship of the region. China continues to benefit from the U.S.A.’s strong demand for its exports, yet started to give out job opportunities to other neighbouring countries through the increase in its import demand for intermediate goods from the same. Here, the emergence of “triangular trade through China” is also observed. What happened in the commodity markets was echoed in the labour markets in the Asia-Pacific region.

Paper 2 also contributes to the analysis by calculating the impact of the Crisis on regional employment. By using the same analytical framework as in Paper 1 but extending the model of “employment multipliers”, the paper simulates the potential number of job losses in each country for the years 2008 and 2009. A particular focus is placed on the “transfer of unemployment” between countries, in which China is again found to be the main transmission hub for Asian countries.

Alternative Measurement of Vertical Specialization using a Ghosh Supply-driven Input-Output Model

Topic: Supply chains
Author: Bo Meng
Co-Authors: N. Yamano

Import contents of export based on the traditional Leontief demand-driven input-output model has been widely used as an indicator for the degree of globalization. In this paper, we propose an alternative measurement to capture the vertical specialization from the viewpoint of activity of multinational enterprises based on the Ghosh supply-driven input-output model. Using the cross border flow data of multinational enterprises (AFA/FATS) and the OECD Input-Output database, the new measurement is applied to selected OECD countries to illustrate the different perspective of the international production network.

A micro-founded Hybrid Input-Output framework

Topic: Climate policy issues: tools
Author: Stefano Merciai

Input-Output Table (IOT) is a very common tool used both for accounting and for analytical purposes. Actually many monetary and physical IOTs have been built in several countries but there are still some limits and discrepancies between the two as stated by Weisz and Duchin (Ecological Economics 2006 57, 534-541). To overcome these problems an IOT is built starting from Supply and Use tables in a hybrid framework, i.e. a micro founded Hybrid Input-Output Table (mHIOT). Here, a

hybrid framework means that each commodity is accounted for using its own characteristic unit – kg, kWh, m2, m3, km, hours etc. Moreover the mHIOT has an asymmetric structure, i.e. commodity by activity, and relies just on by-product technology hypothesis. These assumptions simplify the transformation of SUTs to IOT and, at the same time, the IO modelling has a higher consistency with real processes. For example processes of recycling and uses of packaging can be easily introduced. Furthermore, in this framework, by introducing characteristic vectors and matrix of prices, an analyst may easily move from physically-accounted levels, including for example natural resources and emissions, to monetary one, where values added are displayed, and vice versa.
The paper analyzes the demand-driven model upon a micro-founded hybrid framework. It is showed that the (physical) demand might be not equal to the (physical) production because an overproduction can occur. That is a logical consequence of an approach based on by-product technology hypothesis.
In addition to this, the hybrid framework allows the determination of environmental pressures of human activities and, at the same time, offers information about the value-added chain. The latter, due to the presence of the matrix of prices, is calculated in a more general way compared to the usual method where just a vector of prices is considered. Indeed, value-added ratios are determined by the real transactions generated to satisfy the demand hence, because a price might differ per purchaser, they are not calculated a priori.
To conclude, a numerical example resuming most of the concepts showed in the paper is included. Starting from a very polluting situation, two alternative green scenarios are discussed: the first one consists in increasing of recycling activities and the second one in a shif to renewable energy production. Environmental and economic effects of both scenarios are discussed.

Effect of Changing Energy Prices on Household Expenditure with Emphasis on Industry and Transportation: Preliminary Evidence from Malaysia

Topic: Energy input-output analysis II
Author: Narges Moradkhani
Co-Authors: Anuuar Md Nassir, Taufiq Hassan, Zakariah Abd Rashid

Abstract
This paper evaluates change in prices of different kinds of energy such as crude oil, natural gas & coal, petroleum production and electricity & gas on the household expenditure especially in the industrial and transportation sectors which are major users of energy in Malaysia. We use the IO table of Malaysia for the year 2000* as a reference point and close input-output model applied in this paper. This paper separated primary and secondary energy. The results show that doubling the price of primary energy more affected the prices of other goods and household expenditure compared to doubling electricity prices. By doubling all kinds of energy prices the bottom quintile of the population is more than vulnerable than the top quintile in the housing, water, electricity & gas group but in the transportation top quintile is more affected than bottom quintile, without considering absolute amount of their expenditure.
Key word: input-output technique, energy prices, household expenditure, Malaysia
* By January 2010, maybe the input-output table of 2005 published so we'll apply that table.

Using an Input-Output Framework for Double-Deflated Quarterly U.S. Gross Domestic Product by Industry: Methods, Initial Results, and Future Plans

Topic: Supply-use tables and National Accounts (Special session organized by the IOSG-IIOA)
Author: Brian C Moyer
Co-Authors: Carol A. Robbins, Thomas F. Howells III

The financial and economic crisis of 2008 and 2009 has focused attention on the statistical data available to understand the contributions made by different industrial sectors to aggregate economic activity. While many developed economies produce quarterly, or even monthly, statistics on gross domestic product (GDP) by industry, the U.S. Bureau of Economic Analysis (BEA) currently releases these statistics only on an annual basis. This paper provides a first look at experimental, double-deflated quarterly GDP by industry statistics prepared in a balanced I-O framework and compares these with a set of statistics produced using single-deflation. While single-deflated quarterly GDP by industry statistics have also been shown to provide a good indicator for the direction and magnitude of changes in the industrial composition of the U.S. economy, sensitivity to price changes appear to be better captured by double-deflated industry statistics that take into account price changes in both outputs and inputs. This appears to be especially true at turning points in the business cycle.

Study on Multi-objective Optimization of Export Commodity Structure Based on Non-competitive Input-Output Analysis

Topic: Bias and estimation methods in input-output tables
Author: Zhirui Mu
Co-Authors: Cuihong Yang

After 30 years of reform and opening-up, China’s total foreign trade volume has grown from 20.6 billion U.S. dollars in 1978 to 2.5 trillion U.S. dollars in 2008, but in the meantime it has also paid huge costs of energy shortage and environmental pollution for this. So it is helpful and significant to analyze the effects of export on the economy, employment, energy and environment in a comprehensive way, to optimize the export structure by coordinating the conflict among the four aspects so as to heighten China’s international competitiveness and to promote the sustainable development of its foreign trade.

The first part of this paper sets up the principles of optimizing export structure aiming at the effects of the export on economy, employment, energy and environment, and then establishes a multi-objective programming model. Finally, it obtains the optimized export structures under different trade patterns on the basis of China’s non-competitive input-output table capturing processing trade for 2002.

It is worth mentioning that this paper applies the non-competitive input-output model capturing processing exports to optimize the export structure to differentiate the effects of different trade patterns, which is more helpful to clarify the direction of structure optimization.

The main conclusions are as follows.

First, the results by the multi-objective model show that it can improve the comprehensive effects of export by increasing the export ratio of the sectors of higher value-added and employment and of lower energy consumption and pollution and at the same time by reducing that of those of the

contrary characteristics.

Second, for the two trade patterns of processing export and non-processing export, the positive effects on economy and employment of the latter is lager than the former, and the negative effects on energy and pollution are also bigger than the former. But on the whole, the optimization results show that we should reduce the ratio of the processing export and increase that of the latter accordingly.

Macroeconomic impacts of the bio-fuel sector in Canada

Topic: Energy input-output analyis I
Author: Kakali Mukhopadhyay
Co-Authors: P. Thomassin

The government of Canada, like many others around the world, have recently considered bio-fuels as an opportunity to address some of their policy challenges: climate change, rural development and diversification of energy supply.
The production and use of first-generation bio-fuels has been increasing rapidly throughout the world. In 2000, total world production of ethanol for fuel was less than 20 billion liters and by 2005, production had more than doubled to over 45 billion liters. This provided about 3% of the motor gasoline use in the world, with a slightly smaller percentage in North America.
Canada currently produces 1.4 billion liters of ethanol annually, with the incoming mandates creating a need for 2 billion liters in total. Capacity for at least another 300 million liters annually is being planned. The federal government's Renewable Fuels Strategy announced in December 2006 established a 5 percent threshold level of ethanol by volume in all ground transportation fuels sold in Canada by 2010 and a 2 percent federal mandate for renewable content in diesel takes effect in 2011. The amount of ethanol required to meet this commitment is 2 billion litres. This will require a substantial expansion of ethanol production in Canada. It is expected that corn and other grains, in particular wheat, will be the predominant feedstock for this expansion of the fuel ethanol sector in both Canada and the United States.
Kyoto Ratified by Canadian government in 2002. In view of that GHG emissions should be reduced to 94% at 1990 level. Canada has exceeded their Kyoto target by 34.2%. By 2012 Canada has committed to meet a Kyoto target of 556.5 Mt of greenhouse gas emissions, but since 1990 has risen steadily topping 747 Mt in 2007. Total greenhouse gas emissions in Canada in 2007 had risen to 747 Mt. This meant that Canada exceeded Kyoto target of 556.5 Mt by more than 34%. Over the past year emissions have increased in every sector. Most notable however was the 276% increase from mining emissions since 1990.
To tackle the emissions and tap the renewable sources, the Government of Canada plans to increase production and use of ethanol and other bio-fuels. By 2010, at least 35% of Canadian consumption of fuel will be E10. To meet target, ethanol production must increase from 63 m gallons to 370 m gallons.
All these developments related to the Bio fuel sector will have macro economic impacts on the Canadian economy. The paper aims at estimating the macro economic impact of the Bio fuel sector in Canada.
An input-output model of the Canadian economy is developed to estimate the macroeconomic impact of the Ethanol production in Canada. Input-Output table is prepared to include the Ethanol sector in the economic system of Canada. Several modifications have been made in the Use and Make matrix of Canada, 2003. Originally the Use and Make table of Canada consists of 697 commodities, 16 primary inputs, 286 industries, and 168 final demand categories at Worksheet level. For the purpose of the model, we have aggregated 697 commodities into 125 including 25

detail agricultural commodities. The rest of the commodities have been aggregated to 100 and 16 primary inputs have been aggregated to 11. Like commodities, the scheme of detailed agricultural sector has also been applied to industry aggregation in make and use table of Canada. The Industries are aggregated to 84 from 286, and final demand to 7 categories from 168 including private consumption, investment, change in stock, govt. expenditure, export, re-export and import. Thus Use matrix consists of 125 commodities and 84 industries, 11 primary inputs and 7 final demand categories; and Make matrix consists of 84 industries and 125 commodities. To consider bio-fuel sector in the Make and Use table of Canada 2003 we have included two new industries - bio-fuel and E10. The four new commodities have been entered in the list - ethanol, E10, DDG and CO2. Finally, the number of industries and commodities will be 86 and 129.
The impact matrix is estimated from an Input-output model that estimates the direct plus indirect impacts on the Canadian economy, 2003. This model has been closed to the household sector in the economy by endogenizing this sector into the model. The closed version of the model estimates the direct, indirect and induced changes in industrial output required to satisfy a change in the final for commodities. Some simulation exercises have also been attempted to reach the Kyoto target of Canada at 2012 through increased ethanol production and also the policies of reducing the demand for gasoline through increasing the demand for ethanol production. Results show that the macroeconomic impact of ethanol sector leads to increase in industrial output and employment. The agriculture sector makes necessary adjustments to meet the demand for ethanol product. The petroleum industry is also affected. The paper concludes with several policy suggestions.

The Sustainability Practitioner's Guide to Input-Output Analysis

Topic: Input-Output Guides
Author: Joy Murray
Co-Authors: Richard Wood

The Sustainability Practitioner's Guide to Input-OUtput Analysis.

Edited by Joy Murray and Richard Wood.

Hybrid LCA of a new technology for design of disassembly based on smart materials

Topic: Environmantal Life Cycle Assessment analyses
Author: Shinichiro Nakamura
Co-Authors: Eiji Yamasue

In the current recycling system of end-of-life (EoL) appliances, which is based on shredding, alloying elements tend to end up in the scrap of base metals. The uncontrolled mixing of alloying elements contaminates secondary metals and calls for dilution with primary metals. Active disassembling fastener (ADF) is a design for disassembly (DfD) technology that is expected to solve this problem by significantly reducing the extent of mixing. This paper deals with a life cycle assessment (LCA) based on the waste input-output (WIO) model of an ADF developed using hydrogen storage alloys. Special attention is paid to the issue of dilution of mixed scrap using primary metals. The results for Japanese electrical and electronic appliances indicate that although the use of the ADF increases the emission of CO2 as compared to the conventional system based on shredding, the advantage of eliminating the dilution process by the use of ADF outweighs this disadvantage.

Finding a Global Energy and Resource Network in a Product Supply Chain using a Global Link Input–Output Model

Topic: Supply chains
Author: Keisuke Nansai
Co-Authors: Kenichi Nakajima, Rokuta Inaba, S. Suh, Shigemi Kagawa, Y. Kondo

Decoupling greenhouse gas (GHG) emissions from economic growth is an important global challenge. The Japanese economy is no exception. For such a decoupling, it is inevitable that new low-carbon technologies and products be rapidly developed and widely introduced into the Japanese economy. Increased material consumption is sometimes necessary to spread new technologies such as electric vehicles, fuel cells, and solar panels. However, because Japan lacks domestic natural resources, the Japanese economy is founded upon consumption of large amounts of imported natural resources. Especially, dependence on imported mineral and energy resources is extremely high. Recently, not only have imports of natural resources increased; imports of manufactured products have increased as well. Considering this reality, the materials needed for new technologies also are expected to be dependent on supplies from foreign countries.

To achieve decoupling in Japan with dependence on foreign natural resources, the structural relation between GHG emissions and natural resource consumption in the world and Japanese product supply chain must be understood. A world input–output model including multiple nations composed of multiple economic sectors, with an accounting framework resembling that of a conventional multiregional input–output model, presents a powerful framework to achieve that purpose. However, because of the detailed accounting framework of the world input–output model, such a model often presents difficulty of data compilation, particularly in terms of the making of consistent input–output tables for all nations defined in the model. In actual applications, the world input–output model must be a structure with limited nations and at most 100 sectors for each nation, with aggregation of many products into larger categories. This is unsuitable to characterize global GHG emissions and the natural resource consumption of individual products.

This study detected a global network linking nations and individual products, with mutual connections defined by energy and resource consumption through a supply chain of products using a global link input–output (GLIO) model centering on Japan (Nansai et al., 2009). The GLIO accounting framework enables the definition of about 800 intermediate sectors of the Japanese economy to be examined in this study, with the inclusion of more than 200 nations and regions. Results show that a global energy and resource network with regard to a Japanese product is visually identifiable. The key global network of the product was also found by analyzing the structural characteristics of the network.

Recent controversies in neoclassical modelling and developments in Evidence-Driven Policy

Topic: Historical perspective of input-output analysis
Author: Stuart John Nettleton

The use of Computable General Equilibrium modelling in evidence-based policy requires an advanced policy making frame of reference, advanced understanding of neoclassical economics and advanced operations research capabilities. This paper examines developments in the policy making frame of reference. The process of evidence-driven policy places importance on the validation of potential policies using models. At national, bilateral and multilateral levels, policy

analysis has increasing relied on neoclassical computable general equilibrium models having substantial precedence. Bayesian analysis suggests that a policy which survives a validation test using such a model has a much better chance of being successful than a policy that fails such a test. Yet the 2008-9 Global Financial Crisis demonstrated that policies verified with neoclassical models neither predicted the Global Financial Crisis nor were able to address it. Governments across the world used massive Keynesian stimulus to restabilise economies. Neoclassical models became much maligned within Keynesian and behavioural economics circles. This paper investigates the continuing role of neoclassical models in evidence-driven policy with reference to the deductivism of Sir Karl Popper and Thomas Kuhn, inductivism and the controversial objective theory of evidence. While policy making has always been messy, in recent decades policy makers may have succumbed to the human fallibility of justifying pragmatism with simplified ideological paradigms that inappropriately place over-reliance on neoclassical free market mathematical models because these models are self-reinforcing of the ideology. It is suggested that future policy making will be even messier, with policy makers placing less importance on such simplified paradigms and taking more responsibility for managing plurality in the political process. It is concluded that neoclassical models will continue to have a role in testing policies but those features of neoclassical models that led to the failures in understanding the Global Financial Crisis will need to be addressed. For example, to be relevant such models will need to close for both households and investment and be cognisant of distributional effects such as the sweep of income to the top 5% of consumers through wage and taxation policies.

The Service Science of Climate Change Policy Analysis: applying the Spatial Climate Economic Policy Tool for Regional Equilibria

Topic: Climate policy issues: tools
Author: Stuart John Nettleton

The use of Computable General Equilibrium modelling in evidence-based policy requires an advanced policy making frame of reference, advanced understanding of neoclassical economics and advanced operations research capabilities. This paper examines developments in neoclassical economic models for the analysis of strategy and policy. Regions and industries have the ever-present challenge of building a future where production is competitive and employment is durable. In this context, the inhibitor effects of potential climate constraints on regional industries and bilateral trade is currently a topic of major concern to polity. Threats often bring opportunities and these are sometimes major disruptions to traditional industry structure. Therefore of equal interest to some policy makers are the strategic opportunities that a window of superior domestic productivity and resource expansiveness may bring to nations seeking a transformative boost in export performance. The Spatial Climate Economic Policy Tool for Regional Equilibria (Sceptre) is an intertemporal, multiregional general equilibrium model for investigating regional and industry strategies in the presence of global policies such as carbon emission constraints. In its simplest mode, Sceptre translates global climate policies to regional and commodity effects. This is achieved by bringing together traditional markets for commodities with new markets in carbon commodities. These new markets are emission permits trading and a technology function for carbon abatement and amelioration. A general equilibrium is settled by optimising a social welfare function, in the mode of a Negishi format, within a nonlinear economic-climate feedback loop. Both the technology function for carbon abatement and amelioration and the economic-climate feedback loop have precedent in William Nordhaus' DICE model. The social welfare function comprises regional economic expansion factors, which are developed in a multiregional context using a data envelopment or benchmarking technique successfully applied by Thjis ten Raa to single period national and bilateral models. In a novel intertemporal innovation, Sceptre draws together disciplines

of economics and finance by substituting resource constraints with Dupont sales to asset ratios in order to dynamically link and mediate the stocks and flows of each commodity. This avoids the issue in Ramsey models that investment is merely an uncontrolled residual of production and consumption, and the issue in the Leontief B-matrix approach that final industry assets are cannibalised. Regionally aggregated Make and Use matrices drawn from GTAP's Social Accounting Matrices are used in the underling economic model as regional-commodity production function tableaux. Outputs for policy consideration include global geophysical climate effects, regional and industry activity levels, bilateral trade flows, potential resource expansiveness, investment, labour and regional and industry rate of transition from carbon trading to carbon amelioration and abatement.

Developments in the use of Mathematica for Computable General Equilibrium analysis

Topic: CGE and econometric input-output modeling
Author: Stuart John Nettleton

The use of Computable General Equilibrium modelling in evidence-based policy requires an advanced policy making frame of reference, advanced understanding of neoclassical economics and advanced operations research capabilities. This paper examines developments in the advanced operations research capability of a modern generalised mathematical software platform. Intertemporal general equilibrium modelling has become feasible over recent decades due to the development of powerful computer software and hardware. Software for this purpose has traditionally been highly specialised in its ability to define optimisation problems, presolve, and submit the modified mathematical specification to industrial strength optimisation algorithms. In the last two years, general purpose mathematical software has achieved industrial strength. For example, Mathematica now provides interior point optimisation, a technology that has taken three decades to evolve from mathematical research into a general application. It is now possible to take advantage of the many other attributes of general purpose modelling suites, for example graphics for data visualisation that greatly enhance the execution of research and communication of results to policy makers. This paper outlines techniques for the application of Mathematica to data mining of the GTAP database and in using interior point optimisation for Computable General Equilibrium modelling.

A regional inventory of water demand and water pollutant discharge in the Yangtze River and China as a whole based on an inter-regional input-output analysis model

Topic: Water input-output analysis
Author: Tomohiro Okadera
Co-Authors: Masataka Watanabe, Nobuhiro Okamoto

In this study, a regional inventory model that described water demand and water pollutant discharge while including the effects of hidden flows was developed based on inter-regional input-output analysis model. This model is based on regional model in the City of Chongqing (Okadera et al., 2006) , and then applied to Changjiang River and China, which is currently suffering from water shortages caused by rapid economic growth. This study has analyzed the structure of water demand and water discharge in Changjiang River and China with the some indexes (i.e. water consumption, virtual water or water footprints, and COD discharege). The results calculated using the model

generated here, which were consistent with previously published data, indicated that China's economy depends heavily on the Changjiang Middle Area for water demand and water pollutant discharge. Furthermore, the calculated results demonstrate that water demand and pollutant discharge are impacted by hidden flows in the Changjiang Middle Area that occur as a result of export to foreign countries, North and South China and the Changjiang Lower Area. Taken together, the results of this study suggest that it is especially important to conserve water in the Changjiang Middle Area to ensure sustainable development throughout China. In addition, these findings indicate that it is necessary to scientifically verify current levels of water resource storage and promote the development of effluent treatment facilities and nitrogen and phosphorous circulation systems in the Changjiang Middle Area. Furthermore, the estimated impacts of extra-regional hidden flow in foreign countries that were identified in this study indicate that China must depart from an export-dependent economy to maintain sustainable growth. However, the model used here must be refined to more accurately define the extra-regional hidden flow that exists in other countries so that better estimates of the impact of trade on water use can be made. Moreover, given that there are many trade-offs involved in balancing economic growth with water resource shortages, food availability, energy availability and global warming, these findings indicate that it would be useful to develop an international/interregional model that enables integrated evaluation of water demand, water pollutant discharge, food and energy consumption and CO2 emission. Finally, methodologies that enable the development of such a model are discussed herein.

How much will the Shock get alleviated? –The evaluation of China's counter-crisis fiscal expansion –

Topic: Asia beyond the crisis: visions from international input-output analysis
Author: Nobuhiro Okamoto

The impact of the Financial Crisis for China emerged as the problem of export reduction by the collapse of the world commodity market, although the Crisis itself originates in the U.S. financial markets. Since Chinese economy is an export-driven economy, the export reduction led to an immediate economic slowdown; the growth rate fell even to 6.1% in the 1st quarter of 2009. The economic growth rate less than 8% implies a significant loss of employment opportunities, and thereby causing social unrest and instability. Chinese economy seems to undergo considerable downward pressure from the contraction of the U.S. and the EU markets, and other Asian countries such as Japan, Korea, and Taiwan are also trapped into serious economic recession.

So, is it possible for China to prop up its economy again, and to contribute to the recovery of other Asian countries by using its fiscal instruments? Recently, the Chinese government decided to launch a package of fiscal expenditure with the amount of four trillion Chinese yuan (approx. 520 billion US$), which records an unprecedented level of fiscal commitment in the history of economic policy in China.

In evaluating the effect of China's recent fiscal measure, this chapter conducts the following analyses. Firstly, we quantify the impact of the current Economic Crisis on Chinese economy. This is done by identifying the mechanism of spatial shock transmissions among regional economies within China, and also in relation to other Asian countries, by using Transnational Interregional Input-Output Table between China and Japan 2000 (IDE-JETRO, 2007). Then, we evaluate the effect of the current fiscal measure in moderating or even reversing the downward spiral that deeply haunts the Asian-Pacific region today.

From the analysis, the conclusion is derived as follows.

In the last decade, China became a principal engine of the growth for the Asian region, as indicated by the outstanding magnitude of its production multiplier. It undoubtedly towed the regional economic growth. The opposite picture, however, is equally valid. When the business slows down in

China, it has a considerable negative impact on the rest of the Asian region. As seen in the empirical analysis, the production of export-driven districts such as Huadong and Huanan significantly declined in the 2nd quarter of 2009, to almost half the level of the 3rd quarter of 2008. It brought about the output decrease not only in neighboring Huazhong and Huabei but also further in other Asian economies such as Japan, South Korea, Taiwan, and ASEAN countries.

The recent fiscal measure adopted by the Chinese government, however, is expected to turn the situation. According to our simulation, it is revealed that the policy mainly functions to stimulate the economies of inland regions such as Xinan and Huazhong, although Huabei and Huadong of coastal areas may also benefit through inter-regional economic linkages. Moreover, the impact of fiscal expansion crosses international borders and reaches other Asian countries through extensive trade channels. For instance, construction of infrastructure in China's inland areas induces an increase in the output of basic materials in Japan and in the United States. Although the stimuli may not be sufficient for the whole Asian region to completely restore its economic position, the current fiscal measure of China undoubtedly helps to draw a better prospect for the region to overcome the Global Economic Crisis.

Globalization and Localization of Disaster Impact: An Empirical Examination

Topic: Crisis and disaster analyses
Author: Yasuhide Okuyama

Albala-Bertrand (2007) claimed that economic impact of a disaster, which causes localized damages and losses on capital and activities, may not affect negatively the macro-economy in both short-term and longer-term. This appears to contradict with some empirical observations, such as the 1999 Chi-Chi Earthquake in Taiwan and other recent disasters. The propagation process of disaster impact in a global sense is examined in this paper using the empirical case of the 2004 Indian Ocean Earthquake and Tsunami. The results reveal that the potential propagation of economic impact in a global scale; however, the impact to the surrounding countries are relatively limited. Meanwhile, from the risk management perspective, the lack of localized countermeasures against disasters may lead to the spread of local risk over the global economy through international aids and donations.

Structural Decomposition Analysis Using Spectral Graph Theory and Its Application to the Energy Issue in Japan

Topic: Structural change
Author: Yuko Oshita
Co-Authors: K. Nansai, Shigemi Kagawa

For energy policies, Japanese government has proposed the "Sectoral Approaches" which are tools to improve energy efficiency and reduce carbon dioxide emissions with a focus of energy intensities or carbon dioxide intensities of the particular sectors in question. However, the "Sectoral Approaches" do not afford an incentive to cooperate with other sectors on the carbon mitigations. In contrast, the "Cluster Approach" is clearly one of the alternatives. The objective of this study is to detect industrial energy-intensive clusters in Japan for the period between 1990-2000 by using both Input-Output Theory and Spectral Graph Theory. The structural decomposition analysis using the cluster information from the spectral graph theory enables us to not only visualize the changes in the energy intensive clusters (i.e. environmentally-influenced industrial clusters) , but also to examine the effects of the changes in energy intensities, production technologies and final demands within

the core energy-intensive clusters on the primary energy consumption. The empirical results using the 1990-1995-2000 linked Input-Output Tables of Japan reveal the contribution of improved energy efficiency over ten years period in shaping evolution in the industrial energy network in Japan.

The Changing Structure of Indian Agriculture During the Post-Reform Period: A Study in the I-O Framework

Topic: Sector specific analyses: agriculture
Author: Dipti Prakas Pal
Co-Authors: Mausumi Datta Biswas Ghosh

Agrarian structure is a composite structure comprising of input structure and output structure . In course of economic development the economy goes through structural changes. Agrarian structure also changes due to purposefully designed institutional and technological reforms adopted by the policy makers of the country like India in the 1990's. Changes in agrarian structure may thus be viewed in terms of changes in input and output structures.

The output structure of agriculture is formed by the set of crops produced in the economy. The importance of these crops changes over time due to various reasons like changes in the inter-industry demand pattern, changes in the final demand consequent upon changes in domestic and international conditions and above all rural-urban relationships. The output structure (so to say, the cropping pattern) thus changes. Side by side, the input structure (particularly the inter - industry inputs) changes due to changes in technology used in production . The use of some inputs is reduced while some other inputs are used more. Or, some new inputs come to be used in the production process substituting the inputs hitherto used.

The changing input and output structures of agriculture are of interest to the policy makers. In this paper the dynamics of structural changes brought about in India's agricultural sector during the period of on-going reforms 1993-2003 has bee analyzed using the concept of relation linkage as developed by Pal(1981) . The prime sub-sector(i.e, crops like food and non-food crops in broad terms) of the agricultural sector are identified and their transformation in terms of inter- industry dependence as well as inter- industry importance is particularly examined.

Changing Gross Output Elasticities in the Energy Sector: A Comparative Study in the Economies of India and Pakistan in the I-O Framework

Topic: Energy input-output analysis II
Author: Dipti Prakas Pal
Co-Authors: Swati Pal

Energy is an important input of production of every economy. Its use has been day by day increasing and every economy has been becoming more and more dependent on it. From the demand side it is used by different industries as inputs in their production (called inter-industry demand) and by different final agents like individual consumers, government and export (called final demand) while from the supply side it uses as inputs the outputs of other industries (both endogenous and exogenous).The former corresponds to the output-distribution structure of the energy sector while the latter corresponds to its input-structure. With development both input and output-distribution structures of energy have been changing.

Energy has different components. Coal energy, gas energy, electricity energy and oil energy are distinguished. The energy sector has different sub-sectors like coal, oil, gas and electricity. These energy sub-sectors have different structures of input and output-distribution. Over

time energy structures change, causing changes in the overall economic structure in general and the structures of different industries in particular.

In this paper an attempt has been made to quantitatively examine the nature and the extent of changes in the structures of energy in the economies of India (1993-2003) and Pakistan (1984-90).

The technique of structural decomposition in the I-O framework is used in analysis to isolate the effects of different sources responsible for changes in energy demand and supply and in turn the prime sources are identified. In addition to the decomposition of absolute changes, gross output elasticity with respect to the explanatory factors is estimated for different types of energy output and thereby demand laws are verified. Changes in output elasticity are also analyzed using a scheme of additive decomposition formulated by us. The prime factors influencing the output elasticities are thereby identified.

Teaching Session 1: SimSIP SAM

Topic: SimSIP SAM
Author: Juan Carlos Parra

Introduction to SimSIP SAM: General description of the tool, its features, capabilities, and limitations. Installation of SimSIP SAM on personal laptops. How to load an IO table or SAM into the tool. This session is mandatory for anyone attending sessions 2 or 3.

Teaching Session 2: SimSIP SAM

Topic: SimSIP SAM
Author: Juan Carlos Parra

Preparing your SAM and multiplier analysis: SAM organization, aggregation, and balancing using RAS and Cross-Entropy with constraints. Descriptive analysis and labor multipliers. The inverse matrix, multiplier decomposition, and economic linkages. Design of experiments for quantity and price models.

Teaching Session 3: SimSIP SAM

Topic: SimSIP SAM
Author: Juan Carlos Parra

Structural change, supply constraints, and poverty analysis: Importance of technical coefficients, first-order fields of influence, economic landscape, and directions of change for two inverse matrices. How to impose supply constraints for zero and small excess capacity. Design of experiments under supply constraints. Poverty and income distribution analysis using a household survey.

The bias in accounting for national income changes when pervasive processing trade is present

Topic: Analysis of factor inputs
Author: Jiansuo Pei
Co-Authors: Erik Dietzenbacher, Jan Oosterhaven

Abstract: The constrains and drawbacks of using ordinary input-output (IO) analysis to account for various changes have long been recognized. However, three problems
have implicitly been overlooked in applying so-called structural decomposition analysis (SDA). Specifically, we refine the methodology (i) by taking substitution
between primary input and intermediate input into account; (ii) by considering substitution within intermediate inputs; and (iii) by considering substitution between
domestic and imported inputs within each element. The methodology is adopted to a case study of China's national income change using extended IO tables that explicitly distinguish processing trade from ordinary production for exports. The contribution of export growth to value added generation is found to be roughly one-third smaller compared with results obtained via using ordinary IO tables. At the industry level the difference is even more striking; for "high-tech" industries that mainly produce instrument related goods the bias in measuring the export contribution to value added growth is as high as four-fifth. These results may also be relevant to other developing countries with considerable processing trade.

Structural changes in the Balearic Islands

Topic: Input-output studies on tourism issues I
Author: Clemente Andrés Polo
Co-Authors: Elisabeth Valle

The main aim of this paper is to analyse the economic structure of the Balearic Islands over the last 20 years and, more specifically, the role that the tourist industry has played in it.
The said analysis is based on input-output tables for the Balearic economy, available at three points in time: firstly, the "1983 Input-Output Tables for the Autonomous Community of the Balearic Islands", drawn up by a team of researchers from the University of the Balearic Islands and published by the Government of the Balearic Islands' Treasury Department in 1988; secondly the "1997 Input-Output Tables for the Autonomous Community of the Balearic Islands", drawn up by a team of researchers from the University of the Balearic Islands; and lastly the "2004 Input-Output Framework for the Balearic Islands", published by the Government of the Balearic Islands' Department for the Economy, Treasury and Innovation in 2007.
A uniform analysis could offer a global insight into the evolution of the Balearic tourist industry and its contribution to the Balearic economy from 1983 through until 2004. The analysis will be conducted in three separate stages. Firstly, an analysis of the percentage of wages and salaries, gross operating surplus, gross value added and output generated by sectors defined as tourist sectors (the tourist industry) and changes in these percentages during the three available points in time. Secondly, after analysing the origin of intermediate consumption by the tourist industry, output and uniform demand growth multipliers will be calculated. These facilitate the detection of those sectors with the highest capacity to have a ripple effect or strangle the Balearic economy in 2004. Finally, the main purpose of this paper is to provide an assessment of the weight of tourism in the Balearic Islands in 1997, 1983 and 2004 using input-output techniques and several alternative assumptions on endogeneity of final demand components.

A Construction of Energy Input-Output Tables based on a Life Cycle Approach: A Case Study of Korea Transportation Economy

Topic: Environmantal Life Cycle Assessment analyses
Author: Phirada Pruitichaiwiboon
Co-Authors: Kim Yong-Ki, Lee Cheul-Kyu, Lee Kun-Mo

Corresponding to the crucial work of Climate Change Prevention from the transportation, it is necessary for decision makers to consider the energy consumption and GHGs emissions throughout the life cycle. In fact, it is extremely useful if a comprehensive LCA is conducted. But it tends to be time intensive and costly. As a result, most of the studies and models evaluate only one phase -- the use stage. Since all actions are in urgent need of prevention and reduction, it should not slow down the economic activity or vice versa. Nevertheless, it is not easy to indicate what would happen without knowing how this economy is constructed. Input-output analysis is the only method and database that is available now. It covers the sequence of commodities and service in the economy and is used to evaluate the effects of various policies and scenarios. The ultimate goal of this study aims at analyzing impact of energy, GHGs and economics when the mitigation strategies are made. This effort, firstly, intends to integrate the specific advantage feature of life cycle and Input-Output approach in order to construct energy I-O table. The statistical data on energy consumption and National Economic I-O table are the main sources of development. To construct energy I-O table for transportation precisely, several steps of work are implemented. A vital step includes categorizing intermediated sectors into the life cycle stage, disaggregating energy group, investigating the transportation economy value, calculating coefficient and making different interesting scenarios. The life cycle of this study consists of fuel and raw material extraction, fuel production, materials preparation, manufacturing, transportation, construction and supplement. This table is constructed with the column of life cycle stages and the row of eleven kinds of energy including three basic raw materials. Base on the year 2005, the amount of 35,559,000 ton oil equivalent (TOE) were directly consumed in this economy as a results 99,209,610 ton CO2-equivalent were generated. The main contributor was road mode accounting for 79 %, while the rail mode accounted for only 1 %. This amount has not included energy consumed in the supply chain of the transportation which is normally ignored during making a decision of prevention. Road and rail mode are the main work of this study because they are expected as the source and solution of the numerous problems. Although, rail tends to have lower environmental impact than road, the environmental effects including cost of infrastructure investments to accommodate such shift are substantial if capacity expansion is required. Final demand increment and structural coefficient change are the mitigation scenarios of this study. The profiles of economic change, amount of energy consumption have been investigated. The result obtained from this construction allows quick calculation, inexpensive way and more accurate energy consumption by tracing out the impacts from supply chain activities.

Green Growth Accounting with Combined Use of Hybrid Input-Output Tables and Supply - Use Matrix

Topic: National Economic and Environmental Accounts
Author: Hak K. Pyo
Co-Authors: Dong Koo Kim, Keun Hee Rhee

Korea recently adopted an eco-friendly policy on economic growth called the Green Growth Policy. To find a theoretical base for the policy, this study conducts a structural decomposition analysis of carbon dioxide emission changes in Korea based on green growth accounting which combines hybrid input-output tables with supply and use matrix. The advantage of incorporating Supply-Use

matrix in a structural decomposition analysis lies in improvement for consistent forecasting of GDP based on different scenarios of CO2 emission targets because the Supply-Use matrix links Input-Output Tables to National Income Account. This study estimates the growth rate of future gross domestic product based on the recently adopted CO2 emission reduction targets and the effect of CO2 reduction on employment through combined use of hybrid input-output tables with Supply-Use Matrix.

Is there entropy in an economy? Revisiting an early concept of sustainability introduced by Nicholas Georgescu-Roegen

Topic: Sustainability in Economics
Author: Utz Peter Reich

Utz-Peter Reich, born in 1938 at Bremerhaven, Germany, took his first academic degree in high energy physics from the University of Hamburg. Having lived through the Cuba Crisis he decided to change fields and joined the Federation of German Scientists for a project on "Consequences of nuclear war in Germany". Enrolling in economics and political science, he completed his Ph.D. with a thesis on "The European Security Conference: a game theoretical experiment" from the University of Constance.
When in the 1970s the new Max-Planck-Institute for Social Sciences was founded Utz joined the project "Sustainable growth" and was involved in developing a system of "Labour-consumption accounts". After staying with the German Federal Statistical Office for five years he served as Professor of Economics and Statistics at Mainz University of Applied Sciences until retirement. He is now second trombonist of the Big Band Kameleons at Berlin.

Theories of an unequal exchange ruling within the global economic system have been voiced by Raoul Prebish and Hans Singer, as falling terms of trade, and by Arghiri Emmanuel and Samir Amin, as transfer of surplus value. One reason why neither have found a place in standard economic textbooks may have been, - other reasons not withstanding, – a certain deficiency in making the theories statistically operable. The paper suggests that the newly established statistics of international purchasing power parities when connected to input-output methodology allows to remedy this failure, and to measure inequality in international trade in a well-defined way, a result which may lead to a new discussion of these early theories in respect to equality and efficiency of the present world economic system.

Input-output tables for use in Computable General Equilibrium (CGE) models: the case of the USAGE model of the United States

Topic: CGE modelling
Author: Maureen Rimmer

Maureen Rimmer is a Senior Research Fellow at the Centre of Policy Studies Monash University. She is a key contributor in the development, application and documentation of the USAGE model of the United States. This is a 500-industry, dynamic, CGE model of the U.S. economy, with facilities for generating results for the 50 States and 700 occupations. One of Maureen's specialties is the preparation of input-output data as an input to USAGE.

USAGE is used in Washington by the U.S. International Trade Commission and the U.S. Departments of Commerce, Homeland Security and Agriculture. Apart from the design and

implementation of USAGE, Maureen has made major contributions in applications of the model to key policy areas such as: the replacement of imported crude oil with domestically produced biofuels; legalization of unauthorized immigrants; and an analysis of the 2008-9 U.S. recession with and without the Obama stimulus package.

Maureen's keynote presentation will be on "Input-output tables for use in Computable General Equilibrium (CGE) models: the case of the USAGE model of the United States". CGE models are extensively used to analyse the effects on macro variables and industries of changes in: taxes, public consumption and transfer payments; environmental policies; technology; international commodity prices; labour-market policies; immigration policies; and business conditions and terrorism threats. They are particularly useful when price sensitivity is important. The main data used by CGE models is the input-output table. However, input-output tables prepared by statistical agencies are typically unsuitable for use in CGE models. This presentation is concerned with the transformation of the 1992 benchmark input-output table of the United States into a form suitable for use in the USAGE model. Problems encountered include: negative input-output flows; hard-to-interpret concepts such as "rest-of-world adjustment for final users"; and flows presented in producers' prices rather than basic prices.

Attribution of GDP and Imports to Final Demand Components for Germany

Topic: Final demand in input-output analysis
Author: Liane Ritter

Foreign demand is very important for the economic development in Germany. But Germany is an important importing country as well. Up to now the contribution of final demand components to GDP growth has been measured only by the contribution of domestic final demand categories as a whole and of the balance of exports and imports in Germany. In this paper GDP and imports will be attributed to domestic final demand categories and to exports using input-output tables.

For Germany input-output tables are available from 1995 to 2006. This study will show how domestic production on the one hand and foreign production on the other hand contribute to the value-added chain of final demand components. It shows whether there are differences in the yearly contribution of the final demand components to GDP growth rates using the established method with the balance of exports and imports or using the attribution method by input-output modelling.

The GDP growth analysis is usually based on quarterly data and it is very timely. The challenge of the attribution method is that detailed information about final demand by product groups and data for the input structures of the domestic production process subdivided by origin (domestic or imported) are needed. Usually only yearly data are available. Input-output tables have so far been calculated only yearly in Germany. Preliminary tables are available about 32 months after the reporting year. Only data on parts of final demand components by product groups are available earlier. The impact of input-output tables of different years on the results will be analysed to see whether current estimates of GDP and imports attributed to final demand categories can be based on the input-output table of a previous year. In addition data sources will be checked to find out whether quarterly estimates would be possible for Germany.

The aim of this study is to show to what extent Germany can supplement the established information about GDP growth by estimates for GDP and imports attributed to final demand components.

R&D and Other Intangible Assets in an Input-Output Framework: A First look with U.S. Data

Topic: Supply-use tables and National Accounts (Special session organized by the IOSG-IIOA)
Author: Carol A Robbins
Co-Authors: Mary Streitwieser, Robert Corea, William Joliff

As economic activity shifts in many national economies from manufacturing activity to service activity, intangibles such as research and development, computer software, and entertainment, literary and artistic originals products become increasingly important components of economic output. Unlike many other service activities, these intangibles also contribute to future economic output, and thus should be treated as capital assets. Computer software has been treated as a capital asset in the U.S. statistics since 1997. The U.S. and many other countries plan to adjust their official economic statistics in coming years to recognize R&D and several other intangibles as capital assets. In addition to the impact on aggregate GDP, this new treatment will change the way economists understand industry activity and contributions to growth. As Scherer (2003) and others have shown, the structure of input-output and capital flow tables provide a good framework for analyzing R&D-related technology flows. Our paper provides a first look at intangible assets in an input-output framework for 2002, the most recent last available year of benchmarked industry data. These newly recognized intangible assets include R&D expenditures, motion picture and television originals, musical compositions, and literary originals. We show Make, Use, and Capital flow tables, allowing users to 1) trace the production of these intangibles by industry sectors, 2) identify the input structure of the intangibles production activity itself, and 3) see the impact of intangible assets on adjusted capital flow measures for industries.

Underestimation of the performance of the EU carbon dioxide emission reductions via external trade

Topic: Leontief Prize 2010 Awards
Author: José Manuel Rueda-Cantuche

This paper deals with the identification of appropriate measures of the performance of the European Union in reducing its carbon dioxide emissions via external trade, both at the aggregate and at the industry levels. We have found that standard measures based on the Leontief quantity model and profusely used by input-output practitioners and industrial ecologists will result in underestimation of the actual performance of the EU in reducing its carbon dioxide emissions via external trade. Briefly, standard measures currently available in the literature seem to assign the EU less amounts of exported air emissions (carbon dioxide) than it should be. However, this rule does not hold for all industries individually. From a methodological viewpoint, the conclusions are justified by a new approach to estimate unbiased and statistically consistent emission multipliers. This approach has three important advantages: (a) it improves the accuracy of the environmental impacts assessed by industrial ecologists; (b) it finds a way to compute unbiased and consistent input-output multipliers for input-output analysts; and (c) the use of the Leontief inverse is no longer necessary; only the supply and use matrices are required. In addition, another advantage of this approach is that all the data needed to make the calculations are ready to use worldwide at many countries' statistical offices.

The Choice of Type of Input-Output Table Revisited: Moving Towards the Use of Supply-Use Tables in Impact Analysis

Topic: World Input-Output Database II: Methods and applications
Author: José Manuel Rueda-Cantuche
Co-Authors: Joerg Beutel

The construction of symmetric input-output tables (SIOTs) is a controversial issue in the input-output literature as regard the choice of model to construct both product by product and industry by industry SIOTs, especially the former ones. However, there has been so far little attention paid on the choice of type of SIOT to carry out impact analyses let alone other input-output applications. The UN and Eurostat systems of national accounts just simply refer to this issue vaguely and basically recommend nothing except that the purpose of the analysis will determine the choice of type to be used. Moreover, there are no explicit guidelines for the user to make the correct choice accordingly with its own purpose.
In empirical research, it depends on the objectives of the analysis which type of table is best suited for economic analysis. Particularly in impact analyses, questions like, for example, what fuel price effects would generate an increase in the labour costs of the electricity industry cannot really be answered by input-output price models as it is generally thought. Moreover, this is even independently of the type of SIOT used. Either one assumes that changes in primary costs (labour) occur in homogeneous branches rather than in industries and therefore uses product by product tables or one assumes that the price changes of primary factors effectively occur in industries and thus, uses industry by industry tables. Nonetheless, the corresponding reported price effects will be those of the fuel industry rather than those of the fuel product itself.
As regard input-output quantity models there is also a trade-off in the case of impact analyses related to environment, employment… or any economic dimension for which data is mainly available on an industry basis. Either one assumes that the additional data external to the input-output system (employment, emissions…) is on a product basis and uses a product by product table to evaluate the total effects of a change in the amount of the final demand consumed of a single product (like e.g. bio-fuels) or one assumes that the additional data is on an industry basis and uses industry by industry tables. Nevertheless, the derived total effects on employment, emissions… will correspond to a change in the output of a mixed bundle of goods and services produced by a certain industry rather than to changes in single product outputs.
Two major trade-offs have been identified concerning the choice of type of SIOT to be used in input-output impact analyses. The main shortcoming underlying this issue is related to the symmetry of SIOTs. They are defined as either product by product or industry by industry type. To solve this matter efficiently, supply and use tables are clearly the best choice since they are defined on a product by industry basis rather than solely on a product or industry basis. It is therefore advisable to follow the lines of the pioneering works of ten Raa and Rueda-Cantuche (2007) and Rueda-Cantuche and Amores (2009) and continue exploring the use of supply and use tables in the calculation of input-output impact multipliers of any kind. Of course, one can always come back to standard input-output analysis bearing in mind the methodological trade-offs addressed in this paper.

The construction of input-output tables and the use of supply-use tables in input-output analyses: a review

Topic: World Input-Output Database I: Contruction issues
Author: José Manuel Rueda-Cantuche
Co-Authors: Joerg Beutel

Addressing the choice of method for constructing input-output tables from supply and use tables has generated a sizeable amount of literature not free of controversy. The most widely used methods are the product-technology model and the fixed product sales structure model, but a wide range of alternative models have been proposed. The merits and demerits of the available methods will be investigated and an attempt will be undertaken to answer the question “what method to use under what circumstances?” In addition, this paper also discusses the latest advances in the development of policy analyses using supply and use tables directly, instead of through input-output tables.

Economy-wide impacts of higher energy prices on household cost of living: an extended SAM price model

Topic: Economy-wide impacts and forecasts
Author: Mohd Yusof Saari
Co-Authors: Bart Los, Erik Dietzenbacher

This paper attempts to examine impacts of increase in energy prices on household expenditures, which is defined as an indicator for cost of living. By using a so-called social accounting matrix (SAM) price model, the extent to which household groups as well as production sectors will gain or lose due to the increase in energy prices can be examined within a single framework. As far as distribution is concerned, to what extent is household affected depends largely on the degree of substitutability between energy and non-energy inputs, i.e. non-energy material inputs, labor and capital. For example, an increase in energy prices would not affect much on household expenditures if energy and labor are substitute in production of output, because increase in energy prices would result in an increase in demand of labor and so an increase of wages. To capture such issue, we further extent the static SAM price model by incorporating substitution possibilities among production inputs. Cross-price elasticities between energy prices and demand of non-energy inputs which estimated by a so-called restricted translog cost function, are incorporated to refine the static SAM model. Moreover, to ascribe causes for the increase in cost of living explicitly, we decompose total impacts of higher energy prices into the effects that determined by cost of material inputs, cost of factor inputs and cost of consumption. For analytical purposes, we apply a SAM for Malaysia for 2000, within which detailed information on ethnic groups comprising the Malay, Chinese, Indian and a group of other ethnic minority groups across geographical locations is included.

A Comparison of Input-Output Models: Ghosh reduced to Leontief

Topic: Key sectors and multiplier analysis
Author: Ferran Sancho
Co-Authors: Ana-Isabel Guerra

At present, the Ghoshian model is considered as an appropriate theoretical framework under which, among others, energy and environmental issues should be empirically analysed. Furthermore, a hybrid version that merges both the Leontief approach and the Ghosh model is still very much in

use. Nevertheless, little reflection has been done at a conceptual level in relation to the formal soundness of these practises. After comparing the similarities and the differences between both models, this paper provides a two-fold contribution. On the one hand we present a novel interpretation on the plausibility of the Ghosh model. On the other hand, we show and formally justify the implausibility of coherently combining the two input-output approaches in applied analysis. The main raison behind this statement is the simultaneous incompatibility in some of their formal assumptions.

Alternative Approaches to Designing Climate Policy Response: An Australian Case Study

Topic: Climate policy issues: tools
Author: Suwin Sandu

Environmental pressure from climate change poses an important risk to humanity. Carbon emissions, a major source of climate change, can be mitigated either at the point of production of goods and services, or the point of final consumption. A number of studies exist that assesses the impact of carbon emissions reduction at the production point, while there is a limited study that assesses the impact at the point of consumption. This is mainly because of the complexity involved in accounting carbon emissions embodied in goods and services, and in using this information to assess the impacts of climate policy throughout the economy. This paper reviews some strengths and weaknesses of different methods that can deal with complex policy problems of climate change. The review shows that the framework based on Input-output method is appropriate for this purpose. It encapsulates embodied energy flows and associated carbon emissions within the economy, and hence provides information on carbon footprints of goods and services. The method also captures behavioural response from changes in policy, and thus allows the assessment of the impact from climate policy on the domestic economy. This paper also provides an example for the application of input-output framework for analysing the impact of climate policy – carbon tax – in reducing carbon emissions in Australia.

Extension of Input-Output Analysis to Portfolio Diversification

Topic: Analysis of factor inputs
Author: Joost Reyes Santos

Current portfolio diversification approaches typically employ variance-covariance relationships across underlying investments. Such relationships enable the calculation of volatility, which measures the risk of a portfolio. Although volatility is a widely used metric of financial risk, it needs to be extended to capture extreme market scenarios. Since covariance provides a symmetric relationship between a pair of investments, this paper will implement an input-output-based approach to measure the unaccounted asymmetric relationships. We assume that an investment’s performance can be linked with the performance of an underlying industry (or industries, in the case of conglomerates). Using the input-output accounts published by the U.S. Bureau of Economic Analysis, this paper develops a portfolio-diversification approach to supplement covariance analysis.

A quantitative approach to the effects of social policy measures. Application to Portugal, using Social Accounting Matrices.

Topic: Input-output applied to social issues I
Author: Susana Santos

The impacts of policy measures on transfers between government and households will be quantified using Social Accounting Matrices (SAMs).
The System of National Accounts (SNA) will be the main source used for the construction of the numerical versions of these matrices, which will then form the basis for two algebraic versions. One version will consist of accounting multipliers, and structural path analysis will also be used for its decomposition. The other version will be a so-called SAM-based linear model, in which each cell will be defined with a linear equation or system of equations, whose components will be all the known and quantified transactions of the SNA, using the parameters deduced from the numerical SAM that served as the basis for this model. Macroeconomic aggregates and balances, as well as structural indicators of the distribution and use of income, will be calculated from numerical and algebraic versions of the SAM. These will make it possible to quantify and compare the effects of social policy measures and to evaluate their differences, in order to define the path for future research work on the SAM-based linear model.

Water Rates and Responsibilities of Direct, Indirect and End-Users in Spain

Topic: Water input-output analysis
Author: Cristina Sarasa
Co-Authors: Julio Sánchez Chóliz, Rosa Duarte Pac

Water Rates and Responsibilities of Direct, Indirect and End-Users in Spain

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Abstract
In Spain, irrigation is the main user of water, approximately 80% of direct use, and the price paid for this water has been lower than its cost. The recent Water Framework Directive of the EU requires that all cost should be recovered but its application is having perverse effects. In some cases, farms become economically unviable and, in others, cultivation is intensified (double harvests, changes of crops,...) and water consumption is increased. This paper uses the computable general equilibrium (CGE) model developed by International Food Policy Research Institute (IFPRI 2002), in which we have introduced some changes. We use a SAM of the province of Huesca, a region in north-east of Spain that has nearly 200.000 hectares of irrigated land. The model disaggregates the agricultural sectors in irrigated and unirrigated land and these in different crops. It also incorporates improvements in irrigation efficiency and associated changes in crops. Under this framework, we analyse different scenarios of payments (as they fall on direct users, exporters or end-users). In this way, we go deeply into the responsibility of users, the impact of international market and macroeconomic impacts on agriculture and industry in Spain.

Russian and Regional Input-Output Tables

Topic: National Economic and Environmental Accounts
Author: Alsu Sayapova

The degree of importance of the regional IO tables in the territorial analysis of the Russian economy is determined by the vast territory, the diversity of natural and climatic conditions, as well as by the socio-economic situation and the number of the regions in the Russian Federation (83 subjects). However, the researchers have to compile their own evaluative regional tables due to the non-availability of regional IO tables prepared by the Federal State Statistics Service. In such schemes the developers usually employ the matrix of the coefficient of direct expenses (a technological matrix) obtained from the symmetric input-output table for Russia, thus, they extrapolate the average expenses on the production of the goods and services in Russia to a region in question. As is known, such practices exist in some other countries as well. The author has appraised the feasibility of such an approach and has proposed the methods of adjusting the technological matrix of the national economy in regard to a region. The research has been carried out on the basis of comparative analysis of the Russian symmetric input-output table and of the regional symmetric IO tables for the Republic of Bashkortostan, developed under the author's guidance not on the basis of the Russian technological matrix, but on the basis of a simultaneous study of the expenses' structure and observing the principles of the System of National Accounts and The United Nations Handbook of Input-Output Table Compilation and Analysis (1999)) . Although the differences between technological coefficients in the national economy and the region are significant, still, certain trends can be discerned in these differences. The latter allows to elaborate definite rules for adjusting the technological matrix of the national economy in regard to a region.

Keywords: regional input-output tables, technological coefficients.

Approximate Surrogate Production Functions

Topic: Classical-Keynesian input-output models
Author: Bertram Schefold

Summary:

The Cambridge debate showed that an aggregation of capital is not possible in general. A recent investigation has found one example for reswitching and several for reverse capital deepening, but the paradoxes seem not to be frequent. The paper provides a theoretical justification of this result and shows how wage curves of input-output matrices with small non-dominant eigenvalues become quasi-linear with some numéraires. Large random systems lead to the genesis of such states. Approximate surrogate production functions then seem possible. A family of economic systems with constant capital composition allows to construct a surrogate production function.

The Effects of Nanotechnology Implementation on Production Costs and Employment: An Input-Output Simulation

Topic: Sector specific analyses: manufacturing
Author: Nooraddin Sharify
Co-Authors: Abdolreza Sharifi, Fatemeh Sharify

Implementation a new technology generally affects on the economy indices such as production costs and employment. Although the implementation of nanotechnology may influence the economy through several ways, this paper focuses on its impact through production process. To do so, it is attempted to measure the effects of implementation the nanotechnology in the manufacturing process of different products on the production costs and labour force employment. A simulation based on the input-output (I-O) analysis is employed. To this end, the latest survey base i-o table of Iran for the year 2001 as well as the related data from official centers is used as databases. It is expected the results of the paper make a forecast for implementation this technology in the economy.

Social Equity versus the Environment Dilemma: Evaluating the GHG Impact of Poverty Alleviation in India

Topic: Input-output applied to social issues I
Author: Kazushige Shimpo
Co-Authors: Amrita Goldar, Jaya Bhanot

The Copenhagen taught us that still there is a deep-seated chasm between developed and developing countries. Although India has achieved rapid economic growth in over the years, whether or not this rapid economic growth was actually accompanied by the sustainable development which protects environment and narrows the gap between rich and poor is questionable. The National Sample Survey Organisation (NSSO) conducted a Household Consumer Expenditure Survey in 2004-05 which shows that 45% of people living in the rural area in India (more than 300 million people) do not use electricity as a primary source of lighting, on the other hand 92% of people living in urban area are using electricity as a primary source of lighting. These high level of disparities make a developing country such as India, hesitant to share the responsibility for future climate change.

While from a social equity point of view it can be argued that the fruits of growth need to necessarily percolate down to the lowest rungs of the economy, the reduction in the gaps between the energy rich and poor in India would bring forth changes in life-styles in that may or may not be environmentally friendly. Therefore, studying the changes in lifestyles and their concomitant impact on the environment become crucially important.

To analyze the changes in life-styles of households, many studies adopt the rural-urban and income (expenditure) level classification of households. However, this is a very narrow way of pegging different lifestyles to different households. There are different attributes that need to be analyzed in association with the expenditure levels to understand the lifestyles and energy consumption patterns in households. Therefore, the proposed study would look at different dimensions of household-level energy poverty such as occupation, energy consumption intensity and composition, social class, asset ownership, etc. in addition to the expenditure criterion and try to identify the energy consumption patterns and therefore emission intensity of the energy poor.

The construction of future scenarios of income distribution among households and improvements in lifestyles, would be done based on different trajectories of occupational changes and migration (for example, from agricultural workers in rural area to wage labor in urban area). For this, we would reconstruct the household sector in Indian IO tables with rich information available from the NSSO survey and classify the household sectors by rural-urban and occupational classes. We would construct alternative future scenarios of migration and occupational changes in rural households in India and analyze the impacts on output and CO2 emissions using IO tables for environmental analysis of Indian economy developed by our research group.

Environmentally Extended Input-Output Analysis of the UK Economy: Multicriteria Approach

Topic: Environmentally extended input-output analysis
Author: Stanislav Edward Shmelev

The paper presents a novel way of assessing relative sustainability of investment in particular economic sectors from the point of view of resource use and generation of emissions. The research carried out can be disaggregated into the following three steps: an environmentally extended static 123 sector UK input-output model has been created, which linked a range of physical flows: domestic extraction, use of water, emissions of CO2, CH4, NOx, with an economic structure of the UK. Secondly, following a pioneering study by Lenzen (Lenzen, 2003), a range of environmentally adjusted forward and backward linkage coefficients has been developed, with a particular focus on final demand, domestic extraction, publicly supplied and directly abstracted water, CO2 emissions and NOx emissions adjusted coefficients. Then the data on the final demand and environmentally adjusted forward and backward linkage coefficients was used in a multicriteria decision aid (MCDA) assessment, employing a Novel Approach to Imprecise Assessment and Decision Environments (NAIADE) method in three different sustainability settings: weak sustainability, strong sustainability and a neutral setting. The assessment was set in such a way that each of the 123 sectors of the UK economy was compared with each other using a panel of sustainability criteria, with final demand adjusted coefficients aimed at their maximum and environmentally adjusted – at their minimum values.
Additional results focued on particular sector groups will be presented for the first time.

Indian development paths and long run impacts on Australia

Topic: Australian Bureau of Statistics Special Session II
Author: Tom Skladzien

There has been much speculation amongst policy makers and academics alike that the standard development path of countries observed since the industrial revolution may not be observed with the development of India. The large and fast growing Information Technology and general service sector, especially in places like Hyderabad, has prompted serious thought into the question of whether India will experience the now standard agriculture – industrial – service path, or whether the impact of the information revolution, globalisation and industrial competition from China will prompt India’s development path to largely leap-frog the industrial phase directly to a high technology service economy. This paper analyses the impact of development paths for India on the global economy and on the long-term prospects of the Australian economy. The two development paths are simulated through Treasury’s version of the Global Trade and Environment Model (GTEM) and the impacts of each are analysed.

Calculating wage-profit frontiers and supporting prices in Leontief-Sraffa models

Topic: Multipliers and income distribution
Author: Albert Steenge
Co-Authors: Mònica Serrano

Income distribution problems in Leontief-Sraffa models up to now proved to be extremely difficult to address. One famous example is the problem of deriving the wage-profit frontier in the context of a Sraffian price model. The problem has received renewed attention because new claims on an economy's income are rapidly arising – an example being provided by environmental and climate change related programs.

In this paper we show how wage-profit frontiers in Leontief-Sraffa types of input-output models can be straightforwardly derived. In the case of the well-known Sraffa model the wage rate is shown to be a polynomial function of the rate of profit, linearity arising a) in the case of special price or output proportions, and b) if special "numeraires" are involved – such as Sraffa's notorious Standard commodity.

Endogenous explanation of activities' levels and the exploding multiplier

Topic: Multipliers and income distribution
Author: Albert Steenge

What happens if we increase the number of activities the output of which is explained endogenously? An early example of what may happen is found in the study of income multipliers when households' consumption is explained endogenously - often resulting in unlikely high multipliers. A related example is obtained when IO tables of regions or countries are interconnected through trade flows or otherwise. A problem arises if 'more and more' production and consumption is explained endogenously, and 'less and less' is exogenously given. We may end up with a situation in which multipliers increase unboundedly while the exogenous "stimulus" becomes smaller and smaller. The problem has received much attention in regional applications of IO modeling, where it is known as the problem of the "exploding" or "infinite" multiplier.
In this paper we show that under certain conditions multipliers will indeed explode, but that in such cases the rate in which the stimulus is decreasing may exactly balance the associated effects. Implications for specific cases are given.

Stability of I-O technical coefficients by capacity utilization: A case study of the hotel sector in Taiwan

Topic: Input-output studies of tourism issues II
Author: Ya-Yen Sun

An increasing number of economic impact studies are performed to address special tourism demand conditions such as hosting mega event/ festival or faced with extreme weather, disease outbreaks or terrorist activities. Commonality of these scenarios is that it involves short-term or irregular large-scale demand fluctuation from the baseline point. The adjustment of the I-O coefficient to reflect the cost structure under different demand level is deemed as more critical for the Input-Output analysis. The purpose of this research therefore is to investigate the stability of cost

structure by capacity utilization in the tourism industry, using the accommodation sector in Taiwan as an example. Panel data consisting of firm level hotel financial information based on 13 individual cost categories from year 2000 to 2008 is obtained through Taiwan Tourism Bureau. Panel data analysis is performed to reveal the magnitude and direction of cost structure changes with respect to occupancy rate. For a 10% increase in occupancy from the baseline of 65% occupancy, the intermediate input to sales ratio will decrease from 0.483 to 0.473 while the profit to sales ratio will increase from 0.082 to 0.139, and the employee benefits to sales ratio will decrease from 0.335 to 0.301 for per dollar of final sales. This pattern implies a slight reduced type I sales multipliers and a substantial reduced type II multipliers under a tourism event or festival as the requirement of intermediate input and personal income does not increase proportionally in relation to hotel revenue. On the contrary, a higher type I and type II multipliers can be expected from the standard I-O model during the tourism downtime as a greater proportion of per dollar revenue is allocated to the inter-industry material, service and employee benefits.

Joint Estimation of Supply and Use Tables

Topic: World Input-Output Database I: Contruction issues
Author: Umed Temurshoev
Co-Authors: Marcel P. Timmer

We propose a new biproportional method specifically designed for joint projection of Supply and Use tables (SUTs). In contrast to standard input-output techniques, this method does not require the availability of total outputs by product for the projection year(s), a condition which is not often met in practice. The algorithm, called the SUT-RAS method, jointly estimates SUTs that are immediately consistent. It is applicable to different settings of SUTs, such as the frameworks with basic prices and purchasers' prices, and a setting in which Use tables are separated into domestic and imported uses. Our empirical evaluations show that the SUT-RAS method performs quite well compared to widely used short-cut methods.

Benchmarking and Industry Performance

Topic: Productivity and efficiency I
Author: Thijs ten Raa

Benchmarking is formalized by a linear program that determines the efficiency of a firm relative to its peers and is used to determine the efficiency of an industry. The overall efficiency is shown to be underestimated by mean firm efficiency and the bias is zero if and only if the firm shadow prices of the inputs and outputs generated by the benchmarking programs are equal across firms. Otherwise the bias provides an efficiency measure for the organization of the industry.
A main contribution of this paper is the interrelation of productivity analysis and the theory of industrial organization. A proposition proves that an industrial organization is efficient in the sense of productivity analysis if and only if it is supportable in the entry-proofness sense of Sharkey and Telser (1978).
The known decomposition of performance in efficiency change and technical change is augmented with a term for the industrial organization efficiency change. The performance measure is shown to be consistent with the Solow residual and Malmquist indices for its components are given. An analysis of the Japanese banking industry illustrates and the dynamic effects of entry and exit can be accommodated.

Invention, Entrepreneurship and Prosperity: The Dutch Golden Age

Topic: Productivity and efficiency II
Author: Thijs ten Raa
Co-Authors: Bas van Leeuwen, Jan Luiten van Zanden, Pierre Mohnen

The Dutch 16-17th centuries were a period of unprecedented economic prosperity. Since the Dutch economy was and is very small, an important source of growth was bound to be international trade. In this paper we argue that the contributions of entrepreneurship to innovation transcend the standard categories of the creation of new products and processes. Entrepreneurship also creates new modes of trade. The Dutch were the globalization pioneers avant la lettre. The same considerations apply to the later decline of the Dutch economy. The rise and decline of the Dutch Republic are well explained by a combination of the traditional Total Factor Productivity (TFP) driver, innovations, and two facets of trade, namely openness and entrepreneurship.

Teaching Session 1: Linear programming in input-output analysis

Topic: Linear programming in input-output analysis
Author: Thijs ten Raa

In the first part we quickly review the dual equations of Input-Output Analysis and then introduce the theory of Linear Programming. It is a case of constrained optimization. We will set up so-called shadow prices, one for every constraint, and derive the phenomenon of complementary slackness and the main theorem of linear programming. We will reconnect the latter to the national income identity of Input-Output Analysis. We will show that shadow prices measure productivity.

Reference: Thijs ten Raa, The Economics of Input-Output Analysis, Cambridge University Press, 2005

Teaching Session 2: Linear programming in input-output analysis

Topic: Linear Prgramming in Input-Output Analysis
Author: Thijs ten Raa

In the second part we will zoom in on an important application of Linear Programming, namely Data Envelopment Analysis. This now popular technique is used to assess the relative efficiency of firms, industries or even national economies. There is a connection between efficiency and productivity and we will explain it in detail.

Reference: Thijs ten Raa, The Economics of Input-Output Analysis, Cambridge University Press, 2005

Teaching Session 3: Linear programming in input-output analysis

Topic: Linear Programming in Input-Output Analysis
Author: Thijs ten Raa

In the third part we combine what we have learned in applied general equilibrium modeling with an input-output core.

Reference: Thijs ten Raa, The Economics of Input-Output Analysis, Cambridge University Press, 2005

Towards a New Economic Geography based Estimate of Cross-Hauling in Regional Supply and Use Tables

Topic: Multipliers and income distribution
Author: Mark Thissen
Co-Authors: Dario Diodato

Regional supply, use and input-output tables are commonly estimated using nonsurvey techniques and are not constructed from survey data. However, these nonsurvey regionalization techniques do not take the possibility of exporting and importing the same type of products (cross-hauling) into account. Recently a new method was proposed to address this problem (Kronenberg, 2008). Although this method improves on earlier techniques as it makes cross-hauling possible, it is still subject to two major problems. These problems are the lack of an economic theoretical framework explaining the existence of cross-hauling, and the method is applicable to only one table independent from the others because the resulting regional tables would not add up to the national total. We therefore propose a new approach derived from the theoretical Dixit-Stiglitz-Krugman NEG model which is based on monopolistic competition and the love of variety. Its application is illustrated by the estimation of regional input-output tables for Europe (nuts 2) based on the European System of Accounts tables. Naturally, the new approach does not suffer from the underestimation of trade and the overestimation of regional input-output multipliers of earlier methods. The new method also gives insight in crucial parameters of the Dixit-Stiglitz-Krugman model such as the optimal size of the firm and the number of varieties and, thereby, the size of agglomeration economies in Europe.

The impact and effects of modal shift of waste transportation by IR-WIO (interregional waste input-output) analysis

Topic: Physical input-output tables
Author: Makiko Tsukui
Co-Authors: Keisuke Nakamura

The creation of a recycling society is one of the most urgent and important issues that could reduce global warming gases, use natural resources effectively, and reduce waste, especially for landfilling. The improvement of the efficiency of waste treatment and recycling is one of the issues to consider in creating such a society. In particular, policies for the implementation of a waste transportation system and the choosing of modes of transportation need to be created while considering such factors as cost, reducing the use of natural resources and reducing environmental loads, including global warming gasses. A modal shift, meaning the change of transportation means from automobile

or air, to ship or railway is an effective method for dealing with such issues. In this study, we estimate the effect of a modal shift in the waste transportation.

In our previous work (Tsukui and Nakamura 2009), we constructed the interregional waste transportation model (IR-WTM) which is a very versatile model that can be used for the analysis of transportation in general, not just waste transportation alone. Through the use of this model, we can estimate energy consumptions, CO2 emissions and SOX emissions for multiple means of transportation, such as by automobile, ship, railway, and air. To estimate the effect of a modal shift of waste transportation, we apply this IR-WTM to the interregional waste input-output (IR-WIO) analysis model which is one of the more powerful tools that can be used to analyze economic activities, waste emissions and waste treatments simultaneously (Nakamura et. al. 2002, Takase et. al. 2002, Urabe 2001 and Tsukui 2004, 2007).

In IR-WTM, the unit of measurement, freight ton kilometers, is used to estimate energy consumption, CO2 emission, SOX emission and the cost of energy for each transportation means. For a case study, to demonstrate the usability of this model, we applied it to waste transportation in Japan in 2007, when the latest statistics were published. Japan is one of many countries which have a nation-wide railroad network. However, in recently history, this railway system has not been used for waste transportation, although it has been used for freight transport. As is well known, rail and ship transportation have a much lower energy consumption resulting in less environmental load which is typified by lowered CO2 emissions. In 2007, the total amount of waste transportation between prefectures in Japan was 34.4 million tons; about 80.9 % is transported by truck and the rest by ship. However, when we use freight ton kilometer, units to look at this, the total amount of waste transportation is 6,063.5 million, with the ratio of truck to ship being approximately-equivalent at about 52.0% and 47.9% respectively. This shows that the ship transportation does have a not-insignificant part to play in the long distance transportation of waste. In this present study, we estimate the effect of modal shift from truck to railway transportation. Transportation by truck is mainly used for intermediate or short distance waste transportation between prefectures. We propose that the importance of rail transportation over these distance be raised. According to estimates by applying IR-WTM, if truck transportation is completely replaced by railway transportation, the modal shift from truck to railway may result in a reduction of 0.96 million t-CO2 which is about 3.06 % of the total CO2 emission of waste treatment sectors in Japan in 2007. The CO2 emission of waste transportation by railway is about 69.5 thousand t-CO2, which is much less than that by truck at 1,026.0 thousand t-CO2.

By linking IR-WTM and IR-WIO analyses, we can estimate not only the direct effects of the modal shift concerning the cost of energy, energy consumption and environmental loads but also estimate the spillover effects of the modal shift. We will also estimate the effects of a modal shift of long distance transportation of waste from truck to ship. In this study, we only considered the effect of the modal shift by simply changing the means of transportation. It is also important better to consider the effect of cost, energy consumption and environmental load in the maintenance of the transportation. Along with the popularization of railway transportation, we may have to widen our considerations about the effect on the demand of durable goods and inputs of fixed capital formation sectors, such as a decrease in demand for trucks, an increase in rail freight, and the creation and improvements of transshipment facilities. In practice, it is also important to include the introduction of laws and regulations facilitating a shift in the transportation of waste from road to rail.

The research of the first author was supported by the Japan Society for the Promotion of Science, Grant-in-Aid for Scientific Research C19510049.

EXIOPOL: Philosophy and Main Approach

Topic: EXIOPOL: Latest progress and preliminary results of work on a global, detailed MR EE SUT/IOT database
Author: Arnold Tukker

The Integrated Project (IP) EXIOPOL (A New Environmental Accounting Framework Using Externality Data and Input-Output Tools for Policy Analysis) has been set up by FEEM and TNO (being co-ordinator and scientific director) under the EU's 6th Framework Program. It has a budget of 5 Mio Euro and runs between Spring 2007 and 2011. A key goal is to to set up an environmentally extended (EE) Input-Output (I-O) framework with environmental extensions in which as many of these estimates as possible are included, allowing the estimation of environmental impacts and external costs of different economic sector activities, final consumption activities and resource consumption for countries in the EU.

The EE I-O work in project also forces scientists that worked on rather separate fields such as IO analysis (IOA) Material Flow Analysis (MFA) and Life cycle assessment of products (LCA), to organise their approaches and data in a unified framework. Where in theory such unified frameworks have been developed (e.g. SEEA, UN et al, 2003), EXIOPOL is probably one of the first projects that integrates data on such a broad scale. In this paper we want to discuss the architecture of the project, and the results of EXIOPOL's scoping phase, that brought to the fore a number of inconsistencies in brings together This paper discusses the architecture of the proposed database, and our experiences and proposed solutions for problems related to integrating data and indicators systems that have been set up using different conventions (FEEM&TNO, 2006; Tukker et al., 2007).

In the scoping phase of the project and later in the development of the databas a great number of choices has been made. This paper introduces the project, indicates main methodological choices, and provides the 'big picture' of the project. Subsequent talks will go in more depth into key activities in the project (transforming/harmonizing SUT and IOTs; gathering extensions; linking SUT and IOT via trade, the development of a relational database system, and how the database can be used for policy applications and used with models).

The oil and gas sector in Russian Supply and Use Tables

Topic: Asia beyond the crisis: visions from international input-output analysis
Author: Natalia Ustinova

Oil and gas sector plays a significant role in the economy of Russia. However it is difficult to measure it precisely as possible because the boundaries of this sector are illegible. Not only producers of oil and gas but also enterprises carrying out transportation and trade of these products can be included in this sector. Therefore measuring the size of oil and gas sector and its role in GDP estimation depends on definition of boundaries of this sector.
Problems connected with the quantification of this sector are caused moreover by the peculiarities of functioning of oil and gas companies in Russia. Most of these companies represent vertically integrated corporations which control groups of subsidiaries engaging in the extraction of crude oil and gas, processing and wholesale and retail trade of finished goods. Being owners of raw materials (crude oil and gas) and consequently owners of finished goods (refined oil, chemical products, etc) these holding corporations receive extra-revenues from wholesale trade of finished goods. The great part of value added of oil and gas sector are concentrated in these companies.
The purpose of this paper is to discuss different methods of measuring the size of oil and gas sector

using the data of Supply and Use tables as well as problems and limitations of the current estimates of this sector carried out by the Federal State Statistics Service of Russian Federation. This paper focuses on the measurement issues and contains some figures characterizing parameters of this sector and its role in GDP estimation.

Keywords: oil and gas sector, Supply and Use tables, basic price, consumer price, trade and transport margins.

The change of the capital and labor input for China's economy

Topic: Analysis of factor inputs
Author: Duan Yu Wan
Co-Authors: Cuihong Yang

As for growth of the economy, generally speaking, there are two important paths to realize. One is to increase the input; the other is to improve the technology level. Capital and labor, as the most important input factors, are especially significant to the economic development. China’s economy has a rapid growth in the recent 10 years, so is there something different for its capital and labor input? On the basis of input-output model, this paper uses input-output tables of China to analyze how the capital and labor input changed, and the main determining factors. The paper computes the capital productivity and the labor productivity of different sectors, and analyzes the transfer effect along production chain. Along with the rapid growth of China’s economy, China’s imports and exports witness a fast increase, the paper describes the change of input factors of the import and export goods, and also uses the decomposition technology to analyze the main determining factors. Finally, the paper presents some conclusions and tries to provide some recommendations for the economic development.

A non-linear input-output model for measuring the employment effect of changes in final demand: an approach based on the employment elasticity

Topic: Input-output applied to social issues II
Author: Bin Wang
Co-Authors: Jian Xu

Abstract: The employment effect of changes in final demand has always attracted the attention of researchers. For example, many papers are trying to calculate the impact of the decrease in China’s export due to the U.S. sub-prime crisis on China’s employment. Among many measurement methods, researchers prefer to use the input-output model to measure the employment effects of changes in final demand. The input-output technology can reflect the interdependence among industries in national economic system comprehensively and systematically. Compared with other methods, input-output method has an unparalleled advantage in measuring total impact of changes in final demand on employment. However, classical input-output model always assumes that the relationship between the output of various sectors and its employment is linear. According to economic theory, employment is more sticky than output, which makes employment doesn’t change linearly with the output, but has the obvious non-linear relationship with the output. So, the linear model will overestimate the employment effects of the changes in final demand. To solve the problem, this paper designs econometric models to estimate employment elasticity by sector and introduce the results into the input-output model to get a partial non-linear input-output model. Based on this input-output model with non-linear output-employment relationship, an empirical

research has been done by using the 2007 input-output table in China and the data on China's employment from 2002 to 2009 to analyze the impact of the decrease in China's export due to the U.S. sub-prime crisis on China's Employment. Comparing with the IO model with linear output-employment relationship, the new model got the much smaller employment effect.

How Much Does the International Financial Crisis Affect China's GDP and Employment?

Topic: Crisis and disaster analyses
Author: Huijuan Wang
Co-Authors: Cuihong Yang, Xikang Chen

The financial crisis triggered by the US sub-prime crisis swept across the globe in 2008. China's financial system has entered the process of economic globalization and cannot keep away form the financial crisis.

China's GDP only increased 6.8% year-on-year in the fourth quarter of 2008, 5.7 percentage points lower than the same period of the previous year. Unemployment rate in cities and towns, in the same quarter, increased to 4.2% from 4% compared with the previous quarter, while it has been decreasing since 2003. Though the main reason of downturn and increased unemployment is international crisis, there are many other factors to accelerate the economic deterioration, such as the declining circle of China's economy.

The international financial crisis deteriorated gradually in the first three quarters of 2009, which theoretically influenced China more seriously. But China's economic trend is good because of the macro-control measures flexibility taken by government. China's GDP increased 7.7% compared with the same period of the previous year. Although it decreased 2.2 percentage points, China's GDP increased gradually in each quarter.

In order to distinguish the influence caused by international financial crisis economic circle and macro-control policy, this paper starts from analyzing the influence of financial crisis on China's export and investment, by using Input-Output model of the non-competitive imports type capturing China's processing exports to calculate how much the international financial crisis affects China's GDP and employment. This model divides intermediate input into domestically intermediate inputs matrix and imported intermediate inputs matrix. Taking into account China's processing trade dominating trade pattern characteristics, we further divide domestic production activities into general production for domestic use (D), processing exports (P) and non-processing exports and others (N).

The result indicates that the impact of financial crisis on China's economy is more and more serious during the fourth quarter of 2008 and the third quarter of 2009. The GDP loss, which indicates the actual impact of financial crisis, of the fourth quarter of 2008 is 3737 billion RMB and that of the third quarter of 2009 is 6491 billion RMB, accounted for 8.3% of the GDP of the third quarter of 2009. But China's actual GDP growth rate of the third quarter of 2009 just decreased 0.1 percentage points compared with the same period of the previous year. The impact of financial crisis was not reflected adequately. The number of unemployed people was 12.51 million in the fourth quarter of 2008 and 21.72 million in the third quarter of 2009. However, the situation of employment in China is stable and there is no large-scale unemployment. The situation of GDP and employment indicates that the stimulation measures taken by the Chinese government are effective and stand against global financial crisis effectively.

Application of the Input-Output Model to the Analysis of the Economic Impacts of Transport Infrastructure Investment in Australia

Topic: Sector specific analyses: services II
Author: Jian Wang
Co-Authors: Michael B. Charles

1. Background
The scope of the Australian land transport system – which primarily includes roads, mass transit systems, and rail – is vast and increasingly congested. Passenger and freight traffic are expected to grow substantially in the future, requiring continued investment in land transport systems (BTRE, 2006). With the rapid deterioration of economic conditions and rising unemployment, public investment is back on the policy agenda – as a job-creation program linked to the need to revitalise the nation's crumbling land transport infrastructure.

Controversies often rage over whether such investments are efficient or whether the money would be better spent on other public projects. For this investment to have the greatest positive effect on emerging transport problems, government agencies therefore need ways of assessing the economic benefits that arise from transport projects to see whether they are sufficient to justify the cost. Conventional transport Cost-Benefit Analysis (CBA) largely concentrates on counting the direct impacts of a project, which are principally time and cost savings (ATC 2006). Economic impact analysis assesses how some direct benefits and costs of investment convert to indirect effects on the local, regional, or national economy or on a particular sector of the economy, such as changes in wages and employment, purchases of goods and services or tax revenue. Economic impact analysis includes a number of factors other than those that meet the stricter criteria for inclusion in a CBA framework. As a result, these types of factors have not been incorporated into the cost-benefit calculation (OECD, 2002).

Despite this, it is argued here that the inclusion of economic benefits via appropriate economic data, such as changes in wages, consumption and tax revenue, will help to produce estimates of the direct and indirect economic implications of a potential action, such as the undertaking of a large infrastructure-type investment. The application of economic models such as Input-Output (IO) has been beneficial in evaluating the economic impacts to government agencies assisting a major project. However, IO results often have not been presented in a manner useful for policy makers to weigh up the costs and benefits of an infrastructure project (Layman, 2004).

In this research, we ask whether economic benefits results from IO analysis can be incorporated into the strict discipline of a conventional CBA framework, and whether the two methods can in fact enhance each other.

2. Research Objectives
The research has three broad and interrelated goals;
-Providing a taxonomy of economic impacts (that is, to define a set of categories of benefits that might arise);
-Reviewing conventional methods of assessment that are currently used by government agencies to measure economic impacts; and
-Introducing an IO-based CBA model that incorporates IO results which are often not captured by a conventional CBA assessment.

3. Methodology
This research focuses on an investigation of incorporating IO results into a conventional CBA

assessment for transport project analysis. It will use input-output and CBA techniques as follows:

Modeling the Economic Impact of the Project
Commonly, IO results from the advent of a transport project are presented as;
-Increased Gross Regional Product (GRP) or GDP;
-Increased regional employment; and
-Increased government revenues.

In this research, we focus on measuring economic welfare gain in terms of real consumption. A major strength of IO models is their ability to take investment and production/wages and calculate estimated consumption. Focusing on consumption also automatically removes many of the costs incurred at the advent of the project. Consequently, real consumption is considered as the best practical measure of economic welfare gain.

Cost-Benefit Analysis
-First principles analysis, in which the rational as to why the project should be assisted is determined;
-Estimation of the benefits (real consumption, government revenue and wage bill);
-Estimation of government expenditures and subsidies; and
-Calculation of summary variables such as the Net Present Value and Benefit-Cost Ratio.

4. Data Sources
-Australian Input-Output Tables from the Australian Bureau of Statistics.
-Transport statistics published by the Department of Infrastructure, Transport and Regional Economics.
-GDP-deflator for personal consumption expenditures from the Australian Bureau of Statistics.

5. Expected Results
This research asks whether results from IO analysis can be condensed down to the strict discipline of a CBA. Building on a hypothetical simulation, it endeavors to demonstrate that the two methods can in fact enhance each other and that IO-based CBA model is applicable to major infrastructure project analysis.

Hybrid methods for incorporating changes in energy technologies in an input-output framework

Topic: Environmantal Life Cycle Assessment analyses
Author: Thomas Oliver Wiedmann
Co-Authors: John Barrett, Kuishuang Feng, Manfred Lenzen

Future energy technologies will be key for a successful reduction of man-made greenhouse gas emissions. Worldwide, electricity and heat production account for 43% of industrial CO2 emissions. With demand for electricity in particular projected to increase significantly in the future, climate policy goals of limiting the effects of global atmospheric warming can only be achieved if power generation processes are profoundly de-carbonised, leading to a drastic reduction of CO2 emissions in this sector.

In this work we use financial information as well as specific primary data for technical processes and emissions to conduct a hybrid life-cycle assessment (hybrid LCA) of four key energy technologies: wind power, supercritical pulverized coal with carbon capture and storage, integrated gasification

combined cycles (IGCC) and nuclear power generation. A particular emphasis will be on the comparison of different methodological approaches. Hybrid LCA generally aims to combine the specificity of process analysis with the comprehensiveness of input-output analysis and has been applied to energy analysis since the 1970s.

We investigate the effectiveness and suitability of three different techniques: input-output-based hybrid LCA, integrated hybrid LCA and the novel path exchange method for the analysis of emerging energy technologies in the United Kingdom. We use an updated set of UK supply and use tables with a sector resolution of 123 as the basis for the input-output part in each approach. Input-output-based hybrid LCA is performed by disaggregating the electricity generation sector into several sub-sectors representing the aforementioned power generation technologies; varying degrees of market penetration are assumed in different scenarios. In integrated hybrid LCA we augment the monetary input-output tables with process matrices based on the primary technical data, Finally, in the path exchange method we first perform a structural path analysis of the UK electricity sector, quantifying the CO2 emissions associated with upstream production processes, and subsequently replace relevant paths with corresponding primary process data to improve the accuracy of the calculation. We compare and discuss the results from the three approaches and consider uncertainty implications.

Uncertainty and sensitivity analysis in MRIO modelling – some empirical results with regard to the carbon footprint of the Netherlands

Topic: Multirregional input-output modelling
Author: Harry C Wilting

Recently, an input-output model has been developed for the calculation of the Dutch carbon footprint. The model is a full multi-regional input-output (MRIO) model with feedback loops in trade between 12 world regions and the Netherlands. Given the huge amounts of economic and greenhouse gas (GHG) emission data used in the model and the assumptions made in constructing the MRIO table, an uncertainty analysis seems to be useful.
In the paper, an uncertainty and sensitivity analysis are presented for the MRIO model mentioned. The uncertainty analysis is carried out in order to gain an understanding of the effects of uncertainties in the data on the uncertainties in the outcomes. This uncertainty analysis concerns a Monte-Carlo analysis based on probability distributions around the IO and GHG emission coefficients in the model. The sensitivity analysis is performed to investigate which of the coefficients are the most important in the calculation of the Dutch carbon footprint. Especially the coefficients in the MRIO table are considered by determining their effects on the overall footprint as well as on more detailed outcomes at the regional and sectoral level.

Technology Scenarios, Economic Modeling and Life-Cycle Inventories

Topic: Environmantal Life Cycle Assessment analyses
Author: Richard Wood
Co-Authors: Edgar Hertwich

Ample experience with life-cycle assessment (LCA) shows that two factors critically influence the amount of emissions caused during the life-cycle of a products: (a) The emissions and energy/resource use by the foreground system, that is the product system investigated, and (b) the emissions intensity of the background system which provides energy, materials, services and other

inputs. The degree of responsibility of those two elements varies among different cases, but it is clear that both elements need to be considered. In a prospective assessment of economic activity and environmental impact caused by the future, large-scale application of (novel) technologies, both elements may change and they hence need to be specified.

In a new EU project - PROSUITE - the strategy in the modeling is to integrate the modeling of the value chains of product systems shaped by novel technologies and the modeling of the background economy through a hybrid of product-chain analysis and economic input-output modeling. The foreground system is defined as the parts of the value chain that are specific to the case investigated. The background system is the system that is modeled on a generic basis common for many cases.

The use of technology performance and cost information in scenario development. Scenarios for the evolution of the background economy will be developed. In these scenarios, a prospective future economy will be described in the form of an input-output table. The input-output table contains information on the requirements of energy, some materials and other environmentally important inputs to the economy, as well as information on economic activity and employment triggered by the demand for output from various sectors. There will be several scenarios describing different, alternative futures. Scenarios will be developed for the economy in 2020, potentially extended also to 2030, and taken from key existing models.

There is a need to further specify the break-down of the economic activity in the original IO tables on the more detailed aggregation level chosen for the specific technologies targeted in the modelling. Input from technology characterization will be used to this end:

a. A specification of important technologies which we should assume to have penetrated to significant degrees in 2020 or 2030, and a description of the degree of penetration.
b. A specification of the physical characteristics and costs of novel technologies that will have penetrated at a level significant for the performance or sustainability attributes of the overall economy. This specification should be in the form of a “production recipe” (intermediate input requirements – including capital and labor - and yield).
c. A specification of technological progress attained (decreased intermediate input or labor requirements, increased efficiencies) resulting from technology learning for important technologies.

In environmental assessments, the output of the scenario analysis will be used in the same manner as life-cycle inventory databases are used today: as background data to describe inputs of energy, materials, services and the like. These inputs can be utilized in conventional LCA software. But modeling of economic aspects and overall sustainability aspects may require an integration of the foreground technology scenario and the model of the total (background) economy. This implies that data on inputs, outputs and environmental interventions caused by the processes needs to be integrated into the model.

We conclude with a discussion of the challenges in integrating the foreground and background systems in a dynamic manner such that macro-variables of interest of the background system can be determined endogenously from the foreground system.

Generic methods for estimating input-output models under partial information

Topic: EXIOPOL: Latest progress and preliminary results of work on a global, detailed MR EE SUT/IOT database
Author: Richard Wood

Input-output models have been estimated under partial information ever since the postulation of the RAS technique by Stone in 1962. Methods have become much more advanced since this time, such that any type of related data can now be incorporated in the estimation techniques, not just row and column sums. We are now at the point where any information in any pricing type can be fairly easily incorporated into input-output matrix estimation. As a first step, this paper outlines the generic ability of incorporating new data sources. The flow of information from source to final product can be greatly simplified under a strict adherence to classification structures.

As a second step, this paper discusses the application of matrix estimation techniques for not only updating input-output models, but also for disaggregating the models. As an example, increased sector detail may be available from physical data such as energy or LCA databases that could be incorporated into an input-output model.

As these models are almost always underdetermined (i.e. more data points needing to be estimated than data constraints available), the choice of target function in obtaining a solution can become important. There are two components of the target function, the form, and the contents. The actual economic and physical implication of different target function forms is discussed. The contents of the target function relates (most specifically in input-output modelling) to the choice of minimising distance over coefficients or absolute flows. Under some target functions (e.g. RAS type) this is not important, but for linear or quadratic target functions, the choice has an economic meaning. This meaning is discussed with reference to the underlying uncertainty in the initial data, and the difference between updating and disaggregating input-output tables.

Source data is almost never 100% in agreement, and updating methods generally must be robust enough to handle differences in data sources. Differences can be overcome by a stepped updating method, or by incorporating a specific term within the target function to handle these differences. Again, the choice of form of the term in the target function has different economic meaning.

Finally, whilst computational ability is far beyond what was available to Stone and colleagues, we are still limited by the ability of solvers to find global minimums, and, less so, in the size of problems. These limitations eventually, flows back to the choice of target function, some being easier to compute than others. Discussion concludes on recent experience in estimating single-region and global multi-regional input-output models, with particular reference to the computability of highly conflicting source data.

Study on China’s Energy-Economy-Environment System Based on Sustainable Economic Growth

Topic: Environmentally extended input-output analysis
Author: Yan Xia
Co-Authors: Cuihong Yang, Xikang Chen

China is and will be the most important energy consumer and producer in the world. The growth rates of energy demands and energy-related CO2 emission per capita are relative higher. With the

popularity of low-carbon economy, the causality relationship among energy consumption, gross domestic product (GDP) and environmental pollution is a key issue in energy economics. Although a large number of studies on this issue have been reported over the past years, there is still a lack of analysis as to the distinction of contribution generated by energy to the economy (instead of other resources, for example capital, labor). Is China an energy-exporting or importing country in recent years? In this paper, a non-competitive energy-economy-environment import-type input-output (N3EIIO) model and DEA-type linear programming models are constructed to measure energy consumption performance. The empirical results indicate that in order to obtain a "win-win" outcomes for China's economic growth and the target of energy-saving and emission reduction, more measures should be adopted. The measures include: increasing the proportion of non-fossil energy in primary energy consumption, imposing carbon tax, developing clean coal technology and encouraging processing trade in a controlling manner.

Chinese Agribusiness: Structure, Linkage and Development - A Comparative Analysis Based on Input-Output Model

Topic: Sector specific analyses: agriculture
Author: Geng Xianhui
Co-Authors: Zhou Yingheng

Agribusiness is a complex comprehensive industry chain, which is playing a vital role in the Chinese national economy. The research will introduce the concept of agribusiness for the analysis of Chinese agriculture. Based on the input-output method which has been matured in the word, the research tries to establish Chinese Agribusiness I-O tables based on Chinese I-O tables from 1987 to 2002, which will become the platform to measure Chinese agribusiness and analyze its structure and linkages. At the same time, the study will compare total Chinese agribusiness outputs and the structure with that of US and Japan, on which the research can draw some conclusions and give some certain policy suggestion to speed the development of Chinese agribusiness.

According to calculating based on Chinese and American 2002 I-O table, Japanese 2000 I-O table, agriculture outputs account for 8.91 percent, 1.34pecent and 1.44 percent of all sector total outputs respectively; Agribusiness outputs account for 26pecent, 10pecent and 12pecent respectively. In Chinese agribusiness system, proportions of input sector, produce sector, processing sector and marketing service sector are 0.18 : 1 : 1.32 : 0.44, comparing with that of US 0.30 : 1 : 3.89 : 2.15 and Japan 0.15 : 1 : 4.38 : 2.49. As a result, China's agricultural processing and agricultural marketing are incomplete, which is the key to restrict Chinese agribusiness development. As to linkages, the influence coefficient of Chinese agribusiness is 1.0162, which means that Chinese agribusiness plays and obvious and important role for the development of the national economy.

A theory for measuring productivity change in the system with fixed capital

Topic: Productivity and efficiency I
Author: Takashi Yagi

This paper explains a theory to measure social productivity in the system with fixed capital. I have constructed productivity indexes by using the standard net products of the Sraffa system. My productivity indexes may have a relevance to Pasinetti's dynamic standard commodity. In this paper, I will extend my idea and consider how to construct a productivity index by the production system with fixed capital.

Towards multiproducts production model: analysis from harmonized multinational supply and use database

Topic: Multirregional input-output modelling
Author: Norihiko Yamano

Recently, the availability of harmonized input-output and national account related database has been significantly improved by various efforts by many countries. These multinational data sources enable us to compare the precise production structures and international procurement processes. This study focuses on the information of supply table to examine the multi-products selection model of industries. The substitution effects with imported goods are also estimated using the comparable industry based bilateral trade data. The results show that international procurement processes and multiproduct flexible supplying behavior become evident in last decade. The derived results also imply the argument for effectiveness of conventional production functions used in various economic models.

GHG emissions embodied in international trade (intercountry-interindustry framework)

Topic: Australian Bureau of Statistics Special Session I
Author: Norihiko Yamano

A recent study that measures the carbon embodied in internationally traded products is reported. At an aggregate national level, embodied emissions is measured by constructing a national “CO2 balance”. This balance represents the difference in emissions embodied in consumption and production. The recent updated results for 1995-2005 indicate that the net carbon imports of the OECD countries become much larger than our earlier studies (2003, 2009). Despite the recent improved availability of the data sources regarding input-output, bilateral trade in goods and services and GHG emissions, the estimate model needs to be carefully evaluated due to the statistical issues of trade statistics and the fuel combustion intensities across countries.

Constructing Joint Production Chains: An Enterprise Input-Output Approach

Topic: Enterprise input-output approach, environment issues and policy making I
Author: Devrim Murat Yazan

The aim of this paper is to propose different sustainable production chain (PC) combinations whose environmental impact can be reduced through 3R (reuse, recycling, remanufacturing) activities and various supply policy decisions. Two or more PCs having no relationship in terms of material/energy flows can be linked through 3R activities or supply redirection.
These joint production chains (JPCs) propose sustainable solutions to environmental problems and their material/energy flows can be foreseen by enterprise input-output (EIO) modelling. From an input-output point of view JPCs are categorized in three groups: (1) JPCs incorporating waste reuse/recycling, (2) JPCs incorporating main output recycling/remanufacturing, and (3) JPCs based on final demand redirection. Not only physical flows but also related monetary flows are modelled to foresee the future environmental and economic benefits of such a cooperation among the chains. Numerical examples from second generation bio fuel and first generation bio-energy production and end of life tyre recycling will sustain the constructed model to demonstrate the practical applicability of the model.

The paper has managerial contribution for practitioners in real life problems to adapt their PCs to environmental regulations imposed by governments and to reduce related environmental costs.

Keywords: joint production chains, enterprise input-output, environmental sustainability

The Design and Coordination of Joint Production Chains Incorporating Waste Recycling

Topic: Enterprise input-output approach, environment issues and policy making I
Author: Devrim Murat Yazan
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Although there is an extended literature on waste recycling methods and their utility areas, the design and coordination of newly resulting joint production chains (JPCs) seem to be ignored. Since JPCs incorporating waste recycling are not stable like traditional supply chains their design and coordination needs a specific approach. This paper adopts an enterprise input-output (EIO) approach to foresee the potential economic benefits of JPC actors cooperating through the use of alternative materials obtained by waste recycling. It also investigates the related environmental contribution. Different scenarios – and associated coordination policies – based on (1) recycling task assignment, (2) spatial configuration of chain actors, and (3) main output demand incompatibility are investigated. The empirical application uses the case of a marble-concrete JPC. Moreover, bargaining power of waste supplier(s), willingness to cooperate and rights on benefit sharing of JPC actors are analyzed.
Results show that the behaviours of chain actors are strongly affected by the balance between the available and demanded waste quantity in the market. One of the interesting results is that in the opposition of rational mature markets, an excess of waste supply can provide an advantage to small sized waste suppliers if the demand is less than the available waste quantity in the market. Negotiation, bidding, standardization, gaming, and hierarchy can be adopted as coordination mechanisms according to emerging waste market structures.
The paper theoretically contributes by introducing the EIO approach into the fields of cooperation and industrial symbiosis. A practical contribution is the evaluation of performance drivers and their impacts on the environmental and operational efficiency of the JPC. Finally, managerial implications related to the impact of the behaviours of chain actors can be drawn proposing useful coordination policies applicable in emerging waste markets.

Keywords: joint production chain, enterprise input-output, waste recycling, cooperation, design, coordination

Price and revenue effect of Japan’s VAT reform

Topic: Input-output and prices
Author: Ye Zuo Yi
Co-Authors: Kiyoshi Fujikawa, Mitsuru Shimoda, Takashi Watanabe

Twenties years have passed since Japanese government introduced VAT (value-added tax) in 1989 after 10 years of debate. During those two decades, the VAT rate was raised the current 5% in 1997(4% for the central tax and 1% for the local tax) from the initial 3% to and the taxation coverage of venders has been enlarged. Now the VAT is the third largest tax scheme whose annual revenue for the central government is approximately \10 trillion or $100 million in 2008 after the personal

income tax (\15 trillion) and the corporate income tax (\10 trillion). On the other hand, the government deficit in Japan is huge and the outstanding balance of the government bond is now reaching \1,000 trillion which is twice as large as the current nominal GDP. Under such situation, VAT reform is one of the hot financial issues in Japanese Diet as well as gasoline (energy) tax and pension fund reform.
There are two focuses of the discussion on VAT reform. One is elimination of so-called “Tax profit” which is unique phenomenon in Japanese VAT. Because of a preferential measure for micro venders, a certain amount of VAT paid by consumers to venders is not paid to the tax authority by the venders. In order to avoid “Tax profit”, the current “Account Method” ought to be switched to “Invoice Method” which is used commonly in EU countries. The other is introduction of “plural tax rates”. Since VAT is counter- progressive in terms of income of consumers, introduction of reduced tax rates for daily necessaries like foods would be necessary so that rising VAT rate may be accepted by consumers.
The first purpose of this research is to present a VAT simulation model in the I-O framework. Even-though Japanese government says the current Account Method VAT is in principle same as EU’s Invoice Method VAT, the VAT simulation model in the I-O framework is substantially different especially in case “plural tax rate system” is introduced. And the second purpose is to implement some simulation analyses based on the I-O model. We calculate theoretical tax revenue and price effects for two methods of VAT taking Japan’s regime switch in the mind. And we calculate theoretical tax revenue and price effects when “plural tax rate system” is introduced where agricultural products and foods, for example, are exempt or reduced tax rates are applied to such commodities. Incidentally, exemption and zero-tax rate are theoretically different. When the VAT system switched from Account method to Invoice method and VAT rate is raised in Japan, the difference between exemption and zero-tax rate is significant. We take the difference of exemption and zero-tax rate in daily necessaries into account when we simulate the theoretical tax revenue and price effects.

Comparative Assessment of Application of Gross and Net Multipliers for the Determination of Iranian Economy

Topic: Key sectors and multiplier analysis
Author: Mohammadgholi Yousefi
Co-Authors: Mohammad Hussain Ghelbash

Measuring the importance of an industry for an economy is very important. Knowing key sectors helps policy makers to better allocate their scarce resources efficiently. Traditional or what is called Gross Multipliers by emphasizing on output helps selection of those sectors which have higher forward and backward linkages disregarding the fact that this way of selecting important sectors may not only be uni-directional, i. e showing dependence of other sectors on the chosen sectors and double accounting of output, but it also ignores the possibility and sensitivity of the sectors chosen to the outside shocks and thereby disregarding the vulnerability of the chosen sectors. In other words it does not take into account the possibility that the sectors chosen may highly be dependent on the other sectors to avoid this problem, a new net multiplier has been introduced which is bi-directional in the sense that not only shows the dependence of other sectors to the sectors chosen but it also shows how the chosen sectors themselves depend on other sectors and emphasizing on final demand. We have tested these two concepts to Iranian economy. The result show that net multiplier provide a better picture of Iranian economy. Out of eight sectors chosen six sectors belong to services. This finding is matching the structure of Iranian economy which is dominated by service sectors.

Study on Modern Service Industry of Guangdong Province Based on Input-output Analysis

Topic: Sector specific analyses: services I
Author: Jianwen Yuan

Abstract: On the basis of clear classification and review of the modern service industry in Guangdong province, and according to the input-output tables in Guangdong province in 2002 and 2007, the input-output table of 15 sectors, including 9 modern service industry sectors and the input-output table of 4 sectors, including only 1 modern service industry sector, are derived to analyze the input-output of modern service industry in Guangdong province. The analysis shows that modern service industry of Guangdong province has the characteristics of low input and high output, and that the rapid growth of consumer demand for modern service industry leads to Guangdong's persistent and rapid economic growth; as modern service industry of Guangdong province is highly capital-intensive industry, the development of modern service industry can ensure the persistent and rapid growth of the national economy; in Guangdong province, modern service industry's promoting role is greater than its leading role, and its growth rate is much higher than that of the other industries in the national economy.
Key words: Modern service industry; Input-output; Econometric analysis; Guangdong province

The Sources of Carbon Intensity Change in China: 1997-2007

Topic: Climate policy issues: analyses
Author: Hongxia Zhang
Co-Authors: Zheng Xinye, Xiuli Liu

This paper employs non-competitive input-output model and structural decomposition analysis to analyze the historical change in energy-related carbon intensity in China in the period of 1997-2007, based on the 1997, 2002 and 2007 Chinese input-output tables. The carbon intensity (CO2 emission per unit of GDP) is explained from the demand side and also the supply side. The main factors affecting carbon intensity include the production technology, the energy and environmental technology, the final demand allocation structure, the product structure of each kind of demand (including household consumption, capital formation, exports and others), and the household emission intensity. We can induce the effect of the industrial structure change by the production technology and the demand pattern. The results show that the big decrease of carbon intensity in 1997-2002 mainly attributes to the technology, the great reduction of energy intensity and the change of the production technology. However, in 2002-1997, there are significant changes: (1) the production technology makes the carbon intensity increase, because of the increases in input coefficients of high carbon emission materials; (2)exports becomes much more important for its great negative effect on carbon intensity; (3) the potential of household consumption in decarbonizing decrease, and the negative effect of capital formation increase; (4) the negative influence of industrial structure increases greatly, and the reasons from long term and short term aspects are given in the paper. The policy implications are also investigated at last.

Keywords: Carbon intensity; input-output model; structural decomposition analysis

Regional Environmental Impact of Tourism – Linking the regional tourism satellite accounts and the regional environmental accounts within the Danish regional model framework

Topic: Input-output studies of tourism issues II
Author: Jie Zhang

The main purpose of this paper is to assess tourists' contribution to greenhouse gas emission. To achieve this goal, it is needed to construct the regional environmental satellite accounts for Denmark. The national environmental air emission data from Denmark statistics should be broken down into regional level in order to carry out analysis at the regional level. It requires also a linkage between the regional tourism satellite accounts and the regional environmental accounts within the Danish regional economic modelling framework.
The paper presents the data from both regional tourism accounts and the national environmental accounts. The main discussion focuses on the methodologies needed for constructing the regional environmental accounts and the linkage between the two accounts. The linkage between the two accounts involves two connections with greenhouse gas emission. One connection shows that tourism demand through the tourism related sectors is connected (i.e. backward linkage) to intermediate consumption; the other connection is tourism demand directly linked with private consumption. The greenhouse gas (GHG) emission is accounted through both intermediate consumption and the private consumption.
The Danish interregional macroeconomic model provides a modelling framework for both regional tourism accounts and the regional environmental accounts. The modeling results provide both direct impact and total impact of the tourism demand on GHG emission. Tourism demand in Denmark accounts for approximately 2% of output and 10% of private consumption. The analysis shows that tourism direct impact on GHG emission through production accounts for 1.5% of national emission; while the total tourism impact on GHG emission rises to 5% of the national total. The tourism contribution to GHG emission through private consumption is around 14% of national total emission. The direct and the total impact from tourism on GHG emission through private consumption is not so much different.
The tourism impact on environment concerns both different types of tourism and different tourism destination. Some case studies present some interesting results from different types of tourism and also give a regional overview of tourism impact on environment.

Market Access, Supply Access and Geographic Concentration of Manufactures in China: A Interregional Input-output Approach

Topic: Sector specific analyses: manufacturing
Author: Zhao Zhao
Co-Authors: Shi Minjun, Jing Yang

In past decades, manufacturing sectors continue to concentrate into the coastal regions which have enlarged regional disparity between the coastal regions and the inland areas in China. Exploring why manufactures continue to concentrate into the coastal regions may help gain an insight into China's regional inequality. New Economic Geography (NEG) has provided a new analysis framework which attributes the centripetal forces to market access (MA) and supply access (SA). So far, there have been plenty of empirical analysis proved the role of MA and SA played in spatial inequality both from national level and regional level. However evidences are still lack at sector level and especially little attention paid to China. This paper examined the effects of MA and SA on changes in spatial distribution of manufactures in China based on interregional input-output

analysis. Firstly, changes in spatial distribution of manufactures by four-digit sectors and sector-based market access and supply access are measured by using China interregional IO table 2002 and China Market Statistics Yearbook. Based on this work, the determinants of changes in spatial distribution of manufactures are examined with an emphasis on the effects of MA and SA. The results indicate that MA and SA indeed play an important role in changes in spatial distribution of manufactures; however the effects of MA and SA vary across the regions and sectors. Downstream sectors and upstream sectors, primary sectors and processing sectors, both have discrepant performance in agglomeration and are affected by MA and SA differently.

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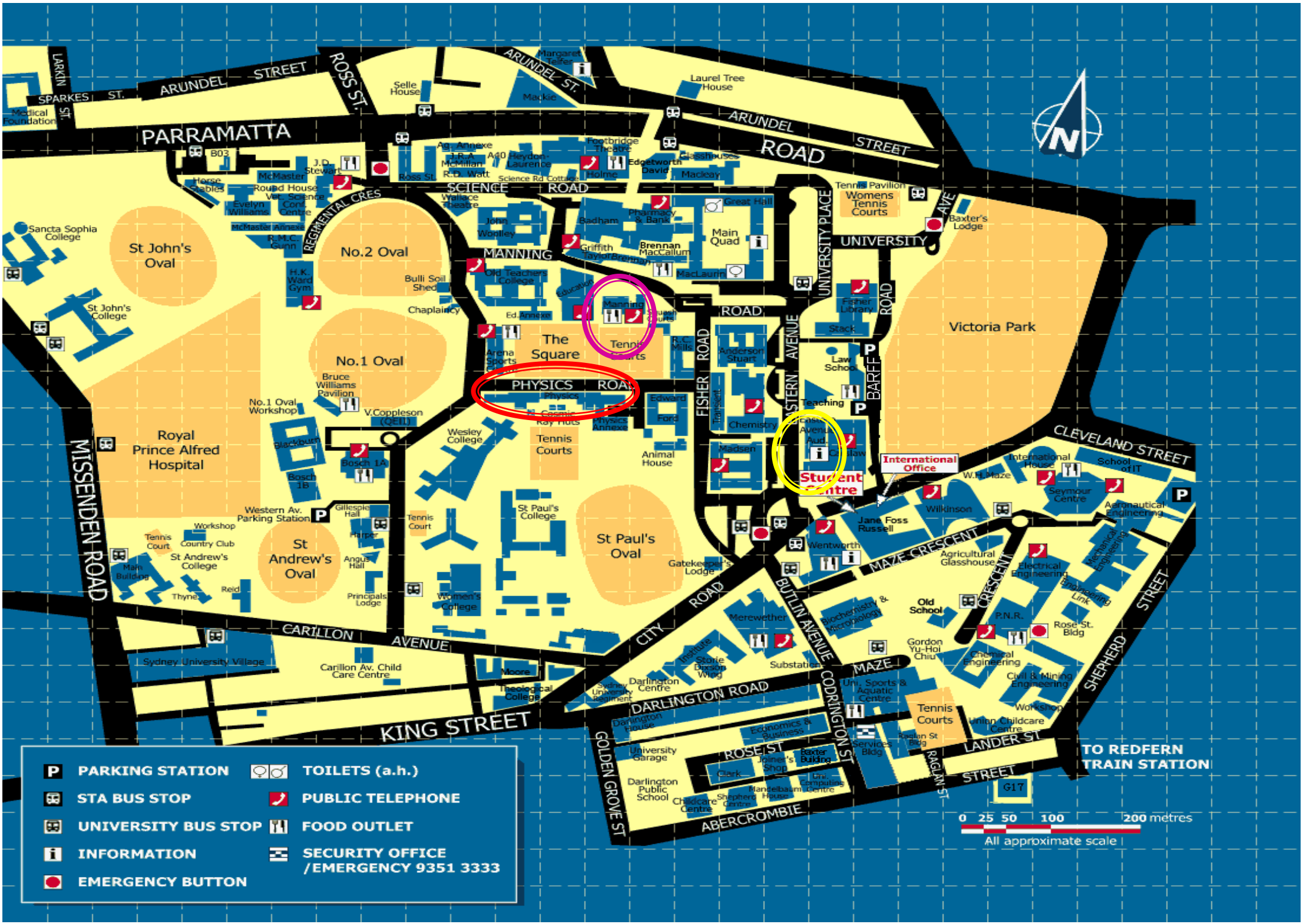
PARRAMATTA ROAD
ARUNDEL STREET
SPARKES ST.
LARKIN ST.
ROSS ST.
ARUNDEL ST.
SCIENCE ROAD
REGIMENTAL CRES
MANNING
PHYSICS ROAD
ROAD
UNIVERSITY PLACE
UNIVERSITY AVE
FISHER ROAD
WESTERN AVENUE
BARFF ROAD
MISSENDEN ROAD
CARILLON AVENUE
CITY ROAD
BUTLIN AVENUE
CODRINGTON ST
GOLDEN GROVE ST
DARLINGTON ROAD
KING STREET
ABERCROMBIE
ROSE ST
LANDER ST
RAGLAN ST
SHEPHERD STREET
CLEVELAND STREET
MAZE CRESCENT
MAZE
St John's Oval
No.2 Oval
No.1 Oval
The Square
St Andrew's Oval
St Paul's Oval
Victoria Park
Tennis Courts
Royal Prince Alfred Hospital
Sancta Sophia College
St John's College
St Andrew's College
Wesley College
St Paul's College
Women's College
Main Quad
Great Hall
Fisher Library
Stack
Law School
Chemistry
Madsen
Anderson Stuart
Physics
Physics Annexe
Cosmic Ray Huts
Edward Ford
Animal House
Old Teachers College
Ed. Annexe
Manning
Badham
Griffith Taylor Brennan
Brennan MacCallum
MacLaurin
Pharmacy & Bank
John Woolley
Wallace Theatre
Chaplaincy
Bulli Soil Shed
H.K. Ward Gym
McMaster
McMaster Annexe
Round House
Vet. Science Cont. Centre
Evelyn Williams
R.M.C. Gunn
Horse Stables
J.D. Stewart
Ag. Annexe
J.R.A. McMillan
A40
Heydon-Laurence
R.D. Watt
Science Rd Cottages
Footbridge Theatre
Holme
Edgeworth David
Macleay
Glasshouses
Selle House
Laurel Tree House
Margaret Telfer
Mackie
Womens Tennis Courts
Tennis Pavilion
Baxter's Lodge
Arena Sports Centre
R.C. Mills
Bruce Williams Pavilion
No.1 Oval Workshop
V.Coppleson (QEII)
Blackburn
Bosch 1A
Bosch 1B
Western Av. Parking Station
Gillespie Hall
Harper
Angus Hall
Principals Lodge
Tennis Court
Workshop
Country Club
Main Building
Thyne
Reid
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0 25 50 100 200 metres
All approximate scale