A

Ambiyah Abdullah (Institute for Global Environmental Strategies,Kanagawa)

Modelling the Economic and Environmental Impacts of Forest Conversion to Palm Oil and REDD Project in Indonesia: An EIRSAM Model

Indonesia has the largest forest area in South-East Asia. For Indonesia, forest has important functions both economically and environmentally. In 2009, forest sector together with agriculture sector contribute about 15% of Indonesia's Gross Domestic Product. Forest sector (including agriculture sector) also employed about 40% of total employment in Indonesia. Forest sector also has large contribution to Government revenue through large amount of export of forest products such as pulp, rubber and palm oil. The Indonesian government selected palm oil, as one of forest products to accelerate economic growth and development in Indonesia. This huge forest converted as palm oil plantation since 2000. This activity got critics from many international organizations and stakeholders related to deforestation, degradation, carbon emission and biodiversity issues. REDD project was proposed as one of strategies to overcome with the environmental issues of forest conversion to palm oil. The objective of this study is to assess the economic and environmental impacts of forest conversion to palm oil and REDD project on the macro level using the 2005 environmentally-extended inter-regional social accounting matrix. To meet the objectives, this study integrated the carbon emission data caused by land use change and forestry into the 2005 Indonesian inter-regional social accounting matrix. The results are two folds. First is forest conversion to palm oil plantation in Indonesia brings positive economic impacts mostly on developed regions than less developed regions. However, it also causes more carbon emission the implementation of REDD project brings larger economic benefits on both developed and less developed regions. In addition, it is also able to reduce carbon emission caused by palm oil expansion in Indonesia.

K. Ali Akkemik (Kadir Has University, Istanbul) and Utku Oren (Kadir Has University, Istanbul)

CGE Assessment of the Korea-Turkey Free Trade Agreement

World trade is expanding via bilateral or free trade agreements, instead of multilateral trade agreements; due to the fact that commercial interests of countries are different and very much complicated. Free trade agreement is a weak form of economic integration between two countries where sides aim to expand the trade volume via reciprocal liberalization of trade, however countries can decide on their policy choices against third parties unlike a customs union. Turkey is also trying

to expand its trading opportunities via free trade agreements. The most recent one of them is signed with Korea in August 2012. Additionally, it is known that there are ongoing work for a possible free trade agreement between Turkey and Japan. Historically Korea, being a prominent import resource, did not become a market where Turkey's exports are directed. In that sense, a comprehensive cost-benefit analysis of the free trade agreement would have generated important insights about the possible economic effects of the agreement for Turkey's economy, however there is no such analysis. Previous studies for Korea for the possible effects of the FTA with Turkey on the Korean economy and results show that Korean economy benefits from the agreement. The aim of this paper is to calculate the possible effects of the free trade agreement on Turkey's economy, including its macroeconomic consequences and wealth effects with the help of a computable general equilibrium (CGE) model.

Martha G. Alatriste Contreras (Aix-Marseille School of Economics, Marseille)

Global Centrality, Key Sectors, and Diffusion of Resources in an Economy: Evidence from France

In this paper we studied the economy as a complex system, where aggregate outcomes emerge from the interaction of heterogeneous sectors. The interaction between sectors is taking place through a network, where the production of one sector depends on the production of others through input-output relationships. We investigated the network properties of the economy and made an effort to answer whether complex network measures provide additional information from standard input-output analysis. We computed authority and hub scores as measures of global centrality for each sector according to its role as input supplier and buyer. These scores are a global measure of the importance of a sector and take into account the effect of the whole chain of production within which a sector is embedded. We assessed if this information is useful to identify key sectors by relating global centrality measures to the diffusion of resources through the economic system. We compared those sectors that have the highest backward and forward linkages to those sectors that have the highest diffusion measure and high authority and hub scores. Results unveiled that the sectors with the best diffusion properties and high aggregate impact on production are the ones that have the highest global centrality. These results have important implications for economic policy design. Authority and hub scores can be used as tools to identify key sectors in the economy suited for selective promotion.

Vito Albino (Politecnico di Bari) and Ilaria Giannoccaro (Politecnico di Bari)

Input/Output-based Fitness Landscapes

The complexity of an economic system is a familiar and important topic that is recently receiving a renewed interest in the literature thanks to an increased awareness that the overall complexity of an economy is the key variable in order to explain economic growth and development and the performance differences between countries (Hidalgo and Hausmann, 2009). The recurrent complexity features of economies that have been investigated to date are autopoiesis, nonlinearity, path dependence, and self-organization (Arthur, 1997; Krugman, 1994). Nowadays a major attention is devoted to the degree of interconnection and interaction as dimensions of economic complexity. To this regard, Lopes et al (2012) define economic complexity as the level of interdependence between the component parts of an economy and measure it through the level of sector interconnection.

In our study we follow this recent trend on the study of economic complexity and adopt the definition by Lopes et al. (2012). The economic system is conceived as made up of a number of sectors populated by firms performing specific production activities, which are in interaction because of labour division, so determining sector interdependence. As the sector interdependence rises, the economic complexity of the system grows.

The best methodology to study sector interdependence is to adopt input/output (I/O) framework. There are several measures of sectoral interdependence in input-output analysis: ranging from the classical indicators proposed by Chenery and Watanable (1958), Rasmussen (1956) and Hirschman (1958), to the more sophisticated ones based on the eigenvalue measure developed by Dietzenbacher (1992). Lopes et al. (2012) review a set of twelve I/O measures that can be employed to assess economic complexity. We agree with them that the I/O measures of sector interdependence are good proxies of economic complexity but we believe that the proposed indicators present a theoretical limitation that cannot be neglected. Basically, they are not coherent with the complexity science approach, because are not able to capture the intrinsic reason why interdependence is a dimension of complexity, namely the importance of the interactions among system components for self-organization and adaptation.

To overcome this limitation, we develop a measure of economic complexity as sector interdependence using the I/O framework but which is grounded on complexity science. Specifically, to develop our I/O based complexity measure, we refer to the NK model developed by Kauffman (1993), where N is the number of interacting components made up the system and K is the average degree of interaction among them. An influence matrix records which component affects each other. N and K govern the system complexity: as they grow, complexity increases. Higher the complexity, lower the ability of the system to adapt to the dynamic environment and thus lower its performance.

As said above, the economic system is modeled as a number of economic sectors that are interconnected. So doing, the complexity of an economic system depends on the number of sectors (N) and the degree of interdependence or, equivalently, interaction among sectors (K). The latter is our economic complexity index. Adopting K means that the complexity of the economic system is determined by the interactions among firms belonging to the different sectors and that complexity affects economic performances because influences the efficacy of the adaptation process of the economic system to the environment.

To compute K, the I/O tables of the economic system are used. We develop an analytic procedure that transforms the matrix that describes the transaction flows between sectors of activities into the influence matrix of the NK model corresponding to the economic system under investigation, so that the K value can be easily computed. The procedure tries to identify the relevant interactions between sectors within the system. First, the mean and the mean square deviation of the transactional flows are computed. Then, the flows that are lower than the mean minus n times the mean standard deviation are considered null, namely no interaction is assumed between the two involved sectors. Once the matrix of I/O flows has been emptied, only the relevant interactions remain and they are simply replaced by a "1" in the flow matrix, so obtaining a new matrix Y. Transposing Y to reconcile the opposite conventions adopted in the NK model with respect to the I/O tables, we finally obtain the influence matrix of the NK model of economic system. The K value is computed by averaging the number of interactions for row.

Such a procedure is finally applied to Italian economy. The economic complexity index (K) of Italy is calculated in three different years (1995, 2000, 2005) using the corresponding I/O tables showing an increasing trend, ranging from 3 to 6, to 7.

Vito Albino (Politecnico di Bari) and Devrim Murat Yazan (University of Twente, Enschede)

Economic and Environmental Benefits of Industrial Symbiosis: An Enterprise Input-Output Analysis

Sustainable production systems can be pursued through industrial symbiosis, which represents a significant approach to mitigate the environmental impact of production chains. Two or more production chains can explore how to exploit such an opportunity through materials and energy exchange. For existing production chains, economic benefits are usually the trigger of the transition toward symbiosis cooperation.

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.
Corresponding economic models are then provided to evaluate the economic benefits of industrial symbiosis to determine under which conditions each symbiotic system is suitable. In particular, prices associated with symbiotic flows affect the economic performance of roundput and potential subsidies to sustain the above transition.
Some case examples related to the bio-energy production chain and to the exhausted tire recovery and recycle are presented and discussed.

Hidayat Amir (Ministry of Finance of Indonesia, Jakarta) and Geoffrey J.D. Hewings (University of Illinois, Urbana-Champaign)

Distributional Welfare Impact of the 2013 Adjustment of Tax-Free Income Threshold in Indonesia: A CGE Simulation

A tax-free threshold, the level of income that the tax rate is zero, in Indonesian tax system is initially motivated by equity principle. The government of Indonesia periodically adjusts the tax-free threshold to keep the purchasing power of the low-income household's group. Within the last decade, there were three times adjustment in 1996, 1999, and the last will be effective in January 2013. The magnitude of the last adjustment is relatively high, the tax-free threshold increased by 53.4%. The policy objective is not only to protect the poor from paying tax but also to stimulate the economic growth through consumption. This study analyses the impact of the 2013 tax-free threshold adjustment with the main focus on the distributional welfare impact using an integrated multi-households computable general equilibrium (CGE) model. The model's database consolidated from three key data sources: (a) the 2008 Indonesian Input-Output Table; (b) the 2008 Indonesian Social Accounting Matrix; and (c) the 2008 National Socioeconomic Survey.

Robbie M. Andrew (CICERO, Oslo), Glen P. Peters (CICERO, Oslo) and Steven J Davis (University of California at Irvine)

Dependence on Foreign Carbon

Demand for fossil fuels, and the products made using those fuels, is often geographically displaced from the regions where fossil resources are extracted. The resulting trade in fuels and products represents substantial international flows of carbon both physically present in fossil fuels and embodied in products. Countries that rely on imported fossil fuels, imported products made using

fossil fuels, or both, are dependent on foreign-sourced carbon. In turn, the greater the dependence on foreign carbon, the greater the potential economic impacts of climate policies implemented down- or upstream in the supply chain. We present a time-series of fossil-fuel carbon inventories over the period 1997–2007 that shows increasing dependence on global trade in fossil fuels and a lesser – but more rapidly growing – dependence on global trade in products. Combined, international trade in carbon increased from 12.3 billion tonnes CO2 (55% of global emissions) to 17.6 billion tonnes CO2 (60%) between 1997 and 2007 (3.7%/yr). In addition to a growing dependence on foreign carbon, we find a generally growing diversity of sources of foreign carbon in the supply chains of both the USA and EU27 driven particularly by increased international trade in products. In light of global efforts to mitigate CO2 emissions, this shift in dependence and diversity suggests that regulation is becoming increasingly difficult with time as countries have less control over their global carbon. Our findings suggest a growing need to develop policy interventions that act across national borders rather than focussing on domestic carbon alone.

Kathleen B. Aviso (De la Salle University, Manila), Raymond R. Tan (de la Salle University, Manila), Michael A.B. Promentilla (De la Salle University, Manila), Krista D. Yu (De la Salle University, Manila) and Joost R. Santos (George Washington University, Washington DC)

A Robust Optimization Model for Implementing a Biofuel Program in the Presence of Multiple Scenarios Brought By Disasters

The global problem on climate change has directed efforts towards the development of technologies and strategies which will reduce greenhouse gas emissions. One such strategy is to promote the use of agricultural products or by-products as feedstock in the production of biofuels. However, research studies have shown that the success of utilizing biofuels may be constrained by the availability of natural resources such as land and water, which can vary significantly should disasters strike. It is thus important to develop a biofuels program which will be resilient to potential changes brought by possible disasters. A robust optimization model which takes into consideration multiple possible scenarios resulting from the loss of resources will be developed in this paper. The biofuel production supply chain will be evaluated based on its over-all carbon, land and water footprint in each scenario considered. The input-output framework will be used to model the interrelationships of the processes within the supply chain. The model will identify the optimal strategy which will remain feasible regardless of which scenario is realized. Case studies will be used to demonstrate the capabilities of the model.

B

Indrajit Bairagya (Tata Institute of Social Sciences, Guwahati City)

Functional Income Distribution to Personal Income Distribution: An Analysis of Impact of Liberalization on Indian Economy

Liberalization of any developing country held mainly either to raise the aggregate income of the country or to benefit the country's abundant factor (Davis, 1996). The Stolper-Samuelson theorem predicts that trade liberalization will shift income towards a country's abundant factor. Thus, for developing countries, this suggests liberalization will principally benefit the abundant unskilled labor in the informal sector. However, Bhagwati (1978) argued that the functional distribution of income, while it can be strongly related to foreign trade regimes in theoretical analysis (e.g. the familiar Stolper-Samuelson theorem), does not appear to show anything like a strong and predictable relationship in the studies. To test the hypothesis whether or not abundant labour in India gets benefits with the increase of informal employment, this paper estimates the functional income distribution overtime and also measures the impact of liberalization on the functional income distribution at the national level aggregates and as well as at sectoral level of disaggregation. Further, the analysis focuses on how the functional income distribution impacts on the personal income distribution (i.e., income inequality) of the entire economy.

The process of liberalization exposes national and global competitiveness across all the industrial units including small household based production units to a well structured formal sector. As a consequence, the industrial units are bound to reduce their cost of production. In an effort to lower production costs, domestic producers seek informally produced inputs either fully or a part giving sub-contracting to the informal firms, which are cheaper since informal producers generally do not abide by labour or fiscal regulations. Increased demand for informally produced inputs therefore leads the informal sector's growth. From the perspective of employment, formal firms attempt to reduce labour costs by cutting worker benefits, replacing permanent workers by part-time labour, or by lying off workers from the production process. The retrenched workers from the formal sector get absorbed in the informal sector due to its easy entry. Therefore, it forces to increase either informal sector employment or informal employment in the formal sector.

Further, results depict that in the initial years (1980-81), labour income accounts for more than 70 percent both in the formal and informal sectors. Since the share of labour income continues to be the same in the informal sector throughout the study period, the labour income decreases mainly due decrease in labour income in the formal sector soon after liberalization and rather drastically after economic crisis. This may be due to the fact that the informal sector uses labour intensive

technology and this high labour intensity of production is the main reason for huge surge of employment generation and, thereby increases the share of labour income. In case of the formal sector, due to the high dependence on the international economies, usage of modern capital intensive technology, the sector enhances the share of capital income overtime which, in turn, reduces the share of labour income. Similarly, declining trend is also evident in respect of the formal sector across all sub-sectors (excepting agriculture and trade, hotels and restaurants) at the disaggregate level. Since the labour share is an indicator of the income of the majority of the population, it persists to increase the inequality in terms of personal income distribution of the economy which supports the theoretical proposition.

Eduard F. Baranov (Higher School of Economics, Moscow), Igor A. Kim (Higher School of Economics, Moscow), Elena A. Staritsyna (Higher School of Economics, Moscow), Liubov A. Strizhkova (Institute of Macroeconomic Analysis) and Svetlana I. Kashirskaya (Institute of Macroeconomic Analysis)

Methods of Transforming Input-Output Accounts into the International Industrial and Product Classifications (the Russian Experience)

Participating in international projects, such as WORLD KLEMS, requires the availability and constant replenishment of the annual time series of Input-Output (IO) accounts at current and constant prices built on a single product mix and economic activities in accordance with international standards.

A significant break in the construction of IO accounts since 2004 occurred due to the transition of Russian statistics to the use of the OKVED (All-Russian classifier of activities) and OKPD (All-Russian classifier of Products by Activity) classifications that are harmonized with the CPA and NACE rev.1 classifications. This deprives the Russian Federation to participate constructively in the projects of this kind (and prevents from the use of the adequate IO accounts in forecasting and analytical calculations for own use).

The problem could be reduced by conducting transformation of Russian IO accounts for 2003 from the Soviet classifications into the OKVED and OKPD classifications. The choice of 2003 was due to the availability of the minimum necessary information for the construction of reliable correspondence tables between the old and new classifications compared to other years.

This work continues a series of studies [(Baranov, Kim, Staritsyna, IIOA 2011), (Baranov, Kim, Staritsyna, IIOA 2012)], which proposed a methodology for constructing time series of IO accounts based on the new classifications for 2003–2010 on the basis of transformed IO accounts for 2003.

By now, we have got expert estimations of IO accounts based on new classifications for 2003. When

constructing these accounts, we identified solutions to the issues of the lack of numerical values for the correspondence tables and matching between national accounts totals and column and row totals of transformed IO accounts for 2003. We developed and applied an iterative method of reconstruction of IO accounts from the Soviet classifications to the OKVED an OKPD classifications. These practices can be used to build IO accounts based on new classifications for the subsequent years.

Louis Bê Duc (Banque de France, Paris)

Flow-of-Funds Analysis at the ECB - Framework and Applications

The financial crisis has enhanced the need for close monitoring of financial flows in the economy of the euro area and at the global level focusing, in particular, on the development of financial imbalances and financial intermediation. In this context the use of flow-of-funds analysis (of financial information in general) appears particularly adequate as flow-of-funds data provide the most comprehensive and consistent set of macro-financial information for all sectors in the economy. This paper presents different uses of flow-of-funds statistics for economic and monetary analysis in the euro area. Flow-of-funds data for the euro area have developed progressively over the past decade. The first data were published in 2001, and fully-fledged quarterly integrated economic and financial accounts by institutional sector have been published since 2007. The paper illustrates how flow-of-funds data enable portfolio shifts between money and other financial assets to be assessed and trends in bank intermediation to be monitored, in particular. Based on data on financial wealth over the period 1980-2007, the paper analyses developments in the balance sheet of households and non-financial corporations in euro area countries over the last few decades, and looks at financial soundness indicators using flow-of-funds data, namely debt and debt service ratios, and measures of financial wealth. Interactions with housing investment and saving are also analyzed. Finally, the paper presents the framework for and use of flow-of-funds projections produced in the context of the Eurosystem staff macroeconomic projection exercises, and reports the outcome of a sensitivity analysis that considers the impact of interest rate changes on the interest payments and receipts of households and non-financial corporations.

Moslem Bemanpoor (University of Tehran) and Ali Taherifard (Imam Sadiq University, Tehran)

A Study on the Effect of Increasing the Price of Electricity and Other Energy Carriers on Electricity Demand in the Industrial Sector in a Developing Economy using a Computable General Equilibrium Approach

Electricity is one of the main inputs in the economic activities especially in industrial sectors. According to the subsidies targeting rule, the sale of electricity should raise the prices to the level of the actual production costs within in fifth development program. This paper uses a computable general equilibrium for measuring the impacts of policy interference on electricity consumption in the industrial sectors of Iran in two scenarios. According to the first scenario, raising electricity price by no change in other energy price, we expect to decrease electricity demand in textile, glass and machinery industries more than other industries. On the second scenario, demand for electricity by the textile, glass industries decrease more than other activities. If we attend to the economic realities of Iran, we understand accessibility to resources such as capital, expertise labor and technology is very limited that means Elasticity of substitution in Iran is very low. We can conclude that decrease in demand for electricity associate with decrease in Industrial production.

Tulika Bhattacharya (Institute for Social and Economic Change, Bangalore)

Measuring Linkages to Identify Key Sectors of the Indian Economy: An Application of Augmented Input-Output Analysis

The Indian economy is the tenth largest in the world in terms of nominal GDP and the fourth largest by purchasing power parity (PPP) (IMF, 2011). Besides, the country is one of the G-20 major economies and a member of BRICS. Despite these achievements, the Indian economy continues to be plagued by a number of problems, such as, a relatively low productivity growth, infrastructure bottlenecks, limitations of energy (especially crude oil and electricity) and food supply, loopholes in Government, etc. remain in the Indian economy, which restricts the growth path of the economy. One of the most important ways to sustain high growth path in Indian economy is to examine the linkages among several sectors of the economy. Thus, in this paper, we have focused on the 'sectoral linkages' such that the importance of any sector can be explained in a better way and the policy makers can concentrate on those high linkage sectors or key sectors, which will enable India to achieve high growth in the long run as well as help to reduce poverty through making the long run growth process sustainable.

The broad methodology we have used for addressing the aforementioned objective is the traditional Input-Output (I-O) Approach developed by Wassily Leontief. We have used the I-O tables for the years 1993-94, 1998-99 and 2003-04 in respect of the Indian economy for identifying the high linkage sectors by way of measuring forward and backward linkage coefficients, which are useful for attaining an expected growth rate in future. In addition of measuring forward as well as backward linkages using allocation and technical co-efficient matrix, we have introduced the household sector

in the I-O model i.e, the augmented I-O model. In the modified augmented I-O model, the private consumption component (i.e, household consumption) from the final demand is endogenous, while the other components of final demand are treated as exogenous. The analysis provides the effect the Keynesian multiplier and Leontief multiplier separately.

Christian Bidard (University Paris-Ouest, Nanterre)

IO as a Tool for a Christian Order: Maurice Potron, Jesuit and Pioneer

In 1911. Maurice Potron (1872-1942), a French Jesuit and mathematician, conceived and analysed an economic model much similar to the one later used in input-output analysis. He studied both the quantity and price sides of the model, with the clear idea of duality, and established an existence result by applying the Perron-Frobenius theorem years before any other economist. He intended to provide an explanation to economic crises and proposed some remedies. Potron had no training in economics and his ideas stem from the social doctrine of the Church, which evolved at the end of the 19th century with pope Leo XIII's encyclical Rerum Novarum. The social and economic organization he promoted is in line with the conception of a just social order sustained by that doctrine.

Hu Bin (Chinese Academy of Sciences) and Xu Jian (Chinese Academy of Sciences)

What Would Be the Impact If the Trade Relation between China and Japan Is Cut Off?

In recent years, the problems caused by historical and territorial disputes have strong negative effect on the trade relation between China and Japan. If these problems cannot be solved, trade between China and Japan maybe break off someday. Then what will happen?

Maybe, China will not import from Japan, but Chinese demand is huge and will not change. Hence, China has to look for substitutes from other countries which will promote these countries' economy and of course will hinder Japan's economy. As to Japan, it is vice versa. Something else we can see is that the world economy is highly globalized and everything is made in the world. If the trade between China and Japan is cut off, there still have some indirect connections between them through other countries' trading. For example, if China does not import vehicles made in Japan and turn to importing from Germany, but when Germany produces these vehicles it may use some components which made in Japan actually, so the trade connection between China and Japan cannot be cut off exhaustively. The Japanese economy can still benefit from Chinese imports from other countries to some extent and vice versa.

There is a Chinese proverb "When the snipe and the clam grapple, it is the fisherman who profits". So, what we want to figure out is that if the snipe and the clam grapple, how much the snipe and the clam lose and how much the fisherman gains. In this paper, we set some scenarios such as trading of one important section or all sections between China and Japan is cut off, and calculate the effects on China, Japan, and some other countries based on the world input-output table published by WIOD database and do some analyses.

Maaike C. Bouwmeester (University of Groningen)

Assessing Cross-Border Impacts of Gas Infrastructure Investment Expenditure across Europe with MRIO

Liberalization of the European gas market is an ongoing process. A major step has been the unbundling of gas companies into gas traders and gas transmission operators. To promote efficiency, a gas market has been created in which gas traders have to compete. The gas transmission operators are natural monopolists due to the high investment cost of installing gas transport infrastructure. These companies were continued as state-owned enterprises under stringent regulation. At the European level regulations and directives have been adopted to guide the creation of the European internal gas market. The gas infrastructure in place has to facilitate an efficient matching of supply and demand of gas. Projections of future gas flows show substantial increases, implying an increase in import dependency given the known reserves in Europe. One of the foreseen bottlenecks in the current infrastructure is the lack of interconnectivity between European countries. In the future one interconnected European network should provide the necessary transmission capacity to service the internal market. Within this network, hubs need to be created that play a central role in the management and direction of the gas flows. Investing in the creation of a gas hub in each country is not necessary. However, national transmission operators will focus on retaining the role as regional hub, which may be supported by national governments. This may lead to overinvestment, especially if similar developments in other countries are not correctly taken into account. To establish at the European level which countries should host the gas hubs, a range of analyses needs to be undertaken. We only focus on one analysis that will contribute to a better understanding of the benefits of the alternative configurations of the investment plans. In this paper we define a range of alternative gas infrastructure investment configurations and systematically assess the impacts of the different investment plans on each European economy via multi-regional input-output modeling.

C

Juan Carlos Castillo (University of Maastricht) and Gaaitzen de Vries (University of Groningen)

The Domestic Content of Mexico's Maquiladora Exports

This paper studies domestic value added content in Mexico's foreign assembly plant exports during the period from 1981 to 2006. Mexico's industrial policy towards export processing firms gradually shifted from viewing them as mere providers of employment towards promoting the sourcing of intermediates from upstream domestic firms and technological upgrading within maquiladora firms. We combine a recently released input-output table for maquiladora industries with detailed longitudinal data on output, domestic and imported inputs, and skill requirements to study the effects of these industrial policies. We find that domestic value added content differs across industries, so structural changes in the composition of output affect domestic value added embodied in aggregate maquila exports. Changes in the industry composition of assembly plants are related to external shocks such as the North American Free Trade Agreement (NAFTA) in the early 1990s and China's entry into the World Trade Organization in 2001. Within industries, we find few signs of increasing intermediate input deliveries by domestic firms or higher embodied value added and skill use in the production process among maquiladoras over time.

Ignacio Cazcarro (Rensselaer Polytechnic Institute,Troy) Rosa Duarte (University of Zaragoza) and Julio Sánchez Chóliz (University of Zaragoza)

Downscaling the Grey Water Footprints of Production and Consumption of the Spanish Regions

Economic input-output data cannot be nowadays easily localized into much more detail than in the 17 Spanish regions (Autonomous Communities), but certainly pollution or grey water impacts are usually localized in very concrete hotspots. In this sense, although considering the interregional flows at the regional level, one can combine this information with spatially explicit information on polluting activities, for a better risk assessment and water management policies. The main goal of this article then is, once estimated the grey water footprints of the 17 Spanish regions with a multiregional input-output model for them and the regions of European Union and Rest of the World, to move again towards the explicit spatial identification of areas of strong final demands (normally the most populated) linking them to the original hotspots or vulnerable areas, where most direct grey water consumption had taken place. In the results, we observe how the strong final demand of regions such as Madrid (and Catalonia, although with much higher direct impact on water) generate directly and

indirectly relevant needs of grey water in net exporting regions such as Andalusia, Aragon, Castille and Leon, Castile-La Mancha, Extremadura and Navarre, which also have very different geographical distribution of vulnerable areas.

Ignacio Cazcarro (Rensselaer Polytechnic Institute, Troy) and Faye Duchin (Rensselaer Polytechnic Institute, Troy)

The Economic and Ecological Impacts of Future Dam and Other Hydrological Infrastructure Projects: A Scenario Analysis Using the World Trade Model

The scenario for 2050 poses some challenges worldwide, involving water and energy supply, and river and ecological threats, which are intrinsically interconnected. On the one hand, with an increasing population to the 9 billion people, further needs on food growth, and hence on agriculture using abundant volumes of water (Bruinsma, 2009), and also on energy supply for human needs are at no doubt. The World Resources Institute projected that the total number of people who live in water-scarce nations (less that 1000 cubic meters/capita/year) will reach approximately 13-20% of the world total population by 2050 (OECD, 1998). Since water is highly unevenly spread geographically, some regions have relied until now on dam projects, and project on keep on doing so to satisfy those needs. By the end of the 20th century, about 45,000 large dams (>15 m in height) and an estimated 800,000 small dams had been built worldwide (WCD 2000), obstructing over 65% of fresh water flow to the oceans (McCully 1996; Nilsson and Berggren 2000). Also in the future years, we will keep on seeing numerous dams being constructed, involving several main rivers and countries or regions (in China, affecting the downstream availability in South-East Asia, in Brazil and in general in South America, in the regions of India-Pakistan, Ethiopia-Sudan-Egypt, Turkey-Syria-Iraq, etc.).

Together with the positive side of goods and services provided (irrigation, hydropower, supply or flood control), on the other hand dam projects also often threaten the provision of desirable river goods and services downstream, as the diversity and abundance of native fish, disrupt river flow regimes, or fertilization of floodplains (WCD, 2000, Brismar, 2002). A global overview of dam-based impacts on large river systems shows that near 60% (172 out of 292) are affected by dams, including the eight most biogeographically diverse (Nilsson et al., 2005), being severely fragmented by dams, diversions, and canals, leading to alterations that adversely affect both terrestrial and aquatic biodiversity (Dynesius and Nilsson, 1994; Rosenberg et al. 2000; Terborgh et al. 2001; Wu et al. 2003a,b, WWF, 2004). Also social effects are in play, since an estimated 40-80 million people have been displaced from their homes by dam construction (WCD, 2000), especially when engineering schemes and no other environmental and economic and social considerations were

taken into account.

The issue then calls for an integrated economic, ecological and social approach for dam projects analysis, with implications in many diverse research fields. Especially the first two aspects can be properly captured with the World Trade Model (Duchin, 2005; Strømman and Duchin, 2006), by adapting the framework of comparative advantage driving the minimization of use of factors, and providing insights on prices or scarcity of natural resources, with the appropriate treatment and alignment of factor uses (among which key ones are those natural resources) and endowments. In this sense, together with the information on the economic variables and technologies, several "types" (qualities, precipitation/earth origins of it at the moment of consumption) of water need to be considered, also the endowments according to the new capacity obtained with the dam projects on site, but also downstream (which can be smaller), but also other water/biodiversity impacts. One of the methodological challenges is trying to treat these impacts in analogous way to the rows of use of factors by sector constrained by its endowment, as the "use" or "responsibility" by sector, and an endowment value which can be, on one hand, without binding constraints to study the growth of impacts or threats, or on the other hand, be fixed to act as a sustainability constraint.

In the article we develop this economic and ecological framework and test it with a comprehensive data on factors (as capital or labour), but especially natural resources (water types, land, forest, fish, coal, oil, gas and minerals), and other environmental impacts, combined with the GTAP input-output tables of 19 key climatic and hydrological regions in the world. The insights that one obtain range from the localization of current regions with comparative advantage in each of the goods/sector productions due to a relative abundance of factors, to the implications for the regional water scarcity, displacement of agricultural production, and effects on the ecosystem.

Baoline Chen (Bureau of Economic Analysis, Washington DC), Tommaso Di Fonzo (ISTAT/University of Padova) and Marco Marini (International Monetary Fund, Washington DC)

Statistical Procedures for Reconciling Time Series of Large Systems of Accounts Subject to Low-Frequency Benchmarks

This study illustrates statistical procedures to reconcile large systems of accounts subject to low-frequency benchmarks (e.g. available every five years). This adjustment is sought in a way such that the reconciled levels (i) are consistent with the low-frequency benchmarks available, (ii) fulfill all the accounting relationships in the system for any given year, and (iii) show movements that are as close as possible to those available in the preliminary levels. To preserve the original movements, we propose least squares adjustment procedures based on two different criteria: the Growth Rates Preservation (GRP) principle and the Proportional First Difference (PFD) principle. Furthermore,

reliability indicators for each component of the tables are taken into account in the adjustment process. Such procedures are applied to reconciling the 1998~2002 U.S. annual input-output accounts, GDP-by-industry accounts and expenditure-based GDP, subject to the 1997 and 2002 Quinquennial benchmarks and all contemporaneous constraints of the system.

Quanrun Chen (Chinese Academy of Sciences, Beijing), Erik Dietzenbacher (University of Groningen) and Bart Los (University of Groningen)

China's Household Consumption Structural Change under the Ageing and Urbanization Process and Its Impact on Sectoral Employment

Some important demographic changes will occur in China in the following decades. Among these upcoming changes, ageing and urbanization have attracted particular attentions of many researchers and policy makers. According to our projection, in 2030 the share of population aged 65+ will reach around 21.5% and the share of urban population will reach around 70.8% in the total Chinese population. We find that the consumption behaviors of Chinese households in different age groups as well as the consumption behaviors of rural and urban Chinese households are quite different. Hence, significant changes are expected to occur in China's household consumption structure during the ageing and urbanization process. From the aspect of demand side, the household consumption structural change will further cause changes in sectoral employments as well as labor demands by occupation via production chains. This paper investigates the impact of ageing and urbanization on China's household consumption structural change as well as on sectoral employments, especially the labor demands by occupation, in the following two decades. The research findings can provide some policy implications with regard to labor training and education for the policy makers.

Xikang Chen (Chinese Academy of Sciences, Beijing), Cuihong Yang (Chinese Academy of Sciences, Beijing), Zhu Kunfu (Chinese Academy of Sciences, Beijing) and Yuwan Duan (Chinese Academy of Sciences, Beijing)

DPN Model and Value Added in Trade: The Study for China

Total value of exports is popularly used to measure the scale of exports today, however, along with the deepening of international fragmentation, the exports of a country often contains abundant raw materials and components produced by other countries. In order to estimate actual size of exports, we should not only use "total value of exports", but also use indicator "total domestic value added of exports". Since 1999 our research team uses input-output technique to estimate domestic value

added (DVA) and employment induced by China's exports. In this paper we will introduce the methodology and its application in China.

There are three parts in this paper. First, we introduce a methodology to estimate the domestic value-added and employment generated by each unit of total exports, of exports by sector, and of exports by commodity, respectively. We also prove mathematically that the gross value of exports is equal to the sum of total value added and total imports.

Second, since the most important feature of China's foreign trade is the value of processing exports accounts for about 50% of total exports, and the imported intermediate input coefficients of processing exports are much bigger than that in production for domestic demands and non-processing exports, then we proposed input-occupancy-output model capturing processing exports and non-processing exports (DPN model). Using DPN model our research team estimated domestic value added and non-agricultural employment induced by China's exports for 1987-2011.

In the last part we use I-O model to reexamine trade balance in China-US Trade. According to the data released by USITC, the US trade deficit is US$260.5 billion and China's exports are 5.27 times as much as that of the US's exports to China. If we estimate trade balance by domestic value added contained in the exports, the US only had a trade deficit of US$115.2 billion in Sino-US trade and China's exports to the US are 3.20 times as much as that of the US's exports to China in 2007.

Erwin Corong (Monash University, Clayton), Lawrence Dacuycuy (De la Salle University, Manila), Rachel Reyes (De la Salle University, Manila) and Angelo Taningco (De la Salle University, Manila)

The Growth and Distributive Impacts of Public Infrastructure Investments in the Philippines

This study investigates the role of public infrastructure investment on economic growth and poverty reduction in the Philippines. Using a dynamic computable general equilibrium - micro simulation model that explicitly models public capital as input into the production structure, we find that the positive supply-side effects of higher public investment expenditure manifest over time, on the back of higher capital accumulation effects and improved productivity. Our findings reveal that higher public infrastructure investment not only brings positive real GDP effects but also reduction in poverty and inequality in the short- and long-run. Against this backdrop, the Philippine government needs to become more proactive in finding ways to finance higher public investment expenditure. This is especially so with respect to international financing as given the narrow tax base in the country, our simulation results confirm that international financing relative to tax financing is a better alternative in improving the economy's physical infrastructure to create job opportunities, improve productivity and complement its social protection measures.

D

Paramita Dasgupta (Ananda Chandra College, Jalpaiguri), Arpita Ghose (Jadavpur University, Kolkata) and Debesh Chakraborty (Jadavpur University, Kolkata)

Leontief Paradox Sixty Years–Where Are We Now?

The year 2013 will mark the 60 years of publication of the seminal article "Domestic Production and Foreign Trade; The American Capital Position Re-examined" by Leontief (1953) which had questioned the empirical validity of one of the major trade theories, the Heckscher-Ohlin (HO) theory. The results of the Leontief study on the trade structure of the United States, well known as "Leontief Paradox", inspired other researchers to make empirical investigations on factor content of trade of various countries including both developed and developing countries. While some of these studies reaffirmed the theory, the others found paradoxical evidences.

The mixed evidences on the Paradox led Leamer (1980) to add a new dimension to the controversy by criticizing Leontief's methodology and showed the Paradox would disappear if "conceptually correct calculations" were done. However, Bowen et al. (1987) and others tested the HO proposition in multi-country, multi-factor framework and did not find strong empirical support. In a major contribution Trefler (1993, 1995) introduced factor-augmenting productivity differences across countries and other modifications into the HO model with which the model received more empirical support and the paradox disappeared. This prompted further researches along this line by relaxing the basic assumptions of identical technologies, factor-price equalization, identical demand and also assuming the existence of internationally traded intermediate inputs (Davis and Weinstein, 2001; Trefler & Zhu, 2010). Even with these modifications the controversy is yet to resolve, however.

The current paper critically reviews the literature on the Paradox and assesses where we are now.

Riccardo De Bonis (Bank of Italy, Roma), Massimo Coletta (Bank of Italy, Roma) and Stefano Piermattei (Bank of Italy, Roma)

Why Do Households Have Different Debts? New Evidence from the Flow-of-Funds

In most of industrial countries, household debt had an increasing trend from the 1990s to the financial crisis of 2007-08 while later on it stagnated because of the economic recessions. Currently, international organizations and central banks have been putting in their policy agenda a strict control of household debt. Large differences in the household debt-to-GDP ratio characterize the countries. In 2011 household liabilities were more than 100 per cent of GDP in the UK, around 90 per cent of

GDP in the US, and 80 per cent in Japan; on the contrary household total debt was around 60 per cent of GDP in France and Italy. The goal of this paper is to study the determinants of household debt. We resort to a large dataset based on the flow-of-funds. The econometric exercises, based on different methods, refer to the period 1995-2011 and evaluate as possible determinants of household debt variables such as disposable incomes, interest rates, savings, country legal origins, and real assets.

Erik Dietzenbacher (University of Groningen), Joaquim Guilhoto (University of Sao Paulo) and Denise Imori (University of Sao Paulo)

The Role of Brazilian Regions in the Global Value Chain

In the recent past, production processes have increasingly become sliced up into ever smaller parts (or fragmented). Many of these parts are outsourced to specialized subcontractors that are more and more located in foreign countries (i.e. offshoring). This has led to an upsurge of trade in intermediate products. Today's products and services are no longer produced within a single country. Instead, they are made in global supply chains, or global value chains. That is, countries import intermediate goods and raw materials, to which they add one or more layers of value after which they sell the product (often to a foreign producer who adds the next layer). Standard trade figures that measure the value of imports and exports do not reflect any more what is really happening. Trade in value added has been proposed as a better approach for the measurement for international trade. The same applies at the regional level, and perhaps even to a larger extent. Due to locational advantages (e.g. the presence of a seaport and/or an airport), one region is typically responsible for most of the imports and exports of a country. Even if the production of some export goods takes place entirely within the country, it is likely that other regions than the exporting region also have contributed to the value of the exports (for example by supplying intermediate inputs and raw materials that go into the final product that is sold abroad). Next to international fragmentation, also interregional fragmentation plays a role when focusing on regions. The present paper analyzes the role of Brazilian regions in the global value chain. We will do this by answering the question: How much value added generated in, for example, the state of Pernambuco is embodied in the consumption bundle of, for example, Canada? This gives us the export of value added from Pernambuco to Canada. It should also be stressed that the Canadian consumption bundle includes imported goods from other countries, such as the US. Indirectly, these goods may include value added from Pernambuco. So, in principle, it may be the case that Pernambuco does not export to Canada but that some of its value added is still embodied in Canadian consumption (for example through US exports that are produced using imports from Pernambuco). In the same fashion, we will also calculate the

import of Canadian value added by Pernambuco. Whereas the methodology to calculate the trade in value added is well-known, the availability of data used to be a problem. In recent years, however, several groups of researchers have developed so-called world input-output tables (WIOTs). These are interregional Isard-type input-output tables with countries instead of regions. In our analysis, we will combine the WIOT for 2008 that was constructed in the WIOD project. It is a full inter-country input-output (IO) table covering 40 countries and the rest of the world as a 41st country. One of the countries included is Brazil. The IRIOT for 2008 is for Brazil and covers the 27 Brazilian states.

Naci Dilekli (Rensselaer Polytechnic Institute) and Faye Duchin (Rensselaer Polytechnic Institute)

Toward Food and Energy Security for the Northeast Region of the United States: Opportunities, Challenges, and Limitations

We identified food and energy security as main future issues in the Northeast region of US, where urban expansion is still a threat to farmlands and forestlands. As a region relying on food imports, it is not a sound choice to grow biofuel feedstock on land that can otherwise be used to grow food. On the other hand, while the Northeast has low concentrations of traditional feedstock (e.g. corn and oil seed), it is rich in one of the next generation biofuel feedstock, wood waste. This is an opportunity for the region as the federal government committed to require 21 billion gallons of next generation biofuel production by year 2022 via incentives. The region also has the potential to grow other types of feedstock, as it has a large stock of unused farmland and pasture land.

This study evaluates the role of comparative advantage and trade as adjustment mechanisms on food and energy production and demand in the Northeast. The objectives of study is threefold: (1) Identify its biofuel and food production potential across thirteen states that are within the region, and to parameterize intermediate and factor requirements; (2) Run the World Trade Model (WTM) in 13 sub-regions with alternative energy production technologies to get a glimpse of the energy and agriculture future of the Northeast, allowing food and biomass energy producing sectors to compete for land and food, in order to see if a food and energy secure future is sensible in this region; and (3) Extend the WTM to implement subsidies in particular sectors, and to let regions share their factor endowments for a more realistic outcome.

Virginie Doumax (Aix-Marseille University), Jean-Marc Philip (Aix-Marseille University) and Cristina Sarasa (University of Zaragoza)

Biofuels, Tax Policies and Oil Price in France: Insights from a Dynamic CGE Model

The 2009 Directive on Renewable Energies has set up ambitious targets concerning biofuels consumption in the European Union by 2020. Nevertheless, budgetary constraints impose a phaseout of the policy instruments to promote the use of biofuels. In this context, finding new incentives to develop the consumption of biofuels could be challenging.

Focusing on France, this paper combines both an exogenous increase of oil prices and alternative tax policies on fossil fuels in order to determine the minimum level of additional taxes needed to achieve the 2020 biofuel target. Moreover, we take into account the budgetary constraints of the government by eliminating the differential tax rate between fossil fuels and renewable fuels.

Policy simulations are implemented through a dynamic computable general equilibrium (CGE) model calibrated on 2009 French data.

Results show that the 2020 biofuel target could be achieved with acceptable levels of taxation, even if the excise-tax rate on biofuels is increased, although incurring larger but limited welfare losses. The integration of rising oil prices into the fiscal framework significantly reduces the needed level of additional taxes.

This paper also investigates the economy-wide effects of these alternative scenarios, particularly on the agricultural sector. We find that the development of biofuel consumption only partially offsets the depressive effect of oil prices on the agricultural output. Finally, we introduce explicitly biofuels by-products in the analysis, notably oilseed meals, in order to check if their presence reduces the price impacts of the biofuel production.

Yuwan Duan (University of Groningen/Chinese Academy of Sciences, Beijing), Erik Dietzenbacher (University of Groningen), Bart Los (University of Groningen) and Cuihong Yang (Chinese Academy of Sciences)

National Content in China's Exports: Changes and Causes

Along with the deepening of global integration, production factors, especially capital, can flow across borders more freely. Especially in China, the large flow of inward foreign investment is a typical characteristic of its economy. Accordingly, China’s exports not only relies heavily on imports (as lots of literature has revealed), but also highly depends on the foreign-owned capital. In this way, Value added generated by China’s exports may include lots of gains from foreign-owned factors, which happens in China but are not owned by Chinese people. In contrast with the existing literature, which only emphasizes the value added in China’s exports, this paper focuses on the national income generated by China’s exports and its change over time, by using China’s national input output tables which distinguish processing exports from other production. Besides that, we will also conduct some decompositions to have a more comprehensive understanding on the change pattern of the benefits

China get from the global value chain. The paper finds that, the benefits foreigners get from China's exports have a great increase over time. From 2002 to 2007, more than 80% of total increment of China's value added in exports is ascribed to the increase of compensation from foreign-owned capital, while only less than 20% is due to the increase of China's national income. There is a trend that dependency of China's exports has moved from on foreign goods to on foreign capital.

Faye Duchin (Rensselaer Polytechnic Institute, Troy)

New Directions in Scenario Analysis: Exploiting the Unique Features of Input-Output Economics

The number of people on the planet in the early 21st century and their average life expectancy and affluence are without historical precedent. But the amount of production and international transport needed to sustain this prosperity rely on an exploitation of natural resources similarly unprecedented in intensity and highly uneven in the distribution of burdens and rewards. Anticipating the further expansion of population amid expectations of increased material comfort, substantial numbers of researchers with different disciplinary roots have become engaged in devising solution concepts to address the challenges. In this environment, input-output models of the world economy have proved to be an approach of choice for evaluating the feasibility and attributes of alternative scenarios.

The objective of this paper is to pinpoint the unique features of input-output economics that explain this popularity. To promote the wider use of the full family of input-output models, thereby challenging the now-dominant computable general equilibrium paradigm, I stress those features that most clearly recommend input-output models for the specific tasks at hand. I believe that developing this line of analysis is indispensable to stimulate progress in the further elaboration of input-output economic theory.

The general form of the simplest, basic input-output model consists of two matrix equations and one scalar equation for a single region, $(I - A)x = y$, $(I - A')p = F'\pi$, and $p'y = \pi'Fx$, where A, F, y, and x are in mixed units, p is the vector of product prices and π the vector of factor prices. Like this basic model, all input-output models provide a meso-level representation of the input structures for consumption and industrial production, including requirements for factors of production, and all capture the interdependency among the economic activities of the meso-level actors (consumers, producers, and owners of factors). Likewise, all input-output models express the intimate correspondence between quantity relationships in the primal model and the dual price model, the former model measuring resources and possibly products in suitable physical units while the latter allows for factor inputs (or pollutants generated) that are unpriced (that is, with a price of zero).

Elaborations that extend beyond the basic model serve one of two purposes. Extensions based on economic theory make endogenous selected variables that are exogenous in the basic model: final

deliveries for consumption, investment, or trade (y), and scarcity rents that are components of the factor prices (π). The other type of elaboration ventures beyond the scope of economics as narrowly defined; it integrates concepts and information from earth sciences on resources, engineering on technologies, or other social sciences on household behavior. It is the -- deceptively simple -- logic combining the interdependency of the economic elements with their systematic representation at the meso-level of detail that enables the basic model's distinctive properties to be retained when it is extended conceptually. The transparency of the logic makes it possible to use a straightforward and concise notation to represent the models. The paper demonstrates these features using the example of a model of the global economy, the World Trade Model. It discusses why such extended input-output models are particularly well suited to operating both as research models, intended for exploratory purposes, and for analyses yielding real empirical content, the latter including those that endeavor to include especially large numbers of regions, sectors, and factors.

One particularly important closure is entirely overlooked in input-output modeling of the global economy, but nonetheless it is important and ripe for further theoretical development. This is the endogenous determination of exchange rates among currencies. In all existing input-output databases of the world economy as well as all of those under development, the economic data for all countries still are measured in money values only, and that in a common currency, namely US dollars or Euros. The conversion of a table that had been compiled in domestic currency to the common currency, itself laborious, is accomplished using exogenous information, namely a single exchange rate, generally the market rate possibly corrected for purchasing power, or at most a small number of product-specific rates. The paper discusses the inevitable, and unnecessary, loss of information about comparative cost structures this process entails and suggests some ideas for moving toward a conceptual solution. It concludes with observations about interdisciplinary collaborations that aim at some level of conceptual integration.

Faye Duchin (Rensselaer Polytechnic Institute, Troy) and Stephen H. Levine (Tufts University, Medford)

Payment Flow Networks in Multiregional Economic Systems

Modern economic systems are characterized by payment flows in the reverse direction to the flows of resources, goods, and services. These money flows follow paths that start with the payments made by consumers for final products and continue "downstream," terminating with payments to the owners of the factors of production. Since consumers and factor owners may be in different regions, the payment flows will include costs of imports and the transportation required to deliver them. Purchaser choices among products produced in different regions determine which industrial sectors,

transportation providers, and factor owners are on the payment paths. These choices reflect constraints associated with limited factor endowments as well as cost comparisons.
The paper describes our framework for: (1) quantifying the receipts by the owners of the factors of production in each region that result from the payments for final goods in a specific region and (2) tracking the paths taken by those payments. This approach combines three components: an input-output database supplemented by data on factor endowments and factor prices, an input-output/linear programming (IO/LP) model of the world economy, and absorbing Markov chains (AMCs). Using this framework, we identify and compare the payment flow networks implicit in two scenarios previously analyzed using a ten-region model of the world economy. These are a 1990 baseline scenario and a second scenario for 2050 incorporating assumptions about the future population, diets, technologies, and factor endowments, in particular for land and water. The paper concludes with a discussion of the empirical results.

E

Nina Eisenmenger (Alpen Adria University, Klagenfurt), Dominik Wiedenhofer (Alpen Adria University, Klagenfurt),, Anke Schaffartzik (Alpen Adria University, Klagenfurt), Fridolin Krausmann (Alpen Adria University, Klagenfurt), Stefan Giljum (SERI, Vienna), Martin Bruckner (SERI, Vienna), Barbara Lugschitz (SERI, Vienna), Thomas Wiedmann (University of New South Wales, Sydney) and Manfred Lenzen (University of Sydney)

The Raw Material Consumption of Austria. Five Methods, Five Results

The increasing integration of economies into the globalized system of international trade gives rise to the need for new indicators of material use within the material flow accounting framework. The standardized headline indicator of Domestic Material Consumption (DMC = domestic extraction + imports – exports) reflects a production-based perspective and no longer suffices to reflect an economy's true share in global resource use. The raw material equivalents (RME) of trade and consumption are the move towards a consumption-based indicator, which includes all upstream material inputs into the production of traded goods within material flow accounts.
The calculation of RME is not yet part of standard material flow accounts and currently a number of different methodological approaches exist, each with specific assumptions and allocation rules for their environmental extensions. These range from single-region input-output models (SRIO) applying a domestic technology assumption for imports, to hybrid approaches where the SRIO is complemented by LCA-derived coefficients, to full multi-region input-output models (MRIO).

In this study we have applied hybrid LCA-SRIO models, the recently published official Eurostat coefficients and three MRIOs (GTAP, WIOD, EORA) to Austria as a case study. We will discuss the differences in the results in the RME of Austrian trade and consumption, highlighting how they relate to the assumptions behind the respective method of calculation and discussing the analytical consequences of each approach. With these findings, we hope to make a contribution to the current debate on RME methodology in order to move towards a harmonization of approaches and international applicability.

Romulo Neves Ely (Federal University of Rio de Janeiro), Arunima Malik (University of Sydney) and Manfred Lenzen (University of Sydney)

An Input-Output Analysis of a Future Australian Sugar-cane Biofuel Industry

Australia is the third largest raw sugar supplier in the world with a production of around 30 million tonnes of sugarcane per year. Despite this, ethanol production from sugarcane accounts to only 15% of the total Australian ethanol production, which is less than 500 million liters per year. In comparison, petrol consumption is approximately 20,000 million liters per year. Australia has the potential to increase the ethanol production using sugarcane as feedstock, expand the renewable energy fraction and subsequently reduce the consumption of petrol. This study aims to assess the performance of future Australian biofuels operations based on the Brazilian sugarcane industry experience. To this end, we insert detailed Input-Output (IO) information about the Brazilian biofuels supply-chains into an Australian Supply-Use Table. In particular, we appraise sugarcane, hydrous alcohol and gasoalcohol (mixture of 10 to 25% of anhydrous alcohol in pure gasoline). In Brazil, these technologies are in mature stages of development, delivering a sizeable renewable fraction in Brazil's energy matrix. Updating the modified Australian IO table using a tailored RAS algorithm allows the estimation of a potential future technical coefficient matrix. The scenario presented in this paper helps in examining the potential changes in the Australian economy required to accommodate Brazil-based biofuels industry. Using the economically viable Brazilian sugarcane model to increase the renewable energy fraction of Australia could open exciting avenues for achieving renewable energy growth and reduce Australia's petroleum dependence and greenhouse gas emissions alike.

F

Mingtai Fan (Chinese Academy of Social Sciences, Beijing), Taoyuan Wei (CICERO, Oslo), Xiaoguang Zhang (Australia Productivity Commission, Melbourne)) and Yumei Zhang (Chinese Academy of Agricultural Sciences, Beijing)

The Composite Impact of the Low-Carbon Development Policies in Beijing's Urbanization: A Regional Dynamic CGE Modeling

The transition to a low-carbon economy, originated from the thinking on the energy future, climate change and sustainable development, has gained global momentum in recent decade. China in the industrialization and the urbanization process has to find an effective and inclusive strategy with policy mix for the low-carbon development. The research on the policies and planning for low-carbon development in China and as well Beijing is accordingly becoming a frontier of policy concerns.

This report aims to highlight the offsetting and the synergy effects in terms of economic growth, energy consumption, and carbon emission by industry of policy pair by quantifying the impact of different low-carbon development policies. As supported by the GEF for the Second Beijing Environment Project, we take Beijing as a case to analyze counter-factually the cost effective policy mix for low-carbon development in urbanization with a dynamic CGE model. This model is a SAM-based regional one, which follows the assumptions of energy consumption and CO2 emission by industries of the GRACE model by CICERO in Norway, the assumptions of commodity flows out and in Beijing as depicted in the PRCGEM model by the IQTE Team at CASS. The policies in the designed scenarios include: (1) A flat increase in energy efficiency by industry; (2) An increase in investment in electricity industry; (3) A flat carbon tax by industry; (4) A policy pair, i.e a mix of carbon tax and investment subsidy for energy conservation and emission reduction to keep the governmental revenue neural.

The conclusion is that the cost effective low-carbon development strategy should be one on the integrated application of applicable policies.

Kuishuang Feng (University of Maryland, College Park), Steven J Davis (University of California at Irvine), Xin Li (University of Leeds) and Dabo Guan (University of Cambridge)

Outsourcing CO_2 within China

Several recent studies have shown that the high standard of living enjoyed by the most developed countries comes at the expense of CO_2 emissions produced in less affluent, developing countries.

Less apparent is that this relationship between developed and developing can exist within a single country's borders, with rich regions consuming and exporting high-value products and services that depend upon imports of low-cost and emission-intensive products from poorer domestic regions upstream in the supply chain. China is a vast country with substantial regional differences in physical geography, regional economic development, demographics, infrastructure, and lifestyles. As the world's largest CO_2 emitter, China is facing the challenge of balancing rapid economic growth and environmental sustainability across provinces that are in different stages of development. Here, we map CO_2 emissions embodied in trade among the different provinces of China as well as international trade. Our results show that 57% of China's emissions are related to goods that are consumed outside of the province where they are produced. The highly-developed coastal provinces import up to 80% of their consumption-based emissions from less developed provinces in central and western China where low-value, carbon-intensive goods are produced. New Chinese policies that target province-specific reductions in emissions intensity will not prevent further outsourcing of energy-intensive industries from affluent coastal provinces to the nation's interior. Consumption-based accounting of emissions can inform effective climate policy within China.

Yu Feng (University of Michigan, Ann Arbor), Sai Liang (University of Michigan, Ann Arbor) and Ming Xu (University of Michigan, Ann Arbor)

The Structure of the Global Trade Network

International trade, which functions as a mechanism to optimize resource allocation at the global scale, can be characterized as a network. Previous studies examine the global trade network considering countries as the nodes and bilateral trade flows as the links. Thanks to the recent development of Eora multi-regional input-output (MRIO) database, we are able to analyze the structure of the global trade network at higher spatial, temporal, and sectoral resolutions. In particular, the Eora-based global trade network has nodes standing for sectors in each country and links representing trade flows between sectors either in the same country or in different countries. It also covers trade links among all countries and regions continuously from 1990 to 2010. Data required for constructing such a global trade network is massive. For example, the 2010 global trade network contains 15,909 nodes and 111,462,955 links.

This research analyzes the structure of global trade network using the 1990-2010 worldwide MRIO data from the Eora database. First, two types of global trade network are constructed, including directed-unweighted network and directed-weighted network. Second, the distribution of node degrees, node weights, and link weights are statistically characterized. Third, the clustering structure of the network is examined by computing the cluster coefficient and detecting communities in the

global trade network. Several community structure algorithms are compared to find the best appropriate one to identify industrial communities in the global trade network. Fourth, nodes and links are compared according to their centrality using betweenness, closeness, and Eigenvector centrality indicators. Last but not least, the fundamental structure of the global trade network (i.e., backbone) is identified at multiple scales.

The examination of the structure of the global trade network will help us understand the evolutionary path of the world economy, the role of critical trade flows (e.g., oil, metals), and identify vulnerable nodes and links threatening the stability of the global trade network.

Esteban Fernandez Vazquez (University of Oviedo)

Estimating Multiplier Matrices by Entropy Econometrics

As Miller and Blair pointed out in the second edition of the handbook Input-output Analysis (2009, p. 243): "one of the major uses of the information in an input-output model is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy", i.e., some type of multiplier. Input-output modeling requires up-to-date tables in order to obtain accurate multipliers estimates, but constructing input-output tables based on surveys is expensive and time consuming. Several non-survey techniques have been developed in order to estimate input-output tables, both in a national or a regional context. The traditional strategy is to depart from an initial table of transactions (or coefficients) that is adjusted until it is consistent with known row and column sums of the target matrix. Once the target matrix is estimated, it is conveniently transformed in order to obtain the matrix with the multipliers.

In this paper a different approach is proposed. In line with a previous proposal by Toh (1998), we suggest departing from an initial matrix of multipliers, which will be directly adjusted to be consistent with the observed information on the actual period. Instead of row or column sums, the information required is the vectors with the final demands and the total uses (or total outputs, depending on the case). The estimation technique proposed is based on Entropy Econometrics and its performance is tested by means of numerical simulations and then illustrated by an empirical example.

Neil Foster (Vienna Institute for International Economic Studies WIIW), Johannes Pöschl (Vienna Institute for International Economic Studies WIIW) and Robert Stehrer (Vienna Institute for International Economic Studies WIIW)

Offshoring and the Elasticity of Labour Demand

This paper examines the impact of offshoring on labour demand and labour demand elasticities for a sample of 40 countries over the period 1995-2009 using the recently compiled World Input-Output Database (WIOD). Estimating conditional and unconditional labour demand models we find that both narrow and broad offshoring have impacted positively upon labour demand, an effect driven by the scale effect of offshoring. Despite this observed benefit of offshoring, we also show that offshoring has tended to increase labour demand elasticities, which can increase the vulnerability and reduce the bargaining power of workers.

Antonio Frenda (ISTAT, Rome)

An Analysis of Complex Statistical Units

As the phenomenon of enterprise groups and Globalization started to establish itself, the need to provide third parties with more information on the prospective of the groups' future development grew, as well as on their organization and on the results of their own activities. For these reasons the legislator provides for a document that can meet the cognitive needs of third parties connected to a group: the consolidated balance sheet.

There is a vast difference between the group's consolidated balance sheet and the category of the integrated accounts. The former takes the system of values for a single company as a point of reference (even though it consists of several related economic units), while the latter refers to the process of aggregation (thus representing a pure sum) of several accounts for various companies, which are associated by sector, company and/or area. The second is the process that is used in National Accounting to estimate the production and valued added for the main economic sectors.

In National Accounts, that is to say at a macroeconomic level, when the production value or the intermediate costs are to be estimated, ESA95 and Sec 2010 suggest that when an institutional unit contains more than one local KAU, the output of the institutional unit is the sum of the outputs of its component local KAU's, including outputs delivered between the component local KAU's.

In its progressive regulation on group legislation, the European Commission has not made a decisive choice concerning the various disciplinary systems available, attempting mediation (both possibilities exist, contract groups and de facto groups).

The following case-studies explain some of the problems that arise when trying to attain accounts that are useful for establishing economic indicators, starting from the accounts of the individual companies included in a group of companies. In particular the following five cases, established on the basis of determined hypothesis, describe the statistical consolidation methods used to pass from the company to the aggregated whole or sector to be analyzed.

Thus it is important to specify that the solution method to be chosen depends on the availability of certain information (such as on intra-group exchanges, accounting criteria used in certain countries, vertical integration, information on foreign branch): where some of these are not available, one method can be chosen rather than another.

G

Giorgio Garau (University of Sassari), Patrizio Lecca (University of Strathclyde) and Giovanni Mandras (University of Cagliari)

How does Ageing Population Affect Energy Use? An OLG-GE Application for Italy

In the next 50 years the Italian population will fall dramatically. Consequently, the economy will experience a pronounced ageing process in the coming decades with a strong decline in the growth rate of the labour force. Since old people has different consumption pattern than young people, in this paper we attempt to evaluate the likely effects of demographic change on energy use. Old people might use more heat energy than young people, whilst we would expect young people to consume more gasoline than older people.

Using a regional overlapping general equilibrium model calibrated on a social accounting matrix for Italy, we investigate how demographic change affect the consumption patterns and especially we try to identify the size of the impact on energy use and greenhouse gas (GHG).

Dalton et al. (2008) and Kronenberg (2009) investigate the relationship between demographic change and GHG. The former uses a growth model that assumes a closed economy, with fixed labour supply. The latter instead uses a fixed income, fixed price model with not substitution between goods and services.

Our approach is to some extent different from other applications as far as the modelling behaviour is concerned. It is an open economy model with endogenous migration and imperfect labour market.

Kelly Ann Whealan George (Embry-Riddle Aeronautical University, Daytona Beach)

The Projected US Economic Impacts of the Space Industry 2030

The Space Project Team of the OECD International Futures Programme (IFP) determined that the future demand for space applications is likely to be substantial. They present three likely scenarios that have different geopolitical, socio-economic, and energy and environment scenarios.

Using the three scenarios for Space 2030 presented by the working group and the presented cost of access to space, determine a potential impact from the change in final demand of the space value chain to the US economy. Because of the interrelations of applications, the space value chain is made up of three broad categories: information services, transport services, and manufacturing. Each scenario gives the most promising applications for the next 30 years, excluding military applications. The Space Project Team presented recommendations to assist in constructing a bridge to the space industry in 2030. The bridge has three equally important focuses required to reach the goals: an implementation of a sustainable space infrastructure, encouragement of public use, and encouragement of private sector participation in innovative space systems. There are also three supporting pillars required to pursue the objectives that include creating a more legal and regulatory environment, strengthening the private provision of space goods and services, and fostering a supportive international business environment.
The impact on the US economy will be determined by using an Input-Output Analysis model and the most current data on US economic output that is available. The most current Input-Output table is available through the World Input Output Database (WIOD) with data generated for 2009. Just as a reference, the most current published IO database that the Department of Commerce publishes is broken down into more categories than the WIOD, but only represents 2002 economic output.

Arne Geschke (University of Sydney), Thomas Wiedmann (University of New South Wales, Sydney), Manfred Lenzen (University of Sydney) and Joe Lane (University of Queensland, Brisbane)

Workflows in the Industrial Ecology Virtual Laboratory

Collaborative Mother tables are likely to be very large-scale, requiring large amounts of input data, processing and storage. The new approach taken here therefore exploits a) advanced means of computation, b) a high degree of procedural automation, and c) highly efficient organisational collaboration. More specifically, a Mother approach to a large-scale Multi-Region Input-Output table compilation would require a) purpose-built, multi-core cluster hardware running parallelised algorithms using in the order of 1 Terabyte shared RAM; b) a meta-language for addressing large amounts of raw data and variable spaces as well as constrained optimisation for data reconciliation; and finally c) a virtual laboratory architecture that allows a large number of data providers and analysts to work on one and the same platform without costly and inefficient human communication overheads.
In the Industrial Ecology Virtual Laboratory, user-specific ingredients such as raw data, concordances and constraints are gathered in a reconciliation engine that uploads the resultant Mother input-output tables into a designated repository. The reconciliation step can involve any of

the procedures commonly applied, such as the construction of an initial estimate and a balancing algorithm. The VL is equipped with an analytical toolbox that allows users to calculate derived quantities such as Leontief inverses, multipliers and environmental footprints, as well as with a facility to interrogate outputs and extract them in various formats. Finally, a user interface comprises a) a library of user-defined concordance matrices that can be used to transform the Mother table into any user-defined format, and b) libraries for storing user-defined inputs and outputs, enabling multiple users to work simultaneously on various individual research projects that may differ by which input data and/or reconciliation method is used. The entire workflow is handled within a cloud computing setting.

Arne Geschke (University of Sydney), Richard Wood (NTNU, Trondheim) and Keiichiro Kanemoto (Tohoku University, Sendai)

Investigating Alternative Approaches to Harmonise MRIO Data

Over the last years, a small number of global MRIO databases were developed as a first attempt at applying an input-output framework to the entire global economy at a high sector detail. These databases have been constructed along different philosophies. Some have been constructed to include as much detail as possible, whereas others have been constructed to principally rely on validated statistical data. In all cases, data from various sources is used to the construction of the MRIO database. In order to adhere to basic economic principles, these data must be harmonised in order to be used within the same MRIO database. We attempt to investigate the differences that alternate harmonisation procedures can have on the subsequent use of a MRIO database. This study compares two of global MRIO databases: The EXIOBASE database developed as part of the EU FP6 &7 programs and the Eora database developed at the University of Sydney. The EXIOBASE database was constructed by some 11 institutes, each responsible for harmonizing a different part of the database. In contrast, the EORA database was developed using a single mathematical balancing routine (the main component of the AISHA tool) for the core MRIO data, with MRIO table and the environmental extensions being harmonised through two subsequent harmonisation runs. The two approaches epitomise radically different approaches to data mining. The procedures used in EXIOBASE largely rely on direct expert knowledge, whilst AISHA relies on indirect expert knowledge through the provision of uncertainty estimates on source data.

This comparison focuses on trying to unravel the effect of the different approaches that were taken to develop the databases by doing a number of runs with the AISHA tool using differing levels of commonality of input data to the AISHA tool. Both databases were analysed from a number of perspectives, including analysing distance measures across harmonised and unharmonised data, and

uncertainty measures of final results using standard Leontief footprint calculations. We conclude that the reliability and robustness of an MRIO database largely depends on the level of detail and reliability of the underlying raw data, and we make recommendations for the generations for the future development of large MRIO databases based on our findings.

Rolando Gonzales Martinez (Unit of Political, Social and Economic Analysis of Bolivia, La Paz)

Balancing Social Accounting Matrices with Artificial Polymorphous Ants

A Social Accounting Matrix (SAM) is the basis of both multiplier models and Computable General Equilibrium Models. A SAM reflects the monetary expenditures and receipts between the sectors of an economy. Since a SAM incorporates information from a variety of sources, during their construction a SAM is not a "balanced matrix", in the sense that the row-sums and the column-sums of the matrix are not equal. In this paper, Artificial Ant Colony algorithms are proposed for balancing social accounting matrices. This meta-heuristic approach is a stochastic optimization based on the swarm behavior of ants, which choose and optimal path between their colony and the source of food leaving a trace of pheromones: in the proposed algorithm, an improving in the balance of the SAM increases the amount of pheromones, thus increasing the likelihood that the artificial ants choose the path towards the equilibrium of the matrix. The results showed that, unlike traditional balancing methods such as RAS or cross-entropy, the algorithm proposed in this paper directly balances the SAM, without requiring the auxiliary calculation of coefficient matrices. It is also possible to restrict the algorithm for balancing only some sectors of the SAM or to include restrictions to reflect the equality between the product calculated as the cell-sum expenditures and the cell-sum economic activities.

Henrique Graça (Instituto Superior Técnico, Lisbon), Joao Rodrigues (Instituto Superior Técnico, Lisbon), Alexandra P.S. Marquez (Instituto Superior Técnico, Lisbon) and Antonio Rito Silva (Instituto Superior Técnico, Lisbon)

An Open and Collaborative Environmental Input-Output Database

In this talk we will present an on-going project, under development at IST. The goal of this project is to design and implement an open environmental input-output (IO) database which fosters the collaboration among IO practitioners. With regard to openness, practitioners can submit their contributions, and thus the database offers a venue for the dissemination of research such as sector-specific or sub-national IO studies. Additionally, the collaborative aspect allows users to offer

feedback on, discuss and improve the available data. These features allow the database to offer an integrated and robust description of the global economy in its monetary and material dimensions from the process to the industry level and from the city to the country scale. In this talk we present and discuss the main features of the database, preliminary results and current challenges.

Joaquim Guilhoto (University of São Paulo), Carlos R. Azzoni (University of São Paulo), Denise Imori (University of São Paulo) and Ricardo Luis Lopes (State University of Maríng a)

The Importance of Households and Productive Structure for Electricity Consumption in Brazil: A Leontief-Miyazawa Approach

The consumption of electricity is fundamental to the development of economic as well as household activities, being the two interconnected. In this direction, the question addressed in this paper is how the relationship between the productive structure and households affects the consumption of electricity in the Brazilian economy. The measure of this interdependence does not happen easily and requires sophisticated models to allow the estimation of the intensity in the interrelationship among the productive sectors as well as with the households in different income groups.

In order to achieve this goal we used an input-output model with the endogenization of the household consumption (Leontief-Miyazawa model) and treatment of the electricity sector in a hybrid form. The results show that in terms of public policy, one should not only look for direct consumption of energy, but also for the indirect and induced effects.

It is observed, in this way, that despite higher income households consume more energy than the lower income groups, their relationship of energy per dollar of income is lower than the one presented by lower-income groups. Thus indicating that in the process of improving the standard of living, which has taken place in the Brazilian economy in recent years, the population in the lower income groups have placed greater pressure for energy resources than the average, which, if not properly planned could lead to blackouts and problems in electricity supply.

The same is true when looking for productive sectors such as Civil Construction which have little direct demand of energy, but has in their inputs and in the needs of its labor force a high demand for electricity.

Zafer Barış Gül (Akdeniz University, Antalya), Celal Tasdogan (Gazi University, Ankara) and Selim Cagatay (Akdeniz University, Antalya)

Using a Class-Based Social Accounting Matrix to Account for Distributional Impacts of Fiscal Adjustment in Turkey

In this study, a SAM is built specifically to account for in-depth distributional impacts of fiscal policies. Two exogenous accounts, savings-investment and rest of the world, are created as in the standard fashion while third exogenous one is created by taking into account only public expenditures and revenues, both classified under seven categories. Endogenous accounts include only households and firms; and in particular the way these institutions are framed in the SAM represent the main distinguishing features. Households are disaggregated into eight categories, comprising urban/rural property owners, petty bourgeois, commodity producers, urban/rural working classes, leisured classes and pensioners; and factor incomes are implicit in household categories. Activities in the economy are aggregated under agriculture, energy, manufacturing, construction and services, to represent private sector; and all are endogenized under separate activities and commodities accounts in firms account. In addition, a separate private sector account for financial activities and commodities is also created under firms. Finally, public banking and state economic enterprises are endogenized explicitly to represent public sector.

Fiscal adjustment experience is based on creating primary surplus in the public budget, to relieve the burden of interest payments on it. Such policies are implemented via the adjusted expenditure items on the budgetary process. The main purpose of this study is to reveal the distributional effects of changes in current and transfer expenditures and also in interest payments on the household categories by calculating the income multipliers from the above SAM built for Turkish Economy.

H

Eri Habu (Yamaguchi University) and Sachiyo Asahi (Mie University)

The Impact and Evaluative Analysis of the Tourism Economy - A Case Study of ISO TC 228 in Japan

The main goal of this paper is to assess the economic effects of the benefits including higher conformance with legislative and regulatory requirements by adopting the ISO/TC228 standard in Japan. We made social accounting matrix based on TSA (Tourism Satellite Account) elaborated by Japan Tourism Agency for the year 2010. This paper applied the said social accounting matrix. ISO/TC228 is a technical committee under the Technical Management Board (TMB) at ISO with the task to develop relevant standards for the activities related to tourism in order to promote international provision of tourism services. The tourism part of ISO (TC228) is composed by 10 working groups and this paper deals with the content of working group 3 “Tourist Information and

Reception Services at Tourist Information Offices". The ISO/TC228 of WG3 includes the concrete activity on the development and the promotion of tourist information offices (TIO) and tourist information centers (TIC) for provision of various services for visitors at TIO and TIC by consolidating information from tourism industry. In the case to attain the level of this ISO for the TIO and the TIC, the initial investment for the informational services and the increase in the number of tourists as well as the increase in the period of stay by tourists can be assumed as economic impact. This paper has originality as being the first research on the impact assessment analysis for ISO/TC228. Furthermore, this analysis provides a mean for important information for evaluation on whether Japanese government adopts the standard developed by WG3 of ISO/TC228.

Eduardo A. Haddad (University of São Paulo) and Yasuhide Okuyama (University of Kitakyushu)

Spatial Propagation of the Economic Impacts of Bombing: The Case of the 2006 War in Lebanon

This paper evaluates the economic effects of the July 2006 War in Lebanon. We estimate the economy-wide impacts on the Lebanese regions according to a reduction of physical capital stocks in the same magnitude of the estimated damages associated with the bombing events. In doing that, we are able to derive the estimates of the economic costs of the War related to the structural break in the availability of economic infrastructure in the country. A discussion on resiliency is also introduced showing how the lack of redundancy in the country's infrastructure is associated with stronger higher-order negative effects.

Eduardo A. Haddad (University of São Paulo) and Eliane Teixeira (University of São Paulo)

Regional Economic Impacts of Natural Disasters in Megacities: The Case of Floods in São Paulo, Brazil

One of the main concerns of contemporary society in relation to climate change projections refers to the forecasted changes in the frequency and intensity of extreme events. Moreover, as a result of an accelerated process of expansion of metropolitan areas, without an adequate development of the urban infrastructure, cities in Brazil are not prepared for the adverse effects of such weather events. This is the case of the city of São Paulo, home to 11 million people, which suffers constantly the effects of flooding caused by extreme precipitation. Localized floods occur every summer in various parts of the city. Besides the losses and inconvenience felt by the residents, floods produce damages that cross the city boundaries, affecting income and output in the metropolitan area as well as in other parts of the state and the country. The objective of this study is to evaluate the economic

impacts of floods in the city of São Paulo through the use of a spatial CGE model integrated to GIS information related to the location of points of floods and the firms within their influence.

Tadayuki Hara (University of Central Florida, Orlando), Yun Ying Zhong and Valeriya Shapoval

Quantifying the Impacts of an Economic Crisis over a Regional Tourism Industry and Economy – Discussion on Versatility of Tourism as an Industry

This is an empirical study to explore the accuracy issue of the Input-Output model in quantifying the impacts of an economic crisis over a regional tourism industry and economy. The model's estimation accuracy has not been verified empirically as often as it should be, particularly in relative to change in numbers of employments in different sectors in the regional economy. The Metro Orlando area in Florida, USA is investigated as an empirical study, and the negative change in visitor expenditure between 2007 and 2008 is taken as the direct shock, when the regional economy witnessed 19% reduction in total tourism-related expenditures in the study region.
We calculate the negative impacts caused by the 19% reduction in tourism expenditures in the Input-Output framework, so that we can see how the calculated total negative impacts data in terms of output and employment fare against the actual data. We find that there are surprisingly large discrepancies between the calculated impacts and the actual data, and that the Input-Output model appears to overestimate the negative impacts. We look into detailed changes in employment in different tourism related sectors, and discuss versatility of tourism as an industrial complex. By investigating the regional economic activities during the study period, we discuss possible explanations on such discrepancies. Depending on availability of data, we may expand the time frame of this study to see the longer-term relationship between expenditures and regional employments.

Tsutomu Harada (Kobe University)

Multi-sector Induced Innovation Model: Another Use of Input-Output Analysis

This paper builds a simple general equilibrium multi-sector induced innovation model, based on two stages of production: technology components as intermediate goods and a commodity. Inter-sectoral relations among intermediate sectors enable us to represent the equilibrium of the model in terms of standard input-output matrix algebra. Thus, this model provides a micro-foundation and theoretical justification for input-output analysis in the fields of technology transactions and innovation. Moreover, it shows demand shocks do not cause innovation while technology shocks induce

asymmetric innovation. If perfect matching among intermediate sectors is allowed, localized subgroups of the same quality level emerge. In this case, the effects of technology shocks are localized symmetrically. Therefore, economic growth should be quantitatively analyzed in terms of inter-sectoral effects which are summarized by the inverse of the input-output table where multiplier, weak or independent inter-sectoral effects could emerge. We also conduct a simple quantitative analysis of a technology input-output table using recent Japanese economic data and examine the inter-sectoral effects.

Marcos M. Hasegawa (Federal University of Paraña, Curitibia), Moisés D. Vassallo (University of São Paulo), Joaquim J.M. Guilhoto (University of São Paulo), Carlos R Azzoni (University of São Paulo) and Geoffrey J.D.Hewings (University of Illinois, Urbana-Champaign)

Economic Interdependence between Parana State and Rest of Brazil: A Miyazawa Analysis

The present study analyzes the nature and strength of economic interdependence between Paraná State and rest of Brazil. The Miyazawa's extended input-output framework, a multiregional model, is used to analyze the interdependence of income formation and output generation. In order to analyze the Paraná State interdependence and rest of Brazil, we defined eight regions: Paraná, Rio Grande do Sul, Santa Catarina, São Paulo, rest of Southeast region, Central-West region, North region and Northeast region. The interrelational income multiplier and the internal and external multipliers for the evaluation of the linkages and interdependence between regions are estimated.

Geoffrey J.D. Hewings (University of Illinois, Urbana-Champaign)

Miyazawa's Contributions to Extended Input-Output Analysis: Introduction to the Special Sessions

This talk will give an overview of the contributions that Kenichi Miyazawa made to the field of input-output analysis. It will set the stage for two special sessions organized in his honor.

Mohd Khairul Hisyam Hassan (University of Malaysia Sarawak, Kota Samarahan) and Zakariah Abdul Rashid (Malaysian Institute of Economic Research)

Construction of an Inter-Regional Input-Output Table for Malaysia: The Case of Sarawak and the Rest of Malaysia

The aim of this paper is to present some results from an empirical investigation of an interregional input-output model of Malaysia. This approach is very important to know and determine the interregional flows and the different level of dependency between Sarawak and the rest of the regions in Malaysia. The model was applied to two regions, namely Sarawak and the rest of the country (Malaysia) and contains 20 sectors for the year 2005. The application focuses on the interregional multipliers (output), linkages (backward and forward), and spillover and feedback effects. However, since Sarawak does not have an established input-output table or regional account system, so we have to develop the regional model using non survey based method (location quotients) to measure the intraregional coefficients, while to estimate the interregional coefficients, we used the RAS technique to balance these matrices. Then, through the direct and indirect regional effects (intraregional and interregional), the policy makers will know the key sectors of the regions that should be given more priority in initiating the economic development process and the expansion of industrial structure of the economy within this key sector.

Rutger Hoekstra (Statistics Netherlands, Voorburg)

A Complete Database of Peer-reviewed Articles on Environmentally Extended Input-Output Analysis

Environmentally extended input-output analysis (EE-IO) is one of the fastest growing fields in input-output analysis. This paper provides a complete overview of EE-IO articles that have appeared in peer-reviewed journals from 1969-2010. The paper clearly illustrates the rapid growth that the field of EE-IO has experienced since the mid-1990s.
The articles have been categorized in terms of the type of publication (empirical application or theoretical), IO methods, environmental problems, country, authors, author affiliations and journals. The 20 most cited papers (published after 1996) are also provided. Based on this overview a number of conclusions are drawn about the progress over the past four decades as well as possible future developments of the field of EE-IO.
A preliminary draft of this paper was presented at the Sydney Conference (Hoekstra, 2010).

Rutger Hoekstra (Statistics Netherlands, Voorburg), Daan Zult (Statistics Netherlands, Voorburg), Ronghao Wu (Statistics Netherlands, Voorburg), Bram Edens (Statistics Netherlands, Voorburg) and Harry C. Wilting (Netherlands Environmental Assessment Agency PBL, Den Haag)

Environmental Footprints from the Perspective of Official Statistics

Since the early 1990's the concept of footprint indicators was popularized by the introduction of the "ecological footprint". In later years, carbon, water, material and land footprints were also developed. Initially these calculations were rarely done using input-output techniques or data, but recently the availability of multiregional input-output (MRIO) and environmental accounting data has changed this situation drastically.

Many overviews have been written about the academic work on footprints (see for example the special issue of ESR in 2013). However, an aspect which gets little attention is the growing statistical work in this field. For example, a number of statistical offices have developed carbon footprints. Currently this work is deemed "experimental" but there is a real prospect that statistical offices will be producing "official" footprint indicators in future.

This paper answers two questions:

1) What hurdles are there for footprints to become "official statistics"? Issues will include: what are the differences between MRIO's and official data? How can MRIO be adjusted to conform to data published by statistical institutes? The paper will show an application for the Netherlands in which the WIOD database is adjusted to conform to the data published by Statistics Netherlands. The method is generic in the sense that other countries can re-use the procedure to adapt WIOD to their official statistics.

2) What changes are imminent in the source data from statistical offices which will affect the production of MRIOs in future? Issues will include SNA/NACE/CPA revisions.

Makoto Hosoya (Bank of Japan, Tokyo)

Flow of Funds Compilation: Measures to Close Data Gaps

Japan's Flow of Funds Accounts (J-FFA) records comprehensive developments of financial assets and liabilities in major economic sectors. It comprises of matrices of 43 sectors and 51 transaction items, recording both outstanding balances of financial assets and liabilities (stock) and financial transactions (flow) in each sector.

In cooperation with international initiatives to close data gaps, we started to release new data series as a reference of J-FFA. From-whom-to-whom matrix for domestic debt securities is another presentation form of J-FFA and is intended to delineate creditor / debtor relations between major sectors. "Amounts outstanding of securitised products" is derived from J-FFA and serves as a useful measure of the size of securitisation market with its key components after financial crisis.

We are also examining practical ways to measure maturity mismatches of each sector in financial system. Data on aggregated remaining maturities for loans, bonds, and deposits would be estimated for release.

Lin Hsing-Chun (National Chiayi University, Chiayi City) and Li-Chen Chou (National Chiayi University, Chiayi City)

The Economic Impact of Cross-strait Agricultural Trade on Taiwan's Industries and Overall Economy—Regional Input-Output Analysis

International trade is very important to the economic development of Taiwan due to her small open island economy. At present, The major exporting country in Taiwan is China, which shows the dependence degree of bilateral trade is rising. With the 2008 cross-strait direct flights, as well as the signing of the ECFA in 2010, economic and trade relations have become more frequent between Taiwan and China., the exports from Taiwan to China's agricultural products are divided into three stages of tariff reduction after signing ECFA, and the changes in agricultural trade brings large impact on the overall industrial output expectedly.

In this study, we use Regional Input-Output Model by Miller and Blair (1985) and the 96 departmental cross-straits input-output link table compiled by Lin and Chang (2011) to analyze the direct and indirect impact of agricultural products in relative industries and the overall economics. We simulate the following scenarios. First, the amount of Taiwan's agricultural exports to China and the amount of net exports. Second, Taiwan's agricultural export earnings amount after the implementation of the ECFA. Third, the substitution between Taiwan's and China's commodities. Use demand side and the supply side input-output model through above scenario, we assess the impact of cross-straits agricultural trade on Taiwan's industries and the overall economics.

I

Silvio M. Ichihara (Secretary of Transport- State of São Paulo), Joaquim Guilhoto (University of São Paulo), Denise Imori (University of São Paulo), Archibald Araujo da Silva (São Paulo State Secretary of Finance) and André L.G. Clemente (São Paulo State Secretary of Finance)

An Interregional Input-Output System for the 645 Municipalities of the São Paulo State: Integrating Different Approaches and Databases

Changes in tax policy and investments in new plants are recurring and generally cause significant structural changes in the economic system of countries and regions. Projecting in advance the effects of these changes in the dimensions of economic activity and tax revenue is a complex job that

requires consistent methodological tools to give results at the regional and sectoral levels. In order to achieve these objectives for the State of São Paulo, a first step is to estimate an Interregional Input-Output System to cover all the 645 municipalities of the state of São Paulo and the flow of goods and services among the municipalities and the other states of Brazil.

The most recent input-output system released by IBGE, the Brazilian Statistical Office, refers to the year of 2005, however, using the methodology proposed by Guilhoto and Sesso Filho (2005 and 2010) it is possible to estimate an input-output system for the year of 2009 based on data available from the System of National Accounts (SNA) at the level of 56 sectors and 110 commodities. Given the needs of this study, this system if further expanded to incorporate 134 sectors and 187 commodities.

The next step is the estimation of the inter-state system for Brazil, in which it was possible to estimate the flow of goods that the State of São Paulo has with the other states in Brazil; this step is followed by the estimation of the inter-municipal system for the state of São Paulo, consistent with the inter-state system. To do so, different databases are combined, the main ones being from: a) the Brazilian Statistical Office (IBGE); b) the São Paulo State Statistical Office (SEADE); and c) the state tax collection system (ICMS) from the São Paulo State Secretary of Finance. Also different econometric, mathematical, and input-output models are combined to: a) reconcile the databases; b) balance the system; and c) make it as close as possible to the real word. The input-output methodologies includes, among others, location quotients, RAS procedure, and gravity models.

Silvio M. Ichihara (Secretary of Transport- State of São Paulo), Karin A. Van de Bilt (University of São Paulo) and Joaquim J.M. Guilhoto (University of São Paulo)

An Input-Output Matrix and a Four-Step Model: a Synergistic Interaction for Cargo Transportation Forecasting

The four-step model is widely employed for transport forecasting, especially for estimating the number of trips that will use a specific transportation facility in an urban environment. The four steps of the classical model are: trip generation, trip distribution, mode choice and route assignment. These procedures are well suited for the evaluation of passenger transportation, but not for regional cargo transport. The common techniques associated with the first step can be improved using data and analysis from the input-output theory. At the same time, the origin-destination matrices, obtained at the end of the process can be used to estimate trade flows and the interregional input-output matrix.

Takeo Ihara (Chubu Region Institute for Social and Economic Research Institute, Nagoya) and Michiya Nozaki (University of Groningen)

A Critical Review of the Impact Studies for Unscheduled Natural Disasters

The aim of this paper is to survey, critically, the Impact Studies for Unscheduled Natural Disasters, and also to measure the economic damages of the Great East Japan Earthquake, which was occurred on March 11, 2011, with an aid of Interregional Input-Output Table for Chubu Region and the Rest of Japan, for example.

It is often pointed out that the damages and losses, which are stemmed from such unscheduled events as earthquakes, flood, etc., have significant and intense impacts on its region's economy. However, most analytical models of urban and regional economies are not able to confront with these unscheduled and significant changes, directly, since they are, at best, obliged to assume incremental changes in the system over time. Moreover, the consequences associated with the event will have many aspects including damages on both sides of demand and supply, since the event may affect a wide range of regional activities in different ways.

In short, the difficulties of the Impact Studies for Unscheduled Events are pointed out, as follows:

1) Disentangling the consequences stemming, directly and indirectly, from the event;

2) Deriving, possibly, different assessments at each spatial level;

3) Evaluating the reaction of households, which are poorly understood;

(Okuyama, Sonis, and Hewings,1999, p.113).

In this paper, we are to examine and scrutinize, thoroughly, such interregional spillover as well as feedback effects within the Interregional Input-Output Framework.

Satoshi Inomata (Institute of Developing Economies-JETRO, Chiba)

The Relative Positions of Countries in Regional Supply Chains in East Asia: Using a Model of Average Propagation Length

The conventional input-output approach to supply chains generally focuses on measuring interconnectedness, or "strength" of linkages among industries, based on the traditional demand-pull or cost-push impact models. Now, in addition to the strength of linkages, the increasing complexity of production networks due to the participation of the variety of industries entails to measure the "length" of linkages for mapping the global supply chains.

The length is estimated using the concept of average propagation length (APL) developed in Dietzenbacher et al. (2005). APL is formulated as a weighted average of the number of production stages that an impact from one industry to others goes through, using the share of an impact at each

stage as a weight. It represents the average number of production stages lining up in every branch of all the given supply chains, or, in short, an industry's level of fragmentation.

APL can be measured both in forward-looking and backward-looking ways. So, by comparing the lengths between the two for cross-national supply chains, we can identify the relative position of a country (upstream / downstream) in the global production networks.

This paper applies the idea to Asian International Input-Output Tables developed by IDE-JETRO, in order to elucidate the change in regional supply chains in East Asia and the relative position of the countries therein, from 1985 to 2005.

Satoshi Inomata (Institute of Developing Economies-JETRO, Chiba) and Bo Meng (Institute of Developing Economies-JETRO, Chiba)

Transnational Interregional Input-Output Tables: An Alternative Approach to MRIO

IDE-JETRO has already constructed and released the "the 2000 Transnational Interregional Input-Output Table between China and Japan". This time, the new data, "2005 Transnational Interregional Input-Output Table for China, Japan and Korea" will be constructed, using the basic framework of the newly released 2005 Asian International Input-Output Table (AIOT). The basic idea is to disaggregate the 2005 AIOT by domestic regions, using split ratios derived from interregional I-O tables and regional import/export customs data of the individual countries. It is expected that the data will serve as a basic analytical tool for studying the evolution of cross-national production networks in East Asia on a region-to-region basis. The project will be conducted in a close collaboration with the institutions in charge of constructing their own national tables; the Bank of Korea, the Ministry of Economy, Trade and Industry of Japan, and the State Information Center of China.

This paper presents an intermediary report on the progress of this new scheme of developing the world MRIO database.

J

Xuemei Jiang (Chinese Academy of Sciences, Beijing) and Yifang Liu (Central University of Finance and Economics, Beijing))

Exports, Carbon and Global Value Chain: Case of ICT industry

This paper investigates the sling up the value chain and the accompanied carbon responsibilities in the international trade of global ICT industry, the most dynamic and globally dispersed sector in the world economy. Based on an inter-country input-output database WIOD, both direct effects due to the productions of regional/national own exports and indirect effects due to the downstream productions of the intermediate inputs of other region/country's exports are considered. The results show that the increasing role of emerging countries in international fragmentation of production, especially China, has considerably changed the patterns of global ICT market. Although the emerging countries experienced much faster growth in exports and technology upgrade in carbon reduction, until 2008 the advanced countries are still responsible for less emission when receiving as same as value-added in ICT exports. Fuelled by the substantial "inequalities" in terms of the received economic benefits and the carbon reduction responsibilities among advanced and emerging countries, the "producer responsibility" is doubted.

Olaf Jonkeren (European Commission, JRC-IPSC, Ispra) and Georgios Giannopoulos (European Commission, JRC-IPSC, Ispra)

Modelling Critical Infrastructure Resilience with a Dynamic Inoperability Input-Output Model

In the framework of the European Programme on Critical Infrastructure Protection, the European Commission is developing a model for analyzing economic losses following from Critical Infrastructure failure in the European Union. Modeling economic resilience on the sectoral level, which mute the economic losses, is a requisite here because it prevents the modeler from finding overestimations. Several extensions of the Inoperability Input-Output Model (IIM) offer an attractive approach to model such resilience measures. They can take into account recovery activities and the presence of inventory (which delays the onset of inoperability) for example.

For the construction of the model in the current study, the state-of-the art with respect to Dynamic Inoperability Input-Output Modeling (DIIM) is taken as a starting point and several extensions are proposed and implemented.

First, the extended DIIM resulting from this process allows for a different recovery path than the traditionally assumed 'concave up decreasing curve' describes. Because emergency and repair activities have to be initiated and logistics are often complex, recovery is likely to take place slowly in the immediate post-disaster period and quicker later on. A concave down decreasing recovery path is more likely to describe such a process.

Second, in case of several types of disasters, recovery may not start immediately after a disaster has occurred. The aftermath of an earthquake or severe storm for example can often be characterized as a situation of chaos and destruction. In these circumstances it can take several hours, days or maybe

even weeks before recovery activities start and thus the presence of such a non-recovery period is likely. Our model takes account of this.
Last, the model refines the aspect of inventory as a resilience measure. Inventory, for example on-hands finished goods, should not only be used to compensate for production inoperability (being unable to supply to customers due to a physical disruption of the production process), but also for sector inoperability (being unable to supply to customers due to a lack of inputs).
The model is applied to both, a simple two-sector illustrative example and a European case study using Input-Output data from the World Input Output database.

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Shigemi Kagawa (Kyushu University, Fukuoka), Shunsuke Okamoto (Kyushu University, Fukuoka), Sangwon Suh (University of California at Santa Barbara), Yasushi Kondo (Waseda University, Tokyo) and Keisuke Nansai (National Institute for Environmental Studies, Tsukuba)
Identifying Environmentally Important Clusters in the Global Supply Chain Network

This paper proposes an optimal combinatorial method for finding groups of industries with relatively large CO2 emissions through a global supply chain network. Using the World Input-Output Database (http://www.wiod.org/index.htm), we estimated a non-symmetric matrix describing how much CO2 is indirectly generated from the global supply chain network through consuming a specific commodity in other developed and developing countries. A symmetric strength of relations matrix describing the CO2 emissions associated with the international trade among countries was further estimated using the non-symmetric matrix. The strength of relations matrix can be viewed as a representation of the global supply-chain network of the final commodity. In this study, we applied the multiway cut approach using nonnegative matrix factorization to the matrix in order to find environmentally important industry clusters in the global supply chain. From the results, we visualize the world CO2 emission structure and argue how China and US as world's big CO2 emitters can reduce the CO2 emissions through the relevant global supply chain engagement.

Yoshio Kajitani (Central Research Institute of Electric Power Industry, Tokyo) and Hirokazu Tatano (Kyoto University)
Estimation of Production Capacity Losses after the Great East Japan Earthquake

The study aims at presenting a methodology to estimate production capacity losses after the disaster to identify the major sources of impacts as well as to test the forecasting capability of available models. Remaining production capacity is indispensable information to estimate the economic losses by any econometric models such as I-O and CGE. In this study, data collected from pre- and post-disaster business surveys in Japan are utilized to develop empirical models for capacity loss estimation. Fragility curves for industrial sectors that have been developed to relate ground motion to production capacity loss from facility damage. The study also employs resilience factors to estimate the production capacity under conditions of lifeline disruption. A case study is conducted for the Great East Japan Earthquake and Tsunami March 11th, 2011. Validity of the proposed methodology is verified by checking the fitness between observed data, the industrial production index, and the estimated production capacity ratio. We find that the proposed method has a relatively good fit for the observed data.

d'Artis Kancs (European Commission, JRC-IPTS, Sevilla/University of Leuven)

Modelling of Agglomeration and Dispersion in RHOMOLO

The present paper describes the strategy of modelling endogenous location taken in the newly developed dynamic spatial general equilibrium model RHOMOLO. The model incorporates three mechanisms of endogenous location: mobility of capital, mobility of labor, and vertical linkages of intermediate goods. The spatial equilibrium in RHOMOLO is an outcome of optimisation involving many dispersion/agglomeration forces and channels of adjustment.

Keiichiro Kanemoto (Tohoku University, Sendai), Daniel Moran (University of Sydney), Manfred Lenzen (University of Sydney) and Arne Geschke (University of Sydney)

International Trade Undermines National Emission Reduction Targets

Many developed countries in Annex I of the Kyoto Protocol have been able to report decreasing emissions, and some have officially fulfilled their CO2 reduction commitments. We show that this is often because current reporting and regulatory regimes allow these countries to displace emissions-intensive production offshore. Using a new highly detailed and UNFCCC-compatible account of emissions embodied in international trade we attributed CO2 emissions to final consumers and found that adjusting for trade, Annex I emissions have increased, not decreased nearly three times reduction target set by the Kyoto Protocol - have been shifted to developing countries. We construct a corresponding inventory of air pollution and find that historically a similar

pattern of emissions displacement has already occurred with SOx, NOx, and PM10. The result has been improved air quality in developed nations but increased total emissions globally. This new finding suggests that if regulatory policies do not account for embodied imports, global emissions are likely to rise even if Annex I emitters enforce strong national emissions targets.

Jonas Karstensen (CICERO, Oslo), Glen Peters (CICERO, Oslo) and Robbie Andrew (CICERO, Oslo)

Attribution of CO2 Emissions from Brazilian Deforestation to Consumers between 1990 and 2010

Efforts to reduce deforestation to mitigate climate change and to conserve biodiversity are taking place on a global scale. While many studies have estimated the emissions occurring from deforestation, few studies have quantified the domestic and international drivers sustaining deforestation rates. In this study we establish the link between Brazilian deforestation and production of cattle and soybeans, and allocate emissions between 1990 and 2010 along the global supply chain to the countries that consume products dependent on Brazilian deforestation. We find that 30% of the carbon emissions associated with deforestation were exported from Brazil in the last decade, of which 29% were due to soybean production and 71% cattle ranching. The share exported is growing, with industrialized nations and emerging markets (especially Russia and China) greatly increasing imports. We find a correlation between exports (and hence global consumption) of Brazilian cattle and soybeans and emissions from deforestation. We conclude that trade is emerging as a key driver of deforestation in Brazil, and this may indirectly contribute to loss of the forests that industrialized countries are seeking to protect through international agreements.

Suparana Katyaini (Indian Institute of Technology, Guwahati), Anamika Barua (Indian Institute of Technology, Guwahati) and Dabo Guan (University of Leeds)

Virtual Water Trade Flows for Sustainable Use of Freshwater in India: A Methodological Framework for Sub-national and Policy Relevant Assessment

'Virtual water trade' (VWT), is emerging as a crucial concept in addressing water scarcity through sustainable water use and is an important way of ensuring water security. The rationales of the concept are "global water use efficiency" and "distribution of scarcity", therefore, it is helpful in analyzing the water use efficiency, water productivity and 'water savings'. The analysis of VWT flows is policy relevant as policies provide the institutional framework for setting the water use agenda for economic activities. VWT flows assessment would be crucial for India, characterized by

regional water scarcity and large regional water use inefficiencies. These result from water intense production and trade processes which are likely to grow due to intensification of international trade with India playing a pivotal role in the global economy, hydrological and technological variations, and different priorities of states in India in water sector as water policy and economic activities are state subjects in India. Therefore, VWT flows assessment at sub-national scale in India, and with the rest of the world would support a comprehensive view of the trade and environment linkages and avenues for sustainable water use.

The paper pinpointed the multifaceted challenge of the mismatch between the water endowments and the policy driven development pathways in India. The policy incentives of states in Northern and Western India induced unsustainable economic development at the expense of scarce water resources; while economic development has been in nascent stage in East and North East India despite water abundance. Realizing the scarcity of water and persistent inefficiencies, Government of India targets increase of water efficiency by 20% (National Water Mission, NAPCC, 2008). Acknowledging these, the research intended to provide a review of the conceptual and methodological approaches for VWT flow assessment to identify the most suitable framework for a policy relevant analysis, applicable for sub-national assessment of VWT flows in India. These range from Hoekstra and Hung (2002) , Zimmer and Renault (2003) , De Fraiture et al. (2004) , Oki and Kanae (2004) , Guan and Hubacek (2006) , Daniels et al. (2011) , Hoekstra, et al. (2011) to others. The environmentally extended input-output analysis was found to be suitable as the foundation for developing the methodological framework for the proposed analysis. The uniqueness of the methodology is consideration of all three sectors of economy- agriculture, manufacturing, and services; where freshwater is an input (environment as source) and wastewater an output (environment as sink). The framework would help in identifying the 'hotspots' of unsustainable water use characterized by water inefficiency, low water productivity and poor water savings.

Scott Kelly (University of Cambridge), Peter Tyler (University of Cambridge) and Douglas Crawford-Brown (University of Cambridge)

Estimating the Macroeconomics of Infrastructure through the Key Linkages Hypothesis

National infrastructure systems such as electricity, gas, water, waste-water, transport and telecommunications are vital for the proper functioning of an economy. The threat of natural hazards such as cyclones, flooding and drought events has the potential to disrupt infrastructure systems and impinge on economic activity. Although the direct effects of infrastructure disruption due to natural disasters on an economy can be devastating, the indirect effects on the economy as a whole are shown to be just as important. This research employs key-linkages analysis and the hypothetical

extraction method to identify both forward and backward linkages for different infrastructure sectors in the UK economy. Using this approach it is possible to identify whether a particular infrastructure sector is more reliant on the factors of production from other sectors in the economy; or alternatively, whether other sectors in the economy are more reliant on the factors of production being supplied by the infrastructure sector in question. Moreover, the five most important forward and backward linkage sectors for each infrastructure sector are identified and quantified. With this information it is possible to trace how indirect effects are transmitted through economies after infrastructure failure. Better understanding of the transmission pathways through which economic shocks propagate through supply chains within national economies helps in the identification of critical sectors indirectly affected by the initial shock. Once critical sectors are identified resiliency strategies are developed to mitigate the transmission of indirect losses through the economy for each of the critical sectors.

Euijune Kim (Seoul National University, Geoffrey J.D. Hewings (University of Illinois, Urbana-Champaign) and Hidayat Amir (Fiscal Policy Office – Ministry of Finance, Jakarta)

Effects of Transportation Investments on Growth and Income Distribution of Indonesia Economy Using a Financial CGE Model

This paper analyzes the impact of transportation investments and financing methods on economic growth and income distribution of Indonesia using a Financial Computable General Equilibrium Model (FCGE) model. The FCGE model integrates a real economy with a financial one in a whole economic system. The model is used to analyze the economic effects of the transportation investment expenditures and their procurement approaches on economic growth and distribution among urban and rural households. The model includes five economic institutions: households (including private enterprises and self-employed individuals), corporations, financial institutions (including the central bank), government, and rest of the world. The portfolio choice is disaggregated into real capital, equity and interest-based financial assets such as private bonds, national bonds, and deposits (money). There are three alternatives for financing and operating the infrastructure projects: government financing with tax revenues, private financing with bond issues and the public-private partnership. They are applied to three major projects including (1) Mass Rapid Transportation System (North - South Jakarta, Rp40 trillion), (2) Railway Transport System (Kertapati Simpang - Tanjung api-api, Rp25 trillion), and (3) Balikpapan – Samarinda Toll Road East Kalimantan (Rp12 trillion). This paper can identify if private financing would have had a more positive impact on Indonesia's GDP with better income distribution over the other cases and which project should be selected for economic growth of Indonesia in the short and long runs.

Makoto Kinoshita (Yamaguchi University) and Junichi Nomura (Yamaguchi University)

Performance Analysis of the Convention Center in the Local City and Its Impact on the Regional Industrial Structure

The first large convention center in Japan was constructed by Kobe City in the 1980's. Recently, some large convention facilities with over 2,000 square meters of floor space operate even in provincial cities. However economic effects of investment for convention facilities are similar to the effects of investment for resorts' facilities and theme park business during the bubble economy. That investment ended up in bankruptcy and left a debt for provincial areas. Therefore the investment for convention facilities has a potentially detrimental effect on provincial areas.

This paper shows that the evaluation of the performance by the convention center in long-run is important for assessment of whether the convention center is typically regarded as major generators of economic activity and jobs or non-performing loans. The evaluation of the performance indicated that following three points are important: 1) how many conventions are attracted after constructing the convention facilities, 2) hotels and other public facilities in the city experience declining incomes or not, 3) the financial reports for the convention center ends in the black or not.

This paper estimates economic effects of "Kunibiki Messe" (Shimane Prefectural Convention Center) at Matsue City, Shimane prefecture and analyzes the impact of the large convention center on the provincial city based on the international estimation procedure called as TSA (Tourism Satellite Account). This paper also evaluates the performance of the large convention center from a standpoint of Matsue City's economy and discusses requirements of successful convention centers in the provincial cities.

Jong-Hwan Ko (Pukyong National University, Busan)

A Study on Economic Effects of the Regional Comprehensive Economic Partnership in East Asia Using a Computable General Equilibrium Model

The Regional Comprehensive Economic Partnership (RCEP) negotiations were launched by Leaders from ASEAN and ASEAN's FTA partners such as China, India, Japan, Korea, Australia, and New Zealand in the margins of the East Asia Summit in Phnom Penh, Cambodia on 20 November 2012. RCEP has the potential to deliver significant opportunities for businesses of all participating countries as well as the rest of the world, because the 16 RCEP participating countries account for almost half of the world's population, almost 30 per cent of global GDP and over a quarter of world

exports.

This paper aims to conduct a quantitative assessment of potential economic effects of the RCEP using a Computable General Equilibrium (CGE) model. A multi-region, multi-sector dynamic CGE model is used for analysis, which places international mobility of capital at the forefront, thus providing a useful vehicle for exploring the impact of the RCEP on economic growth and foreign investment in order to examine whether the RCEP can play an important role in enhancing the attractiveness of the RCEP participating countries as destinations for foreign investment. Simulation results of the RCEP will be described in terms of real GDP, equivalent variation as a proxy for welfare, total exports, total imports, trade balance, terms of trade, employment, demand for capital, foreign investment, and so on at the macroeconomic level. On the other hand, exports and imports by commodity, trade balance by commodity, domestic production by sector, demand for labor and capital by sector, etc. will be examined at the microeconomic level.

This paper will be organized as follows. Section II provides a brief description of characteristics of economic relations between the RCEP participating countries. Section III describes the model used in this study. Section IV examines baseline and policy scenarios of the RECP, and Section V discusses their simulation results. Section VI concludes with some remarks.

Robert B Koopman (US International Trade Commission, Washington DC), Marinos Tsigas (US International Trade Commission, Washington DC), David Riker (US International Trade Commission, Washington DC) and William Powers (US International Trade Commission, Washington DC)

The Implications of Using Value-Added Data for Applied Trade Policy Analysis

New efforts to merge input output data and traditional, gross value, trade data have generated new databases and insights on global supply chains, revealing linkages between countries and sectors not clearly revealed in the traditional data. In this paper we examine what, if any, differences one might observe between models based on the traditional data and models based on the new, value added trade data. We use a value added trade based CGE model, derived the GTAP database, to examine the potential impacts of rebalancing between the United States and Asia. We also use the World Input Output Database to estimate exchange rate pass through using value added and traditional trade data. In both circumstances, the CGE and the econometric effort, we observe significant differences in the effects of the examined question. These preliminary results suggest that the recent efforts to develop value added trade data will do more than illuminate global supply chains, but may also prove useful in estimating the economic effects along those supply chains more accurately than traditional data based models.

Masaaki Kuboniwa (Hitotsubashi University, Tokyo)

Russia's International Input-Output Relations

Developed here is an analysis of Russia's international input-output relations with an emphasis on trade linkages between Russia and EU at the present and those between Russia and Asia in the future. First we look at the trade linkages and value added trade of Russia by using the extended and modified versions of the IDE JETRO 2005 BRICs international input-output table. As is known, Russia is the major exporter of the oil and gas to EU whereas EU is the major exporter of machinery to Russia. We report changes in the impact of this unidirectional trade linkage on growth of Russia and EU in the 2000s from lens of macroeconomic data and international input-output tables as well. We show that Russia largely renovated its production and demand for consumer durables due to trade gains arising from oil shocks, which in turn led to the boost of imports of machinery for intermediate and final demands. We also show that EU benefited from the Russia's boost of imports despite trading losses arising from oil shocks, which resulted in large improvements in EU's energy efficiency. We report a comparative analysis of degrees of supply chains generated by Russia and China, paying special attention to the fact that Russia's machinery industry is largely oriented to only domestic demand. Lastly, we try to further develop the value added trade induced by exports and imports by explicitly considering the contributions of imported fixed capital. This attempt may provide a better estimate of value added trade for industries such as the oil and gas sector with little intermediate inputs and large capital inputs.

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Michael L Lahr (Rutgers University, New Brunswick) and Umed Temurshoev (European Commission, JRC-IPTS, Sevilla)

Marginal multipliers: Hirschmann Revisited

To date, key-sector measures have tended to be static concepts (i.e., input-output multipliers). Thus, when included in the conduct of key sector analysis, the growth potential of industries has generally been an entirely separate consideration from those pertaining to interindustry interconnectedness. Moreover, growth potential has almost exclusively been included as future industry magnitudes. Thus, some industries identified as "key sectors" also had large but steadily decelerating factor (e.g., income, employment) multipliers, which suggests that they may not be worthy of investment from a

marginal perspective. Meanwhile other industries with relatively low, but accelerating, factor multipliers were undoubtedly misidentified as unworthy of investment by standard approaches. Albert O. Hirschmann, who is credited with popularizing key sector analysis, undoubtedly intended dynamic reflections since he focused on national development issues. We revisit his intentions armed with a series of national input-output tables from the WIOD dataset (www.wiod.org). We then make a case for marginal (or dynamic) multipliers that measure recent past change in factor multipliers. We subsequently empirically test the validity of such a measure for identifying growing sectors that enhance economy interconnectedness—key sectors.

Joe Lane (University of Queensland, Brisbane), Thomas Wiedmann (University of New South Wales, Sydney), Manfred Lenzen (University of Sydney) and Arne Geschke (University of Sydney)

Advancing Sustainability Science through a Virtual Laboratory Approach to Input-Output Analysis

Environmentally extended input-output analysis has extensively been used to provide insight on the linkages between environmental impacts and economic activity on scales ranging from individual consumption to world trade. Applications routinely cover consumption-based accounting, life cycle assessments (LCA) and supply chain analysis of resource use and pollution.

However, to make the spatial and sectoral detail for meaningful environmental footprint and LCA applications available remains a challenge. Only a handful of research groups in the world have taken on the task of compiling international or sub-national multi-region input-output databases in high resolution and/or taking process-specific information into account. The conventional approach for this is prohibitively arduous, labour- and cost-intensive, because regional economic data and environmental data are notoriously scarce and misaligned.

We present concepts and example applications of a novel virtual laboratory that significantly advances the analytical capacity of environmental and sustainability science. The Australian Industrial Ecology Virtual Laboratory (IE-VL) is a highly automated research platform that greatly facilitates the compilation and analysis of MRIO tables, environmental extensions and process LCA data. We present examples how the IE-VL support the rapid expansion of national research efforts required to address the challenges of economic development occurring in the face of environmental constraints that are growing in number and in urgency.

Huey-Lin Lee (National Chengchi University, Taipei) and Ching-Cheng Chang (National Taiwan University, Taipei)

Economy-Wide Impact Analysis of the Agricultural Extent Loss to Sea Level Rise: An Application of a Multi-regional Computable General Equilibrium Model

Climate change affects regional agricultural production and food security in complex ways. In this study we used a better and more realistic approach that recognizes agro-ecological dissimilarities in land characteristics for agricultural purposes in a multi-regional, multi-sectoral computable general equilibrium model (the GTAP-AEZ model) and apply such model to investigate the implications for agricultural production of regionally diverse impact of climate change induced sea level rise, as estimated by Dasgupta et al. (2009). By considering crop suitability of land and region-differentiated agricultural extent loss to sea level rise, the framework of our economy-wide impact study in this paper hopes to provide a new perspective for the global concern on socio-economic consequences of climate change. Our study provides an integrated economic assessment on rice in the global and regional context. Among Asian countries, Viet Nam is likely to be hit hard due to agricultural extent loss to sea level rise, as its cultivating zones of paddy rice such as the Mekong Delta are prone to inundation once the sea level rises. This affects countries near and far that depend on Vietnamese rice exports. Countries of this category include Malaysia and Singapore, The Philippines, Middle East, North Africa, and Caribbean and Central America. Luckily, Thai rice would be able to supplement to reduce partially the shortfall due to the retreat of Vietnamese rice exports. In addition, the wheat sector would also be adversely affected, though not directly, in the Asian rice-growing countries. The Asian rice sector would draw more land away from wheat and other crops sectors due to land competition from a steadfast demand for the staple rice crop. Wheat- and grains-growing countries such as North America, EU, Russia, Australia and New Zealand, and Argentina thus reap the benefit of improved terms of trade in the occasion of sea level rise infliction on the Asian rice-growing regions. Although rice is relatively less traded across borders, agricultural land claimed by sea level rise, especially in lower-latitude Asian developing countries, would widen the gap between rice supply and demand of the rice-consuming countries. This suggests an urgent need for establishing safety nets of food security in Asia. Particularly for agriculture of developing countries, sufficient efforts are also needed, in addition to poverty elimination, to brace for and to adapt to climate change, so as to secure their productivity and capacity of food supply.

Attakrit Leckcivilize (London School of Economics and Political Science)

The Impact of Supply Chain Disruptions: Evidence from the Japanese Tsunami

Despite attention in the media concerning international supply chain disruptions due to the increasing number of major natural disasters, little empirical evidence is available. Using, as a natural experiment, the sharp drop in Japanese exports of motor vehicles and parts to the USA after the Great Tohoku Earthquake and Tsunami 2011, the impact of the supply chain disruption on labour inputs adjustment in the US auto industry is estimated. Exploiting state-level variation in numbers of direct employment by Japanese auto makers and location of auto manufacturing factories, I propose empirical strategies based on the CPS and QWI data to identify this adjustment among Japanese companies, their suppliers as well as their competitors. Notwithstanding significant losses of the Japanese firms' market share, I find that the disaster negatively affects only average monthly earnings of workers in Japanese assembly plants whereas their competitors do not seem to significantly increase any labour inputs in their assembly plants. Regarding changes in motor vehicle parts and accessories manufacturing, I detect only production adjustment in the counties where factories from the same auto companies are located. Moreover, other than a slight change in inventory management and sales incentive, there is no evidence of any adjustments on other margins of factors such as import substitution, or spikes in prices. These results suggest that the overall impact of this disaster on the US economy through the auto industry is rather small.

Ingue Lee (Bank of Korea, Seoul) and Youngjin Lim (Bank of Korea, Seoul)

Factor Decomposition of the Differences in Domestic Value Added Effects between Korea and Japan Using WIOD Tables

Korean economy has a high dependency on trades, with a structure heavily dependent on exports of assembly and processing goods including machineries, electrical equipment and transport equipment, of which international specialization in production has accelerated.
However, the domestic value added inducement effect of assembly and processing goods in Korea is just about 70% of that in Japan. Where does the difference come from?
We have started this paper in order to answer this question applying IO analyses. First, we compare major exports in Korea and Japan, in terms of their input structures and inter-industry effects, and then analyze factors contributing to the difference in value added inducement effects between two countries, using a structural decomposition approaches.
We think this attempt is very meaningful in applications of international IO tables, especially in that we apply a structural decomposition method, which is mainly used for growth factor analyses, to analyze inter-industry effects.

Manfred Lenzen (University of Sydney), Arne Geschke (University of Sydney), Thomas Wiedmann (University of New South Wales, Sydney) and Joe Lane (University of Queensland, Brisbane)

Compiling and Using Input-Output Frameworks through Collaborative Virtual Laboratories

Environmentally extended input-output analysis has extensively been used to provide insight on the linkages between environmental impacts and economic activity on scales ranging from individual consumption to world trade. Applications routinely cover consumption-based accounting, life cycle assessments (LCA) and supply chain analysis of resource use and pollution.
However, to make the spatial and sectoral detail for meaningful environmental footprint and LCA applications available remains a challenge. Only a handful of research groups in the world have taken on the task of compiling international or sub-national multi-region input-output databases in high resolution and/or taking process-specific information into account. The conventional approach for this is prohibitively arduous, labour- and cost-intensive, because regional economic data and environmental data are notoriously scarce and misaligned. We present concepts and example applications of a novel virtual laboratory that significantly advances the analytical capacity of environmental and sustainability science. The Australian Industrial Ecology Virtual Laboratory (IE-VL) is a highly automated research platform that greatly facilitates the compilation and analysis of MRIO tables, environmental extensions and process LCA data. We present examples how the IE-VL support the rapid expansion of national research efforts required to address the challenges of economic development occurring in the face of environmental constraints that are growing in number and in urgency.

Fangyi Li (Chinese Academy of Sciences, Beijing)

How Can China Realize Energy Intensity Target toward 2015: the Contribution of Structural Shifts

A 16% reduction in energy intensity (EI) was set to be a national target in the 12th Five Year Plan (FYP, 2011-2015) of China. This research aims to assess how much reduction of EI can be realized through structural shifts before 2015, and what changes are necessary in final demand to realize the target, given the rapid increase of consumption and GDP expected. As a basis of scenario analysis, consumption structure of 2015 is forecasted using a trend extrapolation method. It is found that the EI target is too high to meet if there are no structural shifts or efficiency improvements. Seven scenarios are built to explore feasible ways to meet the target, in which structural shifts of investment, exports and imports are achieved alone or together. In scenario analysis, an input-output table-based (I/O-based) linear optimization model is developed to identify optimized ways to

achieve the maximum reduction in intensity target, within the constraints defined by historical change and forecast. The results reveal that a reduction of 8.6~11.1% in EI is feasible through structural shifts, while the largest contribution is from shifts in investment and exports. Besides, high GDP growth is an obstacle for realization of EI target. The policy implications for target realization are also discussed in this paper.

Hui Li (Chinese Academy of Sciences, Beijing) and Xikang Chen (Chinese Academy of Sciences, Beijing)

China's Total Population and Population Structure Predictions Based on Demographic Input-Output Model

China is the most populous country in the world and the large number of population has been one of the most significant characteristics of China's national conditions. Since the beginning of the 21st century the development of China's population shows a more complex situation that declining trend of fertility rate and population aging have become serious issues.

In the long term, China's population will still be faced with many problems. For example, the proportion of working-age population in the total population will reduce, the supply of young labor force will continue to decrease, the golden stage called "demographic dividend" which Chinese economy has enjoyed during the past few decades will fade away. So over the next 20 years, what will happen to China's total population and structure? Until 2030, how's about the situation of China's aging problem? When China's demographic dividend will disappear? All these questions need our highly attentions.

This paper illustrates a new way of China's population research-demographic input-output model. Combined with the latest census data in 2010, this paper forecasts China's total population and structure changes from 2011 to 2030. The results indicate that although the Chinese population has entered a period of low fertility rate, because of the huge population base and the inertia of growth, the total population will remain to increase for a long period. According to our calculations, the total population peak will reach 1.405 billion in 2026. And the aging process will further accelerate, China's elderly population aged over 60 will reach 332 million by 2030, the proportion will rise to 23.71%, the population aged over 65 will reach 230 million and the proportion will rise to 16.41%. With the decrease of China's fertility rate, by 2030 the 15-24 years old young labor force will decline to 127 million, the proportion in total working-age population will be reduced to 12.57%. In 2017 the 15-64 working-age population will reach a peak of 1.02 billion, accounted for 73% of the country's total population, since then China's total working-age population will be negative growth.

Jing Li (Shandong University, Jinan), Dezhi Li (Shandong University, Jinan) and Chen Lin (Shandong University, Jinan)

Does the "People's Daily" Affect Economic Structure and the Flow of Pollution Flow?

This paper investigates the impact of the People's daily effect on the economic structure and the pollution flow through input-output (IO) model. In this paper, we use the information from People's daily between 2000 and 2011 to measure the industrial orientation of the government. In China, People's daily is an official newspaper of Chinese Communist Party, so it is not only a "newspaper" but also a propaganda tool for the government to promote their proposal and policy. Thus, People's daily potentially influences the economic structure in two paths: from the one hand, most of the information from People's daily reflects the industrial policy and the investment of the government directly; from the other hand, People's daily provides entrepreneurs with effective industrial orientation which affects private investment. Meanwhile, the shifts of economic structure cause the changes of the pollution flow generated by manufacturing sectors. We named this mechanism the People's daily effect.

In order to measure the People's daily effect, we use the frequency of the key words from each sector to construct a new variable, named the structure of the People's daily. Through panel data analysis, the correlation relationship between the structure of the People's daily and the economic structure can be evaluated. Meanwhile, we choose the greenhouse gases (GHG) as the measure the pollution flow. We propose a new structural decomposition analysis of input-output analysis to extract the People's daily effect on economic structure from the whole economic structure change. Finally, we evaluate the impact of the People's daily on the pollution flow. The result shows that there exists People's daily effect in China. Additionally, we analyze several potential scenarios to reduce the GHG through People's daily effect.

Ning Li (Beijing Normal University), Wei Xie (Beijing Normal University) and Jidong Wu (Beijing Normal University)

Analyzing Regional Economic Impacts of Electricity Outages from the Great 2008 Chinese Ice Storm Based on Computable General Equilibrium Model

During the period of the Great 2008 Chinese Ice Storm, traffic volume of highway in Hunan province declined greatly, while traffic volume of railway and airline gone up greatly. It is concluded that during the period of snow disasters, companies sometimes substitute highway transportation with railway and airline transportation when carrying some critical inputs or employees to reduce the

impact of disasters on operation of business. In the science of disaster risk management, these actions belong to adaptation to climate change extremes. Meanwhile, highway transportation also had low disaster risk governance ability during this disaster, eg. terrible preparation to clean snow on road, lack of joint-action mechanism among Ministry of Transport, Ministry of Public Security and Meteorological Administration. This greatly reduced the efficient of highway system. In the science of disaster risk management, this is called as economic resilience ability of disasters. Economic impact of catastrophe can be greatly muted by adaptation and resilience of disaster system. The purpose of this study is to measure adaptation and resilience quantitatively and assess the contribution of these two measures with different level to disaster reduction. The research results can be applied to disaster reduction policy. Computable general equilibrium (CGE) model is a promising approach to this study because it is able to model the substitution effects of different inputs and the contribution of high technology or efficiency to disaster reduction. The CGE model in this paper is advance by subdividing transportation systems into highway, railway, airline and other transportation mode; and linking some parameters in production block of CGE model into adaptation and resilience mitigation. Our model is applied to the case of the Great 2008 Chinese Ice Storm. We assessed the contribution of adaptation and resilience to disaster reduction when multiply their original level by 110%, 130% and 150%. The conclusion is that direct loss of disasters cannot be reduced after disaster occurring, while indirect economic loss of disasters can be reduced greatly through improving adaptation and resilience ability and these measures are high efficient and low cost.

Shantong Li (Development Research Centre of the State Council, Beijing), Sanmang Wu (Development Research Centre of the State Council, Beijing) and Jianwu He (Development Research Centre of the State Council, Beijing)

How to Evaluate the Impact of Export on Provincial Economy in China – Based on China's Inter-regional Input-Output Model

China has more than 30 provinces and autonomous regions and some provinces are even bigger than European countries. Most of foreign trade are concentrated the coastal areas due to geographical conditions and convenient infrastructure. However, the central and western provinces are rich in resources and serve the coastal regions with natural resource and raw materials, which will become intermediate input of export in coastal provinces. Provincial trade hierarchies and specialization enhance the inter-provincial economic linkage, i.e. exports in coastal provinces play an important role in the development of inland provinces.

In general, national input-output multiplier model is used to calculate the impact of export on whole economy at national level. As for provinces inside one country, it's not easy to evaluate this effect

due to interregional dependency. When single provincial input-output table is used, the impact will be underestimated, i.e. single provincial input-output multiplier model can catch direct effect of provincial export and indirect effect of provincial export within the province, but it cannot reflect the effect of other provinces' export. However inter-regional input-output model can be used to get these three types of effect of export.

Literature review shows that most analyses of export have focused on data of international trade directly and single regional input-output model. In this paper, China's inter-regional input-output model is built based on the newly China provincial input-output tables in 2007 and will be used to analyze the interregional dependency. With this model, this paper will calculate the direct effect of provincial export, within province indirect effect of provincial export and interregional spillover effects of provincial export. This is very helpful to understand the regional specialization and supply chain within China and also very useful for authority to carry out regional policy.

Yang Lianling (Chinese Academy of Sciences, Beijing), Xikang Chen (Chinese Academy of Sciences, Beijing) and Cuihong YangCuihong (Chinese Academy of Sciences, Beijing)

Estimating the Imbalance of Service Trade between China and the U.S in Terms of Tourism Exports

This study attempts to evaluate service trade in terms of travel and tourism exports which effects on economy between China and the United States. Tourism is an important part of the bilateral trade, but there are also imbalances in it, such as the annual number of visitors and the tourist expenditure. Though, focusing on the large trade imbalances between China and the United States, great deals of studies have been published about estimations of trade surplus in each side. However, most of these studies are mainly concerned on trade by commodities. The purpose of this study is to investigate the total contributions to a local economy generated by visitor spending based on non-competitive-imports input-output model and to calculate the imbalances between China and the U.S tourism exports. Using the data from U.S. Bureau of Economic Analysis and National Bureau of Statistics of China, tourism expenditures and economic multipliers are estimated to carry out the input-output analysis. And the study mainly focuses on value-added (GDP) and employment, which are what the politicians and the public really care about. Though there is big imbalance between the service trades, the results show strong evidence that the travel exchanges between China and the United States have profound implications for both countries, as tourism is a serious contributor to economic growth and a substantial job creator.

Chen Lin (Shandong University, Jinan), Makiko Tsukui (Tokyo International University), Kaiyan Ji (Shandong University, Jinan) and Xiaoliang Lang (Shandong University, Jinan)

How Do the Waste Treatment Scenarios Affect the Environment Impact of Commute Approaches in China? An Application Based on the Waste Input-Output Table of China

The purpose of this study is to compare the environmental impacts of four commute approaches in China by using the waste input-output model (WIO) of China for 2007. The four commute approaches are bicycle, automobile, and two different types of electric bicycles. The electric bicycles are recently popular in China, which need less fossil fuel than automobiles. However, the assessment of the environmental impact of the electric bicycles depends on the disposal method of their batteries. Especially, in China there is illegal treatment of those batteries, which potentially makes the bicycles less environmental friendly. The WIO table of China for 2007 used in the application has 41 production sectors, 8 household wastes, 8 industrial wastes, and 5 treatment processes. The WIO table of China for 2007 not only covers the regular treatment of wastes, but also considers the illegal treatment which causes serious environmental problems in China. Because the WIO table of China covers illegal and legal treatment processes other than production processes, we can research the impact of different treatment combinations on the life cycle inventory of commute approaches. The results show that the relative advantages of the above mentioned commute approaches depend on the treatment scenarios of waste treatment.

Shih-Mo Lin (Chung Yuan Christian University, Taiwan), Jingyu Liu (Chinese Academy of Sciences, Beijing), Jin-Xu Lin (Chung Yuan Christian University, Taiwan), Chun-Chiang Feng (National Central University, Taiwan), Yan Xia (Chinese Academy of Sciences, Beijing) and Pei-Ling Wen (Chung Yuan Christian University, Taiwan)

Transmission Paths of Oil Shocks in Taiwan and Mainland China – A Financial Social Accounting Matrix Analysis

This paper aims at examining the changing paths along which an oil shock transmits to other sectors of the economy between two time points for both Taiwan and China. To this end, financial social accounting matrices (FSAMs) for two specific years which correspond to the years where official input-output tables are available have been compiled for Taiwan and China. The SAM multiplier decomposition analysis is used to explore the relative magnitude of direct and indirect effect an exogenous shock originating from a specific sector may have on the economy, while the structural path analysis (SPA) is used to examine the transmitting paths of oil shocks to other sectors of the two economies. By comparing the results for two time periods, we are able to figure out how changes in

the input structure of sectors, the industrial structure of the economy, and the financial structure of the economy have contributed to the changed mechanism of adjustment of the economy confronting oil shocks. The advantage of integrating financial-side information into our conventional SAMs in this analysis has also allowed us to examine how financial markets will interact with the real side of the economies under oil shocks, which could shed some light on the direction of possible monetary policies in response to oil shocks for both economies.

Xiuli Liu (Chinese Academy of Sciences, Beijing) and Geoffrey J.D. Hewings (University of Illinois, Urbana-Champaign)

Economic Structure and Structural Changes of Chicago Economy during 1995-2010: Hierarchical Feedback Loop Input-Output Analysis

Evaluating on the processes of change over time associated with the interaction between sectors within an economy has become a major topic for economic analysis. Applying the Hierarchical Feedback Loop Approach, using Chicago input-output tables with 36 sectors from 1995 to 2010, the hierarchical feedback loops for year 1995, 2000, 2005 and 2010 were obtained. The sub-loops and their values of the first three feedback loops and the eighth to tenth feedback loops in 1995, 2000, 2005and 2010 were presented. The changes in the nature and strengths of the loops were analyzed. The economic interaction among different sectors, as well as the change over time in the structural pattern of this interaction of Chicago economy during 1995-2010 were identified and interpreted. The results were compared to earlier work that focusing on the processes of hollowing out, decomposition of changes and the changing average propagation lengths to provide a more complete evaluation of the patterns of structural change.

Ricardo Luis Lopes (State University of Maringa) and Joaquim J.M. Guilhoto (University of São Paulo)

Decomposition Analysis of CO2 Emissions in Brazilian Economy: Renewable and Non-renewable Energies Sources Contributions

In the last few decades, the world has given clear signs that its capacity to absorb residues such as industrial waste, containers, plastics and paper is running out. Nature's answer to these actions takes place through changes in climate patterns. Brazil, traditionally known for making use of clean energy sources, has steadily climbed the ranks of countries who most contribute to the greenhouse effect. The economic transformations faced by the country during the last decade have altered the

Brazilian reality. Faced with this scenario, it becomes necessary to study the causes of this worldwide increase in pollution levels, as well as characterize Brazil's current position in this context. The objective of this work is to analyze, for Brazil, the main factors that influenced CO2 emissions from the burning renewable and non-renewable energies sources by intermediate sectors of the economy, between the years of 2000 and 2009. Highlight is given to the contribution of energy efficiency, the make-up of final demand, and the country's productive structure. To that end, the Structural Decomposition Analysis methodology was employed. The main results show that, in spite of Brazil becoming more energy-efficient and specializing in less-polluting sectors, growth in fields such as transportation, ironworks, as well as iron ore and oil extraction contributed to an increase in CO2 emissions during the analyzed period.

Carlos A. Lopez-Morales (Arizona State University, Mexico City)

Achieving Water Sustainability: Analyzing Scenarios Restricting Water Withdrawals from Surface and Underground Sources with an Inter-Regional Model of the Mexican Economy

This paper builds upon previous research (López-Morales and Duchin, 2011; Duchin and López-Morales, 2012) to define more precise concepts for regional sustainable endowments of water and to construct scenarios that impose explicit quantitative restrictions to water withdrawals from surface and underground sources. The distinction between water sources is instrumental to the definition of sustainable water endowments mainly because of two reasons: underground aquifers should not be exploited beyond replenishment rates, and water requirements of riparian ecosystems should be accounted for and deducted from economically available endowments of surface water. The adjustments mechanisms that could support the transition toward a sustainable pattern of water use in Mexico, which include geographical reallocations of agricultural output, substitutions of non-irrigated agriculture for irrigated agriculture, and the adoption of more water-efficient irrigation technologies, are quantified and assessed by analyzing the scenarios with an inter-regional model for the Mexican economy. The paper aims at contributing to the understanding of the challenges of water sustainability through a better representation of water into economic models.

Bart Los (University of Groningen) and Luca Cherubini (Banca d'Italia, Firenze)

Regional Employment Patterns in a Globalizing World: A Tale of Four Italies

This paper presents the results of a first attempt to integrate sub-national Input-Output tables into the World Input-Output Database (WIOD), in order to assess the effects of changes in the structure of

global value chains (GVCs) on regional employment patterns. As emphasized in recent literature concerning regional development, one of the paradoxes of globalization is the enduring significance of subnational areas as centres of economic activity. A number of GVC studies explore how regional clusters are embedded into global production systems and how changes in this embeddedness (for example as a consequence of 'upgrading') affected development of these clusters. Usually these case studies cannot be generalized, however, as a consequence of which the effects on regional development cannot be studied.

This paper integrates data on four Italian regions (Northwest, Northeast, Centre and South) and WIOD data, to apply the new global value chain metrics introduced by Timmer et al. (2013) at regional level. Italy is an interesting country to study at subnational level, since it is characterized by a high degree of regional heterogeneity. Each region has peculiar geographic, social and economic features which are likely to influence the degree to which regional production systems contribute to GVCs. Furthermore, the mutual trade linkages between the four regions have intensified considerably over the period 1995-2006.

Using detailed labor force survey data, we analyze to what extent the varying degrees to which industries in the four Italian regions managed to capture stages in GVCs affected the level and composition of labor demand in the 1995-2006 period.

Bart Los (University of Groningen), Erik Dietzenbacher (University of Groningen), Robert Stehrer (Vienna Institute for International Economic Studies, WIIW), Marcel Timmer (University of Groningen) and Gaaitzen de Vries (University of Groningen)

Trade Performance in Internationally Fragmented Production Networks: Concepts and Measures

In this note, we outline two perspectives on the value added content of international trade. We distinguish two perspectives: the "direct trade flow (DTF)" perspective and the "global value chain (GVC)" perspective. We argue that both have their particular interpretations. The direct trade flow perspective is useful to analyze the domestic value added content of exports. The GVC perspective is useful for analyzing the importance of foreign demand for income generation in the domestic economy. In addition, the GVC perspective can be used to trace the development of global production networks.

To illustrate the empirical differences between the two approaches, we present a limited set of bilateral statistics related to both perspectives for a number of large advanced and emerging countries, for the period 1995-2009, based on the World Input-Output Database.

Bart Los (University of Groningen), Marcel Timmer (University of Groningen) and Gaaitzen de Vries (University of Groningen)

Made in Europe? Trends in International Production Fragmentation

In a world dominated by the emergence of global value chains, production processes increasingly fragment across a variety of countries. We provide new macro-economic evidence on this phenomenon, using a Theil-type distribution index of value added, which we call the international production fragmentation (IPF) index. In contrast to the well-known Feenstra and Hanson (1999) measure, this novel index does not suffer from a country size-bias and double counting due to re-imported intermediates. Moreover, it is sensitive to changes in the country-distribution of value added. We identify global value chains (GVCs) by the country-industry in which the last stage of production takes place. Using a new dataset of world input-output tables covering 40 countries, we find that since 1995 production processes for most manufacturing goods in Europe increasingly fragmented across countries, although at different paces. In 2008, GVCs of electrical products and transportation equipment were generally most internationally fragmented, while food products and minerals production the least. Averaged across products, Belgium, Ireland and the Netherlands had the most fragmented GVCs in 2008, followed by Germany, the Czech Republic, and Hungary, where fragmentation increased at a high pace since 1995. We also find that in 1995, European value chains were mainly fragmented across other EU countries. Afterwards, however, there has been a strong trend towards increased participation of non-European countries. The financial crisis in 2008 led only to a temporary reduction in international production fragmentation.

Xiaolin Lu (Chinese Academy of Sciences, Beijing) and Xu Jian (Chinese Academy of Sciences, Beijing)

Research on Regional Disparity and Its Influential Factors of Input-Output Coefficients

Input-output coefficients of various regions differ greatly; however, so far, time-series analysis has been widely applied to direct input coefficients, which lacks systematic cross-section research, let alone study on influential factors of their regional disparity. Based on national and 30 regional input-output tables of China (2002-2007), this paper concentrates on important input-output coefficients. Descriptive statistics analysis is firstly done from three aspects: great change in coefficients at the regional level from 2002 to 2007, comparison between coefficients at the national level and weighted coefficients at the regional level, and classification of scatter diagrams of coefficients. Then take important coefficients whose column sectors belong to industry as examples, by selecting a series of relative indices from scale, technical characteristics, ownership composition

and sub-sector structure, regression models are established to find out main influential factors of input-output coefficients, on the basis of which further economic explanation can be made.

Oleg Lugovoy (Russian Presidential Academy of National Economy and Public Administration, Moscow), Andrey Polbin (Russian Presidential Academy of National Economy and Public Administration, Moscow) and Vladimir Potashnikov (Russian Presidential Academy of National Economy and Public Administration, Moscow)

Bayesian Estimation of Input-Output Tables for Russia

The paper continues efforts on stochastic estimation of Russian IOT, presented by the authors on the 20th IIOA (and WIOD conference in 2012), and extends the methodology and results in several ways. First, we apply Monte Carlo Markov Chains (MCMC) methods to disaggregate available in NACE classification SUTs (2004 to 2006, 15 products by 15 activities) into larger 69 by 69 format. Second, since the 15x15 SUTs are published by Rosstat as preliminary estimates, they are not fully consistent with other available national accounts data, such as output and value added by industries. To take into account the data uncertainty, we introduce a measurement error for the aggregated io-coefficients. As result, we estimate posterior distribution of input-output coefficients for aggregated and disaggregated matrices, which are consistent with yearly national accounts information. Third, we update the estimated 15x15 and 69x69 matrices for 2007-2011 period using proposed sampling methods. Also we discuss potential ways to improve the estimates imposing additional constrains and links to national macro statistics. Forth, from computational perspectives, sampling of large-scale matrices is processor-intensive with exponentially growing demand for time. Therefore, we consider several procedures to optimize sampling algorithms, including parallel processing on CUDA-Enabled GPUs. Finally, fifth, we demonstrate an application of the estimated stochastic SUTs on a simple input-output model, analyzing a response to final demand increase, and sensitivity of the results to the estimated uncertainty in input-output coefficients.

Mikulas Luptacik (University of Economics, Bratislava), Michal Habrman (University of Economics, Bratislava) and Martin Lábaj (University of Economics, Bratislava),

The Importance of Car Industry for the Slovak Economy

Car manufacturing is the dominant industry in Slovakia in terms of production and export. In this study we analyze its importance through direct and indirect interdependencies in the Slovak economy. In the first part we employ standard input-output analysis to reveal its effects on

production, value added, import and employment generated in the Slovak economy. Three main car producers in Slovakia plan to undertake an enlargement of its capacities in the next few years, reaching the investment costs to approximately 600 mil. EUR. So in the second part we analyze the direct, indirect and induced income effects of these investments in the Slovak economy through semi-closed Leontief model and discuss the perspectives of car industry in Slovakia.

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Bjarne Madsen (Centre for Regional and Tourism Research, Copenhagen) and Jie Zhang (Centre for Regional and Tourism Research, Copenhagen)

Regional Impacts of Export Jobs, the Miyazawa Extended Demographic Model Revisited

Export jobs are assumed to be attractive for local communities. But how attractive are they and what are the spillover and feedback effects on other municipalities? In this paper, a general interregional quantity model in the tradition of the Leontief input output and Miyazawa extended demographic models is presented. Export multiplier experiments for Danish municipalities with the model LINE are presented.

The paper commences with the Leontief and Miyazawa formulations of the Interrelational Income Multiplier Model, which is decomposed into sub-components using the general interregional economic quantity model based upon the so-called two-by-two-by-two principle. This principle 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 modeling 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 involve two sets of actors (production units and institutions / households, 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 as well as a comparison with the Miyazawa extended demographic model.

Finally, LINE, which is based upon the two-by-two-by-two principle, is used to examine regional impacts of export jobs for Danish municipalities. In the empirical analysis the direct production and export jobs by municipality is measured using SAM-K, which is a national account for Danish municipalities. On the basis of the direct export production and jobs the total effects of export, including both the indirect and the induced effects are analyzed using LINE. In the analysis only the

quantity model of LINE has been used measuring the effects on production and employment in quantities, whereas the impacts of export jobs on the labor market and productivity involving the cost and price model in LINE have not been included in this analysis.

The analysis concludes that there are substantial differences in direct as well total effects of export production and jobs: For municipalities with high representation of

- production activities compared to income generating activities
- export sectors relative to local sectors
- specialization within export commodities

In addition to this the analysis shows that size of the multiplier is important for the total impacts: Firstly, the higher the consumption rates (intermediate consumption, private consumption, governmental consumption) the higher the multiplier becomes. Secondly, the smaller the leakages from trade, out-commuting, outward shopping and tourism the higher the multiplier turns out to be.

Alexandra Penedo de Sousa Marques (Technical University of Lisbon), Joao Rodrigues (Technical University of Lisbon) and Tiago Domingos (Technical University of Lisbon)

Carbon Footprint of Income

Since the Industrial Revolution developed economies' economic growth has been powered by the combustion of fossil fuels. This is believed to be the main cause of one of the most debated environmental problems: climate change. Climate policy's objective is to minimize the effects of climate alterations in a just and fair manner. A new point of view on responsibility for carbon emissions is emerging, bringing into discussion the role of those who enable emissions. In this comment we follow the rationale that carbon emissions from a production process were enabled by and provide economic benefit to those who supplied inputs to that process. If we follow every production chain upstream to the source we find that primary suppliers are income categories (capital, labour and land in various forms). Here, we present for the first time the carbon emissions enabled by each income category and show that capital is the category that enables more emissions (47%). These results may be useful for climate policy, especially with regard to the issue of climate finance. We also show that major fossil fuel exporters are who enabled more emissions worldwide. These results may help understanding the position of such nations in climate negotiations.

Kazuyo Matsubae (Tohoku University, Sendai), Kenichi Nakajima (National Institute for Environmental Studies, Tsukuba) and Keisuke Nansai (National Institute for Environmental Studies, Tsukuba)

Resource Logistics Analysis on Phosphorus by Integrated Phosphorus Cycle Input Output Model

The global population is predicted to exceed 9 billion by 2050, and in addition, bioethanol production has increased by about three times over the past ten years. As a result, the demand of phosphorus will increase in next few decades. There are growing concerns over supply strategies for essential resources because of depletion and price increases, especially of phosphorus. For the sustainable resource governance, we propose resource logistics analysis, based on material flow analysis and input output analysis, and discuss the strategic management of the resources flow through the supply chain in our society. Applying this method, we clarified the stakeholders relating to the phosphorus resource consumption by its forms in Japan in 2005.

Focusing on the logistics of thermal process phosphoric acid, we found that the surface coating process of steel and detergent production process should be important, as a result, the automobile industry, which is the biggest consumer of the surface coated steel, plays the most important role as a yellow phosphorus consumer, while there is no domestic yellow phosphorus producer, and almost all of the yellow phosphorus is imported from overseas. The significant amount, 272kt-P, of phosphorus is accumulated in soil. Additionally, high phosphorus contained sludge is generated from the surface coating process, and has been not well utilized so far, due to the lack of feasible technologies. The results suggest the importance of technology innovation of phosphorus use in agricultural sector, and of recovery and recycling from waste streams.

Bo Meng (Institute for Developing Economies-JETRO, Chiba), Zhi Wang (US International Trade Commission, Washington DC) and Robert B. Koopman (US International Trade Commission, Washington DC)

How are Global Value Chains Fragmented and Extended in China's Domestic Production Networks?

Global value chains are supported not only by firms who export goods and services to the world market directly, but also by other domestic firms who take part in the global economy indirectly through providing parts and components to the exporting firms. In order to reveal the nature and significance of a country's position and its degree of participation in global value chains, we need to better understand the domestic segment of global value chains, especially for large developing

countries like China, and India who have many regions with relatively large economic scales and at very different development stages. This paper develops a method to link domestic and international segment of the global value chains by applying the input-output based concept of "Trade in Value-Added" to investigate the linkages between a country's regional value chains and global markets.

We apply our methodology to China. Based on an international input-output table with endogenized Chinese domestic interregional input-output table in 2002 and 2007, our preliminary results show how global production is fragmented and extended within China's domestic regions, as well as how value added is created and distributed in both domestic and global value chains. We also use our measurements to discuss China's economic performance and policy orientation as well as their interaction with the world market at detailed regional and industrial levels.

Bernhard Michel (Belgian Federal Planning Bureau, Brussels)

Is Offshoring Driven by Air Emissions? Testing the Pollution Haven Effect for Imports of Intermediates

Over the last couple of decades environmental regulations have become more and more restrictive in developed countries, in particular regarding emissions of air pollution. In this context, it is feared that, in order to avoid the growing costs of compliance, firms decide to carry out emission-intensive activities in countries with a less stringent environmental policy stance, the so-called pollution havens. So far, empirical investigations of this pollution haven effect have tested whether environmental regulations have an impact on import flows or foreign direct investment decisions. Evidence of a significant pollution haven effect is scarce. This paper develops a test of the pollution haven effect that is specifically focused on the sourcing of intermediate manufactured goods from abroad, which is also commonly referred to as materials offshoring. The test consists in determining whether emissions-related considerations have an impact on offshoring decisions by estimating to what extent an industry's share of foreign sourced materials is influenced by its emission-intensity. For this purpose, we derive a system of cost share equations from a translog cost function. It includes five variable input factors: labour, energy, domestically sourced materials, foreign sourced materials and services and other inputs. Capital is treated as a quasi-fixed factor. We add several extra demand shifters to the cost share equations among which industry-level intensities of polluting air emissions. This allows for the computation of the elasticity of imported materials with respect to the emission intensity. For the estimation of the system – by fixed effects ISUR – we use Belgian data for 23 manufacturing industries covering the years 1995-2007. These data come from a time series of constant price supply-and-use tables, where domestic output and imports are deflated with

separate price indices for each product, and from the Belgian air emission accounts. Emission intensities are calculated for three standard composite emission indicators (GHG, ACID, TOFP) and lagged one period in the estimations. According to the first estimation results, the elasticity of the demand for imported intermediate materials with respect to the emission intensities is positive for all three composite indicators. This means that on average emission-intensive industries source more materials from abroad. However, the elasticity is only significant for ACID. In other words, we find some evidence of a pollution haven effect, i.e. of environmentally motivated offshoring, but this turns out to be rather weak. The result is nonetheless robust to the inclusion of a time trend and the industry-level R&D intensity to control for technological progress as well as to a split of the capital stock into ICT and non-ICT capital.

Kenji Mori (Tohoku University, Sendai)

Georg Von Charasoff and the Anticipation of Von Mises Iteration

(i)In his main work *Das System des Marxismus. Darstellung und Kritik*, 1910, Georg von Charasoff criticized and reconstructed Marx's price theory and, in doing this, anticipated, at an advanced analytical level, most of the results that were going to be achieved later in the course of the 'transformation controversy'. However, his contribution can be considered to go beyond the particular range of Marxian theory. Mori (2011) consistently reformulated his argument by a mathematical model to extract some analytical characteristics of his model. The aim of this presentation consists in examining the contribution of Charasoff's linear economic analysis, in particular his theory of "Urkapital (original capital)", price of production and labour value in the light of the development of matrix theory in the beginning of the 20th century.

(ii)The linear algebraic development we would like to refer to as background is in particular the so-called Power Method (or von Mises Iteration) devised initially by Richard von Mises and Hilda Pollaczek-Geiringer (1929). von Mises, the brother of the economist Ludwig, together with Pollaczek-Geiringer devised and proved practical procedures to calculate eigenvalues and eigenvectors for any (not only non-negative) square matrix under some assumptions. For each square matrix, starting from a suitable vector, one can reach the matrix's eigenvector associated with the dominant eigenvalue by multiplying the initial vector iteratively by the matrix.

von Mises and Pollaczek-Geiringer developed their ideas of iterative procedure based on an iterative procedure which approximately determines eigenvalues and eigenfunctions of boundary-value problems (see Vianello (1898), Stodola (1904), Pohlhausen (1921), Koch (1926)). This so-called Vianello-Stodola method was used by them to compute the "natural frequency (Eigenschwingung)" of an elastic material. This calculation is important in the mechanics because if e.g. the speed of a

rotating shaft of steam turbine reaches its natural frequency, the resonance occurs and the material could break down (so that it is called "critical speed (kritische Drehzahl)"). Just as the book title of Stodola (1904) indicates, this research field was closely related to the development of steam turbines which just started to be used in ships and trains from the beginning of the 20th century. Therefore, von Mises and Pollaczek-Geiringer (1929) can be seen as a natural extension of research on such a historical context. Furthermore, von Mises and Pollaczek-Geiringer proposed to use also an iterative procedure to solve inhomogeneous linear equation systems. Before them, there had been a forerunner in this subject, namely Seidel (1874), and they took over some of his ideas. However, the one of their iterative procedures which matters in respect to Charasoff was developed independently of Seidel (1874).

(iii)Georg von Charasoff's analysis uses mainly numerical examples (and this only at most three-dimensionally) and therefore cannot be seen to contain an algebraic general proof. However, it exemplifies de facto the existence of the above mentioned Frobenius root and its semi-positive eigenvector. Indeed, it is unknown whether Charasoff knew the papers of Perron or Frobenius, however, the earliness (one or two years after Frobenius) of his publication is as itself already remarkable. Besides, the characteristic feature of this exemplification consists in anticipating those procedures that were going to be discovered 19 years later by von Mises and Pollaczek-Geiringer. The main ideas of both works are quite similar. Furthermore, going beyond von Mises and Pollaczek-Geiringer, Charasoff carried out the iteration in the dual manner, namely in the search of the eigencolumn and eigenrow and also paid more attention to the uniqueness of solution.

This linear algebraic analysis was not carried out by Charasoff in an abstract form, but in an application to the economic context where the matrix was implicitly assumed as an input-coefficient matrix, column and row vectors as quantity and price vectors. According to the duality, the vector iteration converging to the eigenvector expressed the iterative regression of an (arbitrary semi-positive) initial good vector to its input vector converging to the ultimate (unique) input vector i.e. "original capital (Urkapital)" as the primal problem, and the iterative progression of an (arbitrary positive) price vector to its successively corrected price vector converging to the unique equilibrium price vector i.e. "price of production" as the dual problem.

Kakali Mukhopadhyay (McGill University, Montréal) and Debesh Chakraborty (Jadavpur University, Kolkata)

Water Pollution and Impact of Abatement Policy in India

India is rich in water resources. The main water resource of India consists of the precipitation on the Indian Territory which is estimated to be around 4000 km3/year. Water consumption is only 634 km3

for 2000, while in 2010 it increased to 813 km3 by different sectors of India. Agriculture and irrigation sector used about 70.9% of water, while domestic, industry and electricity by 13.90%, 15.40% and 0.6% respectively.

Rapid development drives water consumption and leads to increased discharge of untreated wastewater. A limited number of industries in India have been compelled to minimize the pollution generation in industries. An increase in production cost due to the control of pollution generation will affect the market price of the product of those industries as well as the industries whose products are being used as inputs by other industries. Thus the prices of all the sectors will be affected.

The study estimates the total amount of water pollution generation directly and indirectly from different sectors of India and the effect of pollution abatement policy on the output and prices of different goods and services and also on the final consumers of the Indian economy using the input-output table for the year 2006-7. Further it estimates the Green GDP. The results indicate the variation in the pollution content of different economic activities, however, the highest abatement cost is noticed for the livestock, sugar, beverages and chemical sector. A loss in terms of NDP is also calculated as 2.65% for the year 2006-7.

Kakali Mukhopadhyay (McGill University, Montréal), Paul J. Thomassin (McGill University, Montréal) and Debesh Chakraborty (Jadavpur University, Kolkata)

Macro-Economic Impact of Healthy Diet: An Econometric and Input-Output Approach

Changes in food consumption patterns and lifestyle have been identified as risk factors in the prevalence of obesity in Canada. Increased levels of obesity are associated with chronic diseases such as diabetes, cardio-vascular diseases and some cancers. A better understanding of the demand for healthy and unhealthy foods by households will assist in the understanding of food consumption and the better design of policies to address the obesity problem in Canada.

The objective of the current paper is to estimate econometrically an Almost Ideal Demand Systems (AIDS) model representing the Canadian household decisions to allocate budgets across healthy and unhealthy food as a function of prices and total expenditure and to integrate the information on elasticities available from the AIDS model into an Input-Output model for Canada. This econometric and input-output approach would help estimate the macroeconomic impacts of healthy diet.

The study will use Food Consumption Survey of Canada 2001 and 2010 to estimate AIDS model using selected categories of healthy and unhealthy food as outlined by Health Canada. The categories included are: fruits and vegetables, meat and meat products, dairy products, grains, chicken, egg, processed foods and sweetened foods. The input-output table of Canada for the year

2006 will be used for the study.
The paper will also assess the impacts of policy alternatives such as imposition of taxes / subsidies.

N

Akiko Nakajima (University of Fukuoka)

Natural Prices Versus Market Prices: Input-Output Analysis of Japan for 1951-2000

David Ricardo thought that market prices fluctuate around natural prices, and that natural prices are regulated by the total labour requirements of producing each commodity. That is, total labour required to produce that commodity (total labour requirements) determines the value of each commodity, and relative prices are determined by its value. This paper tries to examine this preposition using data from input output tables, supporting tables and other labour statistics (RIETI) from Japan from 1951 to 2000.
Market prices and natural prices for 32 industries of Japan for years 1951 to 2000 were calculated. Two sets of natural prices were calculated based on input output tables as prices that achieve equal return to all those engaged in production.
Findings tell us that the results vary according to data set. According to one data set, findings are (i) Divergence between market prices and natural prices for all industries fluctuates. (ii) When narrowly defined manufacturing industries are taken into account, the gap between market prices and natural prices are decreasing. This may be explained by international competition of free entry and exit as machineries are traded goods and also by the standardised wage negotiation process of manufacturing sectors. (iii) Market prices of profitable industries at profitable periods have tendency to diverge from natural prices. These findings did not change much by proportioning the depreciation costs to supplying sectors.
Findings according to another data set tell us that the gap between market prices and natural prices of all industries are gradually decreasing over time.
Results are very sensitive to the statistics of direct labour requirements.

Ryohei Nakamura (Okayama University) and Akira Matsumoto (EX Research Institute, Tokyo)

A New Approach to the Correction of Interregional Income Disparity by Extended Interregional IO Table: Trading Wood Biomass Energy and CO2 Credit

In this study we develop a new approach to correct interregional income disparity by extending interregional IO table. The meaning of 'new approach' is to propose a new concept for correcting interregional income disparity by utilizing environmental resources which are usually abundant in rural regions and to conduct new type of simulation which implies a change of input structure induced by energy substitution. We use an interregional IO table of eleven regions which is extended from interregional IO table initially developed METI (Ministry of Economy, Trade, and Industry) in Japan. By implementing new type of simulation we can find substantial improvement of income disparities between metropolitan areas and rural regions by trading CO2 credit as well as trading renewable energy such as chips and pellets made by wood biomass.

Kazuyoshi Nakano (CRIEPI, Tokyo), Yoshio Kajitani (CRIEPI, Tokyo) and Hirokazu Tatano (Kyoto University)

Modeling Recovery Process of Regional Economy after a Disaster for Consistent Measurement of Overall Economic Loss

Economic impact assessment of a natural disaster provides essential information for conducting cost-benefit analysis of alternatives that reduces the impacts. In order to evaluate countermeasures for enhancing resiliency in industrial sectors, it is necessary to measure the overall economic loss considering the recovery process after a disaster.

This paper develops a multi-regional dynamic CGE model for analyzing recovery process of regional economy after a disaster. Schedule of investment for recovery is a key factor determining the recovery speed, which also determines the investment demand for products and services related to recovery. Overall loss should be measured considering the cost of recovery, the lost value-added and such change in investment demand.

Double-counting problem is a key issue and it should be avoided for measuring the overall economic loss. A consistent method for measuring the overall economic loss without double counting will be proposed in this paper. The method will be implemented in the CGE model. The model will be calibrated using multi-regional I-O in Japan and applied to evaluating the overall economic loss of the 2011 Great East Japan earthquake.

Satoshi NakanoS Japan Institute for Labour Policy and Training, Tokyo) and Kazuhiko Nishimura (Nihon Fukushi University, Mihama)

Backward and Forward Measurement of Structural Propagation of Innovation

The purpose of the paper is to take into account the structural transition associated with the qualitative change in the commodities. Assessment of new technology would become more elaborate if we could account for such general substitution effect. In doing so, we introduce both qualitative and quantitative improvement measures on each commodity items within the multi-industrial production functions. These qualitative and quantitative improvements, in other words, product and process innovations can be measured by hedonic method or discrete choice observations. Theory and practice are linked by assuming Cobb-Douglas production functions that are compatible with the available input-output measurements.

Satoshi Nakano Japan Institute for Labour Policy and Training, Tokyo) and Kazuhiko Nishimura (Nihon Fukushi University, Mihama)

Measurement of Net Innovation in the Input-Output Observations

The purpose of the paper is to take into account the qualitative change in both inputs and outputs, into the measurement of TFP (total factor productivity). We call such kind of TFP an NI (net innovation). NI can be used for assessing effective R&D investment for example, for it excludes the extent of contribution of qualitative improvements in the inputs. We use the 1995-2000-2005 linked input-output tables and the associated quality adjusting deflators for Japan in our empirical calculation.

Keisuke Nansai (National Institute for Environmental Studies, Tsukuba), Kenichi Nakajima (National Institute for Environmental Studies, Tsukuba), Shigemi Kagawa (Kyushu University), Yasushi Kondo (Waseda University, Tokyo) and Sangwon Suh (University of California at Santa Barbara)

Characterization of Global Flows of Rare Metals and Their Relation to Japan's Economy (for a Special Session)

Some green technologies require the particular physicality of rare metals and rare-earth minerals. Production supply chains no longer begin and end within a single country, but instead extend globally, which suggests that comprehensive improvement of the material use efficiency of all global supply chains related to rare metals must be addressed cooperatively by many countries. First, for 231 countries and regions, we conducted a material flow analysis of rare metals (neodymium, platinum, and cobalt) that are necessary for new energy technologies. We then clarified the international movement (material flows) of such rare metals. Subsequently, the international

channels of rare-metal movement were characterized depending on the technical level of the countries and regions that trade products containing rare metals. The rare metal flows were classified into three: green, yellow, and red. The responsibilities and roles related to the use of rare metals for each country were assessed based on how the countries are involved in flows of these three types. Then this study integrated the global material flow analysis and a global link input–output model (GLIO) founded on a simplified multiregional input–output model. We extracted only those flows which are induced by Japanese final demand. By particularly addressing the major countries which account for the extracted flows, we identified key countries to which Japan should strategically offer its own technologies related to rare metal use to enhance the global sustainability of rare metal use and to enhance the security of rare-metal supplies for Japan.

Hongfu Ni (Development Research Center of the State Council, Beijing), Shantong Li (Development Research Center of the State Council, Beijing) and Jianwu He (Development Research Center of the State Council, Beijing)

Study of Relationship between Demographic Change and Economic Structure in China Based on Input Output Analysis

The feature of Chinese demographic structure is changing from a high fertility rate, high death rate and low life expectancy to low fertility rate, low death rate and high life expectancy, and the phenomena of ageing population in coming future will become more serious. This demographic change has not only increased the burden of social security pension and reduced the active labor force; it will also influence the saving rate and consumption structure and further affect the economic structure and sustainability of China's economic development.

This paper starts the study to analyze change of consumption structure of household of various age structure based upon survey data of CHIPS (Chinese Household Income Project) to explore the changing relationship between China's demographic structure and consumption structure. Moreover, Input Output model (2007) is applied to analyze the impact of change of various population age structure on industrial structure and employment structure through the impact of consumption structure. Results reveal that change of population age structure has the high influence on service sector and its employment, but different service sectors will be effected in different natures and degrees, such as medical and health care service will be increased tremendously, in correspondence, the demand of technical personnel specialized on medical service, health care and elder care will also be increased tremendously.

Michiya Nozaki (University of Groningen)

How to Examine the Total Economic Impact, Stemmed from the East Japan Great Earthquake: Within the Interregional Input-Output Framework

The purpose of this study is to examine the total economic impact caused by the Great East Japan Earthquake within the Interregional Input-Output Framework. The large amount of the study about the economic impact of the Great East Japan Earthquake on 11 March, 2011 has been estimated and evaluated the forward and backward, and the direct and indirect effects. But, we have not yet obtained the total economic impact data of the Great East Japan Earthquake. Thus we have to examine the estimation of the stock damages and economic damages. In this study, the impacts from this event have spilled over from the damaged region to other regions, and the impacts have influenced the national economy as a whole. An extended Interregional Input-Output Table for Chubu region is composed of nine prefectures and the Rest of Japan. We intend to examine the total economic impact by the help of the Interregional Input-Output Analysis.

O

Hajime Ohno (Tohoku University, Sendai), Kazuyo Matsubae (Tohoku University, Sendai), Kenichi Nakajima (National Institute for Environmental Studies, Tsukuba), Shinichiro Nakamura (Waseda University, Tokyo) and Tetsuya Nagasaka (Tohoku University, Sendai)

Input-Output Approach for Development of Appropriate Recycling System of End of Life Vehicles Aimed at Efficient Utilization of Steel Alloying Elements

Regulations for end of life vehicle (ELV) recycling have been introduced in many countries and recycling ratio of ELVs has become higher as a result of regulations in this decade. However these regulations pay little attention to the quality of recovered materials. As a typical example, steel, which is a major component material in automobiles, is recovered from ELVs and recycled as a secondary iron source by steelmaking process. The contents of alloying elements are rarely cared, while the copper contents in steel scrap derived by ELVs are strictly cared in the treatment process due to the harmful effect of copper for mechanical property of steel. Consequently, unintentional intrusion or dissipation of alloying elements during steel recycling process is likely to occur. In our previous study, it was obtained that significant amounts of alloying elements of which corresponded to 5% of annual consumption by steel industries were unintentionally introduced to steel recycling process in Japan.

Given these circumstances, the present study clarified flows of alloying elements during automobile industries by means of Waste input-output material flow analysis (WIO-MFA) based on Japanese IO table for 2005. Raw IO table for Japan has automobile parts sector, however, it is highly aggregated in just one sector. In this study, disaggregating automobile parts sector, detailed material compositions of each part of a car were clarified. Based on the result, the appropriate disassembling and scrap sorting for ELV were considered.

Shunsuke Okamoto (Kyushu University), Shigemi Kagawa (Kyushu University) and Keisuke Nansai (National Institute for Environmental Studies, Tsukuba)

Industry Cluster Analysis of Life-Cycle CO2 Emissions from Service Industries

Japan's transition toward a service-oriented economy has contributed in reducing CO2 emissions, but the extent to which it has slowed the pace of global warming remains unclear. Important empirical studies on the relationship between the transition to a service economy and CO2 emissions include those of Suh (2006) and Nansai et al. (2009). Suh (2006) demonstrated that household consumption of services, excluding electric utilities and transportation services, accounts for 37.6% of total industrial GHG emissions in the United States. Nansai et al. (2009) analyzed the factors governing life-cycle CO2 emissions in Japanese service industries between the years 1990 and 2000 and concluded that increased inputs of energy and resources (including materials and components) led to significantly increased CO2 emissions. However, it is not revealed which supply chain networks associated with the production of a particular service industry have contributed to CO2 emissions remarkably. This paper uses an optimal combinatorial method for finding groups of industries with relatively large CO2 emissions (Kagawa et al., 2012a, 2012b) and further evaluates the cluster instability by using a minimum matching distance function (Ben David et al., 2006). From the results, we analyze the role of the identified supply chain clusters on greenhouse gas emissions by estimating their within cluster effects and argue how the supply chain engagement of service industries contributes to reducing the CO2 emissions.

Keijiro Okuoka (Nagoya University), Yusuke Kito (Acaric Co., Tokyo), Tomer Fishman (Nagoya University) and Hiroki Tanikawa (Nagoya University)

Estimation of Inter-regional Human Time Input

Decreasing labour force is becoming a crucial issue to solve. Labour force has been declining, because of aging population and decreasing birth rates in some developed countries. This

simultaneously harms both the city and the hinterland that support production activities in the urban area. To understand and evaluate the usage of labour force, Human Time is a useful quantitative tool. Human Time is defined as the total human hours available in society on a year basis (Giampietro, Mayumi, et al., 2001). In this study, we clarified the inter-regional Human Time input in multiple scales, based on the concept of Human Time, focusing on Japan in 2005. First, we estimated direct Human Time input in 25 industrial sectors, using the average working hours in a week from the national census and the table on employees engaged in production activities calculated by input-output tables for each of Japan's prefectures. Next, the inter-regional Human Time input on the national scale was estimated with inter-regional Input-Output table provided by METI. In addition, inter-regional Human Time input was also estimated on a regional scale. The results of this study show that all regions in Japan basically used their own Human Time, since they used an average of 23% of input from other regions. Moreover, input from the Greater Tokyo region (Kanto) into other regions was one giga hour, which was larger than input from other regions into the Kanto region.

Yasuhide Okuyama (University of Kitakyushu)

Issues of Measuring Disaster Impact and Effects

The main aim of this paper is to provide an overview and a critical analysis of the methodologies used for estimating the economic impact of disaster. Based on the critical review of methodologies, especially those recently progressed, such as input-output, social accounting, and computable general equilibrium models, the paper presents the strengths and weaknesses of the methodologies. In addition, the issues raised by the 2011 East Japan Earthquake and Tsunami, such as supply chain disruptions, nuclear power plant accidents, and demand declines after the event, are discussed and are illustrated with a simple modeling framework.

Gabriele Oliva (University Campus BioMedico, Roma), Olaf Jonkeren (European Commission, JRC-IPSC, Ispra), Roberto Setola (University Campus BioMedico, Roma) and David Ward (Milano)

Validation of an Experience-Based Inoperability Input-Output Model

Representing interdependency among Critical Infrastructures (CI's), as well as identifying key sectors are mandatory tasks in order to implement CI protection policies and strategies. Among the several models that have been provided in these years, the Input-output Inoperability Model (IIM) gained large attention due to its simplicity and compactness. Such a model is able to emphasize cascading effects and domino effects; however the economic origin of Input-Output data and the

stationarity assumption reduce the applicability of the framework. In this paper a different approach [1] is discussed, where the coefficients are assessed by interviewing CI domain experts. The paper compares the proposed model with the economic data based input-output model (which is constructed out of supply and use tables) for a relevant subset of the Italian sectors. The main limitation of the classical input-output inoperability model is that it uses economic data to evaluate the infrastructure dependencies. As stressed by Rinaldi, et al. [2], economic flows are merely one dimension for evaluating interdependency phenomena. To illustrate this point, consider the aftermath of the March 11, 2011 tsunami in Japan. The cost of the water used as coolant in the nuclear plant was negligible, but the lack of water led to a major nuclear crisis, one that resonated more than six months later. Lewis [3] suggested that a practical approach to address this limitation is to complement the economic data with information about infrastructure interdependencies gathered from experts who have extensive knowledge about operational consequences. This information is typically expressed in human-oriented "linguistic" terms such as "strong," "limited" and "weak." Orsi and Santos [4] have attempted to explicitly introduce uncertainty in the input-output inoperability model to handle pandemic phenomena; however, their approach limits uncertainty to external perturbations, i.e., the dependency coefficients are assumed to be known precisely. Oliva, et al. [5] have proposed a framework for evaluating an input-output inoperability model with fuzzy-valued initial conditions and perturbations based on the theory of discrete-time fuzzy systems. Such a framework can be also used to compose the opinions and belief of different domain experts in order to provide a non-fuzzy, yet expert oriented Leontief matrix, also considering different outage duration scenarios [1]. Specifically, each coefficient of the Leontief matrix is evaluated with the help of the experts of the i-th infrastructures, which are invited to estimate the impact on the i-th infrastructure of the complete absence of the services (or resources) provided by the j-th infrastructure; such a procedure is then iterated for each infrastructure. Hence, the question posed to the expert of the i-th infrastructure was in the form:

"Which are the effects on your infrastructure deriving from the complete absence of service provided by the j-th infrastructure for a period of x hours, assuming that all the other infrastructures are in fully operational conditions?".

In other words, the expert has to quantify the consequences in terms of decrement of the operational capability of his own infrastructure due to the (temporary) absence of just one service/resource. Therefore, the models' parameters are set up considering only the "consumer" role played by each infrastructure within the scenario. Such a choice has been taken because operators are typically aware of the effects deriving from resources outages on their own infrastructure, hence they are able to estimate the impact with a good confidence. In this paper a comparative analysis is carried out between an experience based and an economic data based IIM. The aim is to identify, among the subset of infrastructures considered in the case study, the key sectors with respect to both the

economic and experience based methodologies, highlighting to which extent the proposed approach can be used to complement economic analyses. The aim of the paper is indeed ambitious, since by resorting to human experience it is possible to take into account phenomena that would be neglected otherwise.

Yuko Oshita (Kobe University), Shigemi Kagawa (Kyushu University), Ryoji Hasegawa (Osaka International University) and Sangwon Suh (University of California at Santa Barbara)

Identifying Economic Impacts on Japanese Supply Chains Caused by the Tohoku Earthquake: Using a Structural Path Decomposition Technique and Japanese 47 Region Multiregional Input-Output Table

The Tohoku Earthquake, which occurred in Japan on March 2011, has seriously affected not only Tohoku region, but also the rest of Japan through the supply chains associated with Tohoku region. The Tohoku Earthquake highlighted the importance of supply-chains risk management considering the potential risk of disasters. This paper analyzed the economic impacts on the Japanese supply chains caused by the Tohoku Earthquake, and detected the supply chains which had significant impacts from the earthquake using the 2005 Japanese 47 region multiregional input-output table at the 80 commodity classification level. Moreover from the results, we evaluated the impacts of the important supply-chains on the overall economy using a structural path decomposition technique (Wood and Lenzen, 2009; Oshita, 2012). This study sheds lights on robust and sustainable supply-chains resilient to disaster impacts.

Christian Samen Ememen Otchia (Nagoya University)

Growth, Diversification and Welfare in the Democratic Republic of Congo: A CGE Analysis

In an attempt to explain the difference in growth performance between developed and developing countries, recent literature concludes that countries that export the greatest number of categories of products and those which have more products at different prices within those categories tend to have higher levels of GDP. Diversification toward goods associated with higher productivity level is therefore necessary for developing countries in order to achieve rapid growth. In the context of African countries which economies largely rely on primary commodities, economic diversification can reduce their resilience to external shocks and vary government revenue to make it less dependent on natural resources.

The empirical evidence on the possible effect of diversification is dominated by the product based

analysis. They argued that diversity is reflected in the export basket. However, this approach ignores the type of production activities that occur in the country. Some attempts have also been made to address diversification within a general equilibrium framework. These researches failed to specify the process through which diversification affects growth.

In order to contribute to better understand how economic diversification affects growth and welfare, this paper develops a SAM based CGE model where diversification is modeled as an input to total factor productivity. Economic diversification is thus supposed to affect growth through an additional effect on productivity. In this sense, three specific objectives are defined: (i) determine the impact of economic diversification of growth, structural change and household welfare; (ii) construct a social accounting matrix for the Democratic Republic of Congo using the supply and use table for 2005; (iii) attempt to model economic diversification in a CGE framework.

Anne Owen (University of Leeds), Kjartan Steen-Olsen (Norwegian University of Science and Technology, Trondheim), John Barrett (University of Leeds), Thomas Wiedmann (University of New South Wales, Sydney) and Manfred Lenzen (University of Sydney)

A Structural Decomposition Approach to Comparing Input-Output Databases

In recent years there have been a number of global MRIO systems developed. Construction of MRIO tables is complex and the resulting data are subject to uncertainty. Uncertainty enters the MRIO system through uncertainties in the source data; in the methods for aligning data from different countries; through the assumptions made in constructing trade data matrices; and through methods employed to balance the table. Consequently, the different data and construction choices made by the developers of the global MRIO models have led to different model outcomes. In this paper we outline a structural decomposition methodology for determining the effect making differing choices has on the model results, such as environmental multipliers and footprints. We apply our methodology to MRIO versions of Eora, GTAP, WIOD and EXIOPOL aggregated to a harmonised collection of sectors and regions. We believe that a better understanding of the underlying causes of differences will allow developers to focus their attention on those aspects of MRIO modeling that are critical to the overall model reliability.

P

Murilo Pagotto (University of Queensland, Brisbane) and Anthony Halog (University of Queensland, Brisbane)

Towards a Circular Economy: An Application of Input-Output Oriented Approach to Improve Eco-efficiency of Australia's Food Industry

The food industry in Australia (agriculture and manufacturing) performs a fundamental role in Australian society, contributing to improvements in socio-economic sectors nationally. The Australian food industry generated a gross production value of $ 155 billion, contributing 12% to Australia's Gross Domestic Product in 2010-2011. However, the industry has been causing severe environmental stresses during the production of food. The agricultural sector in Australia is the largest consumer of water. Additionally, land degradation, greenhouse gas emissions, energy consumption and waste generation are considered the main environmental impacts caused by the industry.

The research project aims to evaluate the eco-efficiency performance of various sub-sectors in the Australian food systems through the use of input-output oriented approaches of data envelopment analysis and material flow analysis. This helps in establishing environmental and economic indicators for the industry. The results are expected to identify inefficiencies during the life cycle of food production in Australia. Based on the principles of industrial ecology, the study recommends the implementation of more sustainable processes to increase efficiency, diminish undesirable outputs and decrease the use of non-renewable inputs within the industry's production cycle. The final research outcomes are projected to be useful to inform decision makers about the advantages of moving from a traditional linear system to a circular production system, where a sustainable and efficient circular economy could be created in the Australian's food industry.

Wenqing Pan (Tsinghua University) and Yaxiong Zhang (State Information Center, Beijing)

China's Regional Economic Spillover and Feedback Effects from 1997 to 2007

Based on China Multi-Regional Input-Output (CMRIO) tables 1997 and 2007, this paper studies the effects of the intraregional multiplier and the interregional spillover and feedback effects among eight regions of China. The result shows that the contribution of spillover and feedback effects to the regional outputs is increasing, while the contribution of the multiplier effect is decreasing. The spillover effect mainly comes from the developed regions in the southeast coast of China and adjacent areas. From the view-point of the factors, it is the total final demand, especially the investment, affects the change of the spillover effect on one region, while the contribution of the Input-Output structure change to the spillover effect on one region cannot be overlooked.

Rajas Parchure (Gokhale Institute of Politics and Economics, Pune)

Existence of Equilibrium in a Monetary Economy: An I-O Perspective

Neoclassical general equilibrium models of barter economies are known to possess an equilibrium solution (a fixed point). Until recently it was thought that Scarf' algorithm provided a constructive way towards the numerical determination of the fixed point. However, recent developments have shown that the fixed point is in fact not computable. Parallel investigations of the general equilibrium in monetary economies seem to have concluded that these models do not possess an equilibrium in which money plays an "essential" role, that is to say, possess an equilibrium which, while differing from that of the barter economy, would be one in which money itself has a positive exchange value. The result of these theoretical investigations has been that some central issues that constitute the core of economic theory have become mystified and obfuscated. The objective of this paper is to undertake a fresh inquiry into them from the perspective of Input Output analysis. To that end the paper first presents an Input Output model of production, consumption and exchange in a barter economy and shows that it has a unique, positive and computable equilibrium solution. Next, the model is generalized to incorporate currency (outside) money. It is shown that if money is made essential, the model does not possess an equilibrium. Finally, the model incorporates deposit (inside) money whose outcome is the existence of multiple equlibria at different interest rates.

Jean-Marc Philip (Aix-Marseille University, Aix-en-Provence), Julio Sánchez Chóliz (University of Zaragoza) and Cristina Sarasa (University of Zaragoza)

Policy Strategies to Ensure Future Water Availability in a Spanish Semi-Arid Area: A Dynamic CGE Approach

The real evolution of water supply in the last years in the province of Huesca in north-eastern Spain is taken into account to make a forecast with a 2030 time horizon. The downward trend of water supply and the scarcity of water in some years lead to water productivity losses in this area. The main aim of this work is to find a tax policy strategy to apply to water management to cope with future water availability, integrating extreme events like droughts, through an improvement in water efficiency

For this purpose, we develop a dynamic computable general equilibrium (CGE) model with water as an explicit factor of production. In this paper, we evaluate the economic impacts of alternative assumptions applied to different tax policies. These policy strategies are focused on smoothing

impacts of water constraints combined with improvements in water efficiency through both exogenous and endogenous technological change. Levels and types of taxes needed to increase efficiency are determined. In addition, we take into account that the way the government uses the tax revenue could be a key determinant. The results show that letting market law functioning would not be enough for goods such as water and that a tax policy strategy is more efficient in the long term. Moreover, it could be possible to manage future water availability, even in presence of droughts, to reverse the long-term economy trend induced by a tax policy which would involve technical progress.

Matías José Piaggio (University Autonoma de Barcelona, Bellaterra), Vicent Alcantara (University Autonoma de Barcelona, Bellaterra) and Emilio Padilla (University Autonoma de Barcelona, Bellaterra)

Input–Output Subsystems: Agro Industrial CH4 and Services CO_2 Emissions in Uruguay

This paper analyzes methane emissions of the agro industrial subsystem and carbon dioxide emissions of the services sectors subsystem in Uruguay in 2004. The relationship of these subsystems with the rest of the economy is analyzed through input–output methodology employing a multiplicative decomposition. This is combined with an additive decomposition for the study of the linkages within them. This approach allows to study the relevance of these subsystems as units in the economic structure as well as to analyze in detail the relationship between the different branches in each of the subsystems. The results depict in which sectors mitigation policies are more effective, and if they would be better tackled through technical improvements and better practices, or through demand policies.

Shri Prakash (Birla Institute of Management Technology, Greater Noida)) and Ritu Sharma (Institute of Management Studies, Noida)

Multiplier Effect on Growth of Income and Investment: Analysis of Sequential Rounds in Input-Output Framework

Consumption and savings are related bi-directionally; but their inter relations are both concurrent and lagged. Current consumption and savings depend upon current income, but current income is an outcome of consumption and savings in the preceding period. These relations are based on lead and lag structure of these three variables. Current consumption is basically based on average/marginal propensity to consume out of current/marginal income. This is what Keynes states “The fundamental

psychological law upon which we are entitled to depend with great confidence, both a priori from our knowledge of human nature and from the detailed facts of experience, is that men are disposed, as a rule and on the average, to increase their consumption as their income increases, but not by as much as the increase in their income".

The paper not only uses above assumptions of Keynes but it also evaluates their empirical validity. A dis-aggregative, multi-sector and inter temporal model, synthesizing multiplier-accelerator processes of growth into Leontief's structure, is developed. Thus the main objectives of the study are to determine (i) maximum rounds over which multiplier-accelerator processes of growth remain operative in response to initial consumption; (ii) periods over which accelerator operates as a consequence of increase in income in response to initial multiplier effect; (iii) disentangle multiplier from accelerator effect on growth.

CSO's Input Output Tables for 2003-04 and 2006-07 constitute the main data base of analysis. But data relating to Whole Sale Price Index, income/GDP and Savings are taken from Economic Survey, Government of India, ministry of finance.

Segmented but complementary models of growth of consumption and output have been developed for determining the impact of multiplier process and its resultant activation of the accelerator process of growth. The models are sequential and hierarchical rather than simultaneous in nature.

The model facilitates the determination of effect of multiplier process of consumption on growth of income and savings; the effect of initial consumption on growth is spread over several rounds.

The model design itself explains the contribution that this paper is likely to make in terms of enhanced understanding and explanation of the growth effects of consumption and investment. The study will also identify relative contribution of consumption and investment individually and separately. The model facilitates the prediction of the growth of income as a result of initial level of consumption: the prediction will cover as many years as the multiplier and accelerator process last over if there is no other change in the economy.

Gio C. Punsalang (De la Salle University, Manila) and Laurence A. Tan (De la Salle University, Manila)

Assessing the Inter-Industrial Linkages and Economic Contribution of the Philippine Transport Industry

The impetus of industrialization in many developing economies raised the significance of the transportation sector in carrying out business proceedings to satisfy growing demand for goods and services. Transportation networks form the backbone of trade facilitation and passenger movement around the world. As such, unraveling the economic implications of the industry is crucial for

policymakers in their infrastructure development planning and maintenance of apt regulatory frameworks for various transport subsectors. Using the latest 2000 240x240 National Input – Output (IO) table released by the Philippine National Statistical Coordination Board (NSCB) in 2006, an IO analysis will be undertaken to assess the intersectoral linkages of the Philippine transport industry as well as its economic impacts on output and labor market outcomes.

Hak K. Pyo (Seoul National University), Keunhee Rhee (Seoul National University) and Sae Rang Song (Seoul National University)

Two Financial Crises and Induced Employment Effect in the Republic of Korea

In the recent years, the Republic of Korea has experienced two financial crises in 1997-1998 and 2007-2009 respectively over a decade interval. The first one was an endogenous twin-crisis as part of Asian financial crisis involving both domestic banking crisis and foreign exchange crisis. The second one was a kind of exogenous financial shock from a part of global financial crisis. The purpose of the present paper is to trace the impact of these crises on employment structure in Korea. We have used two input-output Tables of 2000 and 2010 to identify sources of induced employment effects by both industries and final demand sectors. The paper demonstrates that the difference in the characteristics of financial crises produce quite different employment inducement effects through structural changes in industries and final demand.

Q

Pedro Quaresma de Araujo (Brazilian Development Bank, Rio de Janeiro)

Assessing the Risks of a Downturn Evaluating a Chinese Slowdown in Investment in China on the Brazilian Economy

In recent years, it grew considerably, the relevance of the Chinese economy in Brazil. Especially in foreign trade, China became, in 2009, the main destination of Brazilian exports, while in 2012 the country became the primary source of Brazilian imports. In this sense, in a moment that Chinese economic growth is decelerating and that is being discussed a reorientation of the development model of the country from a investment-led growth to consumption-based growth, we could wonder about the adverse effects on Brazilian economy with this transition.
Therefore, the aim of the paper is to measure the impacts of a slowdown in Chinese investment on

the Brazilian GDP. Considering the sectorial decomposition of Brazilian exports to China and the elasticity of these in relation to Chinese investment rate, we could evaluate the direct and indirect effects on different sectors, using Brazilian input-output matrices. Moreover, in a comparative exercise, it is possible to simulate the effects of a similar downturn in exports in other relevant Brazilian partners in order to evaluate the dependence of the Brazilian economy in relation to each of these, especially with regard the industrial sectors.

R

Isabelle Rémond-Tiedrez (European Commission, Eurostat, Luxemburg) and Pille Defense-Palojarv (European Commission, Eurostat, Luxemburg)

Conversion of US Supply and Use Tables Using the European Classifications – A First Analysis for the Years 2008 and 2009

After publication in autumn 2012 of the consolidated table for the European Union for the year 2008, Eurostat has started investigating the US supply, use data available for the same year (2008) to convert this data using the NACE (classification of activities, based on ISIC 4) classification in which Eurostat disseminates European data. The paper will examine some of the assumptions made for the conversion and present a first comparison between EU and US economies.

Isabelle Rémond-Tiedrez (European Commission, Eurostat, Luxemburg), José Manuel Rueda-Cantuche (Pablo de Olavide University, Sevilla), Jörg Beutel (Konstanz University of Applied Sciences), Antonio F. Amores (European Commission, JRC-IPTS, Sevilla) and Silke Stapel-Weber (European Commission, Eurostat, Luxemburg)

Consolidated European Supply, Use and Input-Output Tables for 2008 and 2009

Eurostat, Statistical Office of the European Union, has produced for the first time in October 2012 supply, use and input-output tables in the new classification NACE Rev 2, based on ISIC 4. This paper will present the process of estimation for individual MS and then the process of consolidating 27 Member States tables into European tables. An analysis comparing the consolidated table and the pure sum of 27 Member States will be presented.

Joanna Z. Resurreccion (University of the Philippines Diliman, Quezon City), Joost R. Santos (George Washington University, Washington DC) and Johan Rene Van Dorp (George Washington University, Washington DC)

Uncertainty Analysis of Decision-Maker Preferences: An Input-Output-Based Approach for Prioritizing Critical Interdependent Systems

Large-scale disruptions in the flow of goods and services expose a regional economy to uncertain economic consequences. The inherent interdependencies across business and infrastructure sectors further exacerbate the direct and indirect disruptions in the aftermath of disasters. Hence, it is imperative that such critical sectors be identified and prioritized to holistically minimize the impacts of disruptive events on the affected regional economy. Decision-making preferences with respect to multiple objectives and their associated trade-offs may significantly alter the magnitude of economic losses within the recovery horizon. In this research, we integrate decision-maker preference uncertainty analysis with a multi-criteria prioritization framework for minimizing (i) extreme economic losses, and (ii) sector inoperability. A Stochastic Inventory-based Dynamic Inoperability Input-output Model (SIDIIM) is extended to assess the performance of each sector in the economic loss and inoperability criteria, which are then used to define the prioritization coordinates of the visualization tool. The beta distribution is utilized to generate realizations of preferences for each of the criteria to generate a robust set of critical sectors for prioritization. The unique contribution of this research is the determination of the likelihood that each sector will have a critical status given a disaster scenario. Our methodology for incorporating the analysis of preference uncertainties provides an opportunity to engage decision-makers in prioritizing the sectors that are critical in disaster recovery.

Christian John Reynolds (University of South Australia, Adelaide) and John Boland (University of South Australia, Adelaide)

Waste Not, Want Not? The Economics of Waste and the Good of Charity in a WIO Framework

Goods quickly change value in the modern economy. Nowhere is this more apparent than in the changing value of waste. Traditionally, waste products that were only conceptualised as zero value negative externalities of consumption or production processes. However, waste is now imbued with value through the advent of resource recovery and associated secondary markets.

After providing a review of traditional waste value theory, this paper will examine charity as an informal waste treatment method and the case of philanthropic goods: where products that have no value to one party are donated to another party which still values them.

A case study will investigate the charity 'rescue' (disposal) of food waste in the Australian economy in 2008. Methodologically discussing how the Waste Input-Output model (Nakamura and Kondo 2009) can be adapted to investigate the economic flows of philanthropic goods.

Davide Rigo (UNCTAD, Geneva) and Carlo Altomonte (Bocconi University, Milano)

The Impact of GVC on Domestic Employment

Based on the recently compiled World Input-Output Database (WIOD) we analyze the link between international offshoring (outsourcing) and job creation. By applying the GVC perspective introduced by Los et al. (2012), we use the number of jobs created abroad for the production of a final product as a proxy for offshoring. We find that offshoring activities have a direct negative impact on a country employment growth. Starting from the prediction that offshoring activities, by increasing domestic efficient, would however have positive general equilibrium effects on domestic job creation along specific country characteristics, we explore at the country level the interaction between offshoring and the extent of participation in the GVC, the level of employment protection and financial development. We show that countries with higher level of involvement in the GVC or financial development have positive employment growth for increasing shares in international offshoring.

Paola Rocchi (University of Barcelona), Monica Serrano (University of Barcelona) and Jordi Roca (University of Barcelona)

The Reform of the European Energy Tax Directive: Effects on Prices

To address risks related to atmospheric contamination, it is widely accepted the need for policy instruments aimed to reduce emissions. Policy intervention seeks to reduce polluting behaviours by encouraging a more respectful conduct and/or the use of more efficient technologies. The European Union (EU) counts with two important economic mechanisms for emission control at European level: the Energy Taxation Directive (ETD), an environmental taxation approved in 2003 that affects the price of energy products; and the Emissions Trade System (ETS), a cap and trade system introduced in 2005 that directly affects the CO2 emission quantity. In 2011, the European Commission proposed a new version of the ETD. The main aim of the proposal was to increase the effectiveness of the instrument through stronger fiscal pressure on energy products and to coordinate the environmental taxation with the ETS, establishing a comprehensive and consistent CO2 price signal for sectors not included in the EU ETS. However, in May 2012 the European Parliament

delivered a setback for the European Commission plans regarding the ETD and the process stopped. The main worry seems to be the effect of such proposal on competitiveness; in particular the concern regards sectors, like transport industry that would be mostly affected given the intensive use of energy products.

The aim of the following study is to analyse the effect that the ETD reform would have if implemented, in particular on the level of prices for the European countries where the reform would imply to increase energy taxes. Using data from the World Input Output Database (WIOD) project, the main finding is that the new energy tax regime would have a really low impact on prices. Since prices would not be strongly affected by the reform, there will be no drawbacks for competitiveness and distributional implication, but this result will also imply a low capability of this reform to cause changes in consumption and production towards less environmental pressures.

Joao Rodrigues (Instituto Superior Técnico, Lisbon)

The Prior Uncertainty of Input-Output Data

In this paper we address the problem of calculating the uncertainty of Input-Output multipliers, when correlations are explicitly taken into account. Under a Bayesian approach, Input-Output source data are described by a multivariate truncated Gaussian distribution, characterized by a set of best guesses, uncertainties and correlations. We present two numerical integration methods: Monte-Carlo integration and Gaussian quadrature using the Stroud formula. We compare both methods agains conventional Monte-Carlo simulations (without correlations). We also perform a sensitivity analysis to assess the effect of the correlation among source data on multiplier uncertainty.

Joao Rodrigues (Instituto Superior Técnico, Lisbon)

Data Reconciliation in Input-Output Analysis

This paper addresses the problem of data reconciliation in Input-Output analysis, using a Bayesian approach. We study the problem of combining multiple priors of a given IO datum, when both a best guess and an uncertainty estimate are available for each prior, in two ways. First, we address data reconciliation as a data balancing problem under a particular structure. Afterwards, we impose the properties that define the data reconciliation method. Under both approaches, we conclude that the formula for the reconciliation of best guesses is a weighted arithmetic average and that the reconciliation of uncertainties is a harmonic average.

Shikhanwita Roy (Roy Ghosh and Associates, Howrah) and Debesh Chakraborty (Jadavpur University, Kolkata)

Information Sector of India and the Twelfth Five Year Plan: An Input-Output Analysis

Since the inception of the liberalization of the Indian economy in 1991, the ICT industry in India has played a key role in putting India on the global map. It has been not only one of the most significant growth contributors of the Indian economy, but also a prominent player in transforming India from a rural agriculture based economy to a knowledge based economy.

The industry has reached the aggregate revenue of US $88.1 billion in FY 2011, out of which export revenues constitute US $ 59.4 billion and domestic revenue accounts US $28.7 billion. This robust growth of the ICT industry can be attributed to meticulous IT Planning in India. The Government is of the opinion that a focused and coordinated push in the IT sector during 12th Plan period (2012-13 to 2017-18) will help India achieve faster, sustainable and more inclusive growth. According to Nasscom-McKinsey report Indian IT industry is poised to become US $225 billion by 2020. The export component of Indian IT industry is expected to reach US $175 billion by 2020.

Realizing the tremendous potential of the Indian ICT industry, the paper attempts to analyze the sources of growth of Indian ICT industry during 1993-94 to 2007-08 with the help of input-output Structural Decomposition Analysis (SDA), using input-output tables for the years 1993-94, 2003-04 and 2007-08. The paper also intends to carry out a simulation exercise to study the impact of the targeted growth rate of exports of the information sector on the Indian economy during the 12th Five Year Plan.

José Manuel Rueda-Cantuche (Pablo de Olavide University, Sevilla), Antonio F. Amores (European Commission, JRC-IPTS, Sevilla) and Isabelle Rémond-Tiedrez (European Commission, Eurostat, Luxembourg)

Evaluation of Different Approaches to Convert Time Series of Supply and Use Tables from NACE Rev.1.1 into NACE Rev.2

The new Regulation 715/2010 implementing the revised NACE Rev.2 and CPA Rev.2 as industry and product classifications, respectively, brings in a breakpoint of the time series of European Supply, Use and Input-Output Tables (2000-07), which have been published so far in the old classification. So, presently, this makes impossible any medium-long term analysis with such tables. In order to solve this problem, a new procedure is proposed for making the conversion on the basis of bridge tables that map one classification into the other, i.e.: the so called RACE method. This is compared

against the EURO method, which is a projection method that would use the official tables of 2008 as base year. The analysis has been carried out for the Czech Republic, Greece, the Netherlands and United Kingdom (2005-07). The EURO method seems to perform better according to the empirical results.

José Manuel Rueda-Cantuche (Pablo de Olavide University, Sevilla), Joerg Beutel (Konstanz University of Applied Sciences), Isabelle Rémond-Tiedrez (European Commission, Eurostat, Luxembourg) and Antonio F. Amores (European Commission, JRC-IPTS, Sevilla)

A Set of Good Practice Guidelines in the Estimation of Use Tables at Basic Prices and Valuation Matrices

There are currently a number of European Union (EU) funded projects that aim to construct multi-regional supply, use and input-output frameworks for the EU and the rest of the world in order to carry out environmental and economic studies relevant for the EU. To do so, they all have to face the estimation of use tables at basic prices and valuation matrices of the individual countries to comply with their objectives. But unfortunately, an empirical based guideline to identify the best approaches/ assumptions to do so does not exist and the projects frequently use the most simplistic assumptions provided the large number of industries and countries that they have to cover. In order to fill this gap, this paper aims to run an empirical analysis comparing the estimated results of an exhaustive list of approaches against official Supply, Use and Input-Output Tables of countries for which all the information is available. Belgium, Germany, Italy, Netherlands, Finland, Austria and Slovakia are our candidate countries. The final outcome will be a set of good practice recommendations so that researchers can improve the quality of their own outcomes and last but not least, so that Eurostat can enhance the compilation process of the consolidated EU27 and euro area Supply, Use and Input-Output Tables.

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Mahdi Sadeqi-Shahedani (School of Economic Sciences, Tehran) and Moslem Bemanpoor (University of Tehran)

Energy Price Reform in Iran: Is It Equitable in terms of Labor Market Considerations?

Iranian parliament allows the government to make reforms in energy market. While the benefit of

the reform from efficiency ground had been widely acknowledged, whether or not such reform was equitable in terms of unemployment distribution between skilled and unskilled workers, still open for debate. The paper presents a CGE model for evaluating energy price reforms measures with emphasis on their employment impacts. The presented CGE model takes into account the non-clearing of the labor market (wage curve for skilled & minimum wage for unskilled) as it occurs in reality and as it is of high importance for any economic assessment. Endogenizing labor supply, allowing labor to choose between leisure and labor supply with leisure entering into the workers utility function, is another key characteristics of the model.

The model is calibrated to Iranian micro and macro data. With this method, various counter-factual scenarios analysis of the passed energy price reform law in Iran and redistribution plan is carried out. The simulations suggest that without economic restructuring this law leads to higher unemployment in both labor markets; however, if at the same time government redistribute released income (unpaid subsidy and income from higher energy price) between household, energy intensive sectors and himself, it tends to decrease unemployment, especially unskilled labors. Proper and effective compensation matters in mitigating the unemployment impact of the reform.

Joost R. Santos (George Washington University, Washington DC), Larissa May (George Washington University, Washington DC) and Amine El-Haimar (George Washington University, Washington DC)

An Input-Output-Based Workforce Recovery Model for Disaster Risk Assessment: An Application to a Pandemic Scenario

Recent publications on disasters and extreme events have placed significant attention on preparedness and resilience measures for physical infrastructure systems. Such systems are essential in promoting regional business operations, commerce, and economic livelihoods, as well as in maintaining continuity of government in the aftermath of disasters. Nevertheless, significant research is severely lacking in areas of modeling, assessing, and managing the adverse impacts of disasters on workforce recovery. Although several studies underscore the enormous losses that can stem from workforce disruptions, there is not currently an integrated methodology that is capable of disaggregating workforce consequences across interdependent sectors, regions, and recovery time scales. Hence, this research addresses the following research hypotheses that merit attention in modeling workforce recovery dynamics:

• Variations in workforce unavailability and labor dependencies across different sectors can significantly affect assessments of regional recovery rates and economic losses.

• Variations in workforce origins and destinations can result in heterogeneous distributions of economic losses across sectors, regions, and recovery time scales.

• Variations in workforce recovery strategies across different sectors and regions can significantly affect the efficacy of reducing recovery periods and economic losses.

This research will investigate the effects of influenza epidemics to the workforce sectors in the US National Capital Region. Nevertheless, the resulting methodology will have the flexibility and scalability for use in other regions and disaster scenarios.

Kiyotaka Sato (Yokohama National University) and Nagendra Shrestha (Yokohama National University)

Shock Transmission, Production Fragmentation and Business Cycle Synchronization: New Evidence from Globally Integrated Input-Output Table

By employing the globally integrated input-output table (henceforth, GIO table), this paper empirically investigates the degree of shock transmission across countries to show new evidences of the regional and global economic linkages with a focus on Asian countries. We construct the new GIO table for eleven years from 2000 through 2010 with 35 industries, 27 endogenous countries and 61 exogenous countries. We conduct the simulation analysis by generating a fall of the US import demand for final goods to explore how and to what extent a negative shock to the US import demand is transmitted globally and regionally to the production and trade of intermediate goods. The simulation results show that Japan tends to be severely affected by a fall of the US import demand for final products, not only because the Japan's final goods sectors procure most of intermediate inputs from the domestic sectors, but also because Japan's intermediate goods production is largely integrated into the regional production chain in East Asia. Given the Japan's unique production structure with the asymmetric shock transmission pattern, Japan will be less likely to play a central role of regional economic integration in East Asia.

Alsu Sayapova (Russian Academy of Sciences, Moscow) and Tatyana Tagaeva (Russian Academy of Sciences, Novosibirsk)

Compilation Variants of Symmetric Input-Output Tables and Their Aplication Areas (the Case of Russia)

In Russia symmetric input-output tables (SIOTs) are traditionally published in one variant: as a product-by-product table. Our calculations have shown that transformation of supply and use tables to symmetric input-output tables is carried out on the basis of the so called product technology assumption. As known, there are also other approaches to transformation to product-by-product table,

transformation to industry-by-industry table on the basis of various assumptions is also possible. As it is fairly mentioned in manual of supply, use and input-output tables: each of these tables is viable and has its own application area. We have taken an attempt to calculate various variants of symmetric input-output tables (product-by-product tables and industry-by-industry tables) on the basis of available supply and use tables information. Comparative analysis of different variants of symmetric input-output tables and evaluation of opportunities of use of some or another table for solution the certain problems are also performed. For instance, comparative price changes analysis on the basis of symmetric product-by-product and industry-by-industry tables is carried out. Division for domestic and import products consumption is traditionally published in Russia for use tables only. We also calculated symmetric input-output tables for domestic and import products.

The reasons for negative input-output coefficients and other unsatisfactory results are analyzed. The latter, is particularly performed with involvement of information on cost structure of secondary products, manufactured in another industry as primary products and on the share of secondary product output in total output of industries.

Guoqiang Shen (University of Oklahoma,Norman)

Spatial Input-Output Model and Spatial Interaction Model Compared: The Case of Inter-Metro Freight Flows in USA

It is well-known that metropolitan cities in a country compete and cooperate for competitive advantage in economic development. The freight flow between a pair of metro cities is a good indicator of such economic competition and cooperation. Numerous ways exist for estimating or predicting freight flows for metro cities. This paper first uses a spatial input-output model to estimate the inter-metro freight flows in value for 130 American metropolitan statistics area (MSA). Then, this paper calibrates a gravity-based spatial interaction model to yield inter-metro freight flows for the same US MSAs. These two sets of freight flows are compared with the well-known freight analysis framework version 3 (FAF3) at the MSA level. The focus of the comparison is on total freight flow for all types of goods rather than for individual commodities. The results indicate that the spatial input-output model generates similarly accurate results for the total or aggregate commodity flow as the spatial interaction model does. However, when dealing with individual or dis-aggregate commodities, the spatial input-output model produces more accurate inter-metro freight flows.

Tsubasa Shibata (Institute for Developing Economies-JETRO, Chiba)) and Kosaka Hiroyuki (Keio University, Kanagawa)

An Input-Output Model Building for Nine Regions of Japanese Economy Based on Microeconomic Foundation

Input-output table depicts the economic activity as a system of interrelated commodities, services, and final demand. Input-output analysis is utilized to explain economic changes in today's economy, which lead to useful insights to us. However, we advocate that input-output model should have more sophisticated framework which reaches to the microeconomic theory. The purpose of this study is to construct the input-output system, where the output and price is interdependently determined under the optimization of household and producer in imperfect market.

This approach is incorporated into the construction of an interregional economic model in Japan by using interregional input-output tables of eight data points collected in five-year increments from 1965 to 2000 of Japan. Thus, intermediate demand, consumption expenditure, labor demand, and price determination are endogenized in an interregional input-output system, where: a) consumption expenditure is explained by the Almost Ideal Demand System in which expenditure minimization is a key factor ; b) intermediate and labor demand are derived from the generalized Ozaki cost function; and, c) sector price is determined by an monopolistic market. This interregional system is incorporated into an interregional input-output model of nine regions.

We simulated the model and made some indices of expressing structure of Japanese economy such as economy scale, elasticity of price or demand, technical progress, and total factor productivity. These results can assure potential use of input-output model for practical policy recommendation, because we model the consumer preferences, production technology and resource constraints that govern economic agent's behavior. We would believe that our attempt will contribute to potential applicability of input-output model.

Hiroyuki Shibusawa (Toyohashi University of Technology), Nian Li (Toyohashi University of Technology) and Koichiro Nakazawa (Toyohashi University of Technology)

Economic Assessment of Natural Disasters in China: A Spatial CGE Approach

We develop a spatial computable general equilibrium model to investigate the regional economic impacts of an earthquake. In our spatial model, China is subdivided into 30 cities/regions. All the cities/regions are connected by transportation networks. Our model is of a decentralized economy with utility-maximizing consumers and value-maximizing firms in a static context. The model is

calibrated for the regional economy using a multi-regional input-output table for China. We estimate the impacts of a hypothetical earthquake, which is expected to occur in the near future, on the regional economy in a case study of a specified city/region of China. The results show the indirect and distributional economic impacts after an earthquake.

Yosuke Shigetomi (Kyoto University), Keisuke Nansai (National Institute for Environmental Studies, Tsukuba) and Susumu Tohno (Kyoto University)

Future Projection of Global Greenhouse Gas Emissions Associated with Japanese Household Consumption with a Global Link Input–Output Model

The Japanese population is expected to decrease gradually with accelerated demographic aging, which entails an increase of elderly households and a decrease of young households. Household consumption directly and indirectly generates environmental burdens via energy consumption, greenhouse gases (GHG), and air pollutant emissions: households generate CO2 emissions not only directly with heating appliances and private automobiles but also implicitly through the supply chains of goods and services which the household consumes. Nansai et al. (2012) identifies Japan's carbon debt as 256 Mt CO2eq in 2005 using a global link input–output model (GLIO) (Nansai et al., 2009), demonstrating that Japan's consumption-based GHG emissions are greater than its production-based emissions. However, no report in the literature describes estimation and analysis of the future change in consumption-based emissions in Japan. This study therefore projects future change in consumption-based emissions or global GHG emissions associated with Japanese household consumption, considering changes in population and household composition during 2005–2030. Japanese household expenditure survey data were used to disaggregate the household expenditure sector in GLIO into six sectors: household expenditure sectors of household heads up to 29 years, and with heads in their 30s, 40s, 50s, 60s, and 70s and older. Final demand for goods and services in each sector during 2005–2030 given to GLIO determined future global GHG emissions induced by household consumption. Results show that future transition household composition exhibits a peak of global GHG emissions associated with households in 2015 and a subsequent decline by 2030. Expenditures causing a large change in global emissions during 2005–2030 are those for kerosene, electricity, dairy products, rice, and hotels, which implies the importance of working on GHG emissions management for these products and global supply chains in the future.

Kazushige Shimpo (Keio University, Tokyo), Koichi Hikita (Kobe Shukugawa Gakuin University) and Toshifumi Unno (Keio University, Tokyo)

Visualizing Economic Vulnerability to Disaster: The Case of 2011 Tohoku Earthquake and Tsunami in Japan (1306)

The East Japan encountered the unprecedented earthquake and tsunami on 3.11, 2011. The Japanese government reported the values of direct damages of the disaster, say, the lost productive stocks such as equipment and buildings, agricultural land and infrastructure. However, we have little information about the values of lost flows such as output and employment and also the values of indirect damages, for example, how the supply chains of products were severed. In this study we estimated the values of indirect damages using the national and regional input-output tables and 1km-mesh data of manufacturing production and whole sale-retail sales statistics. In order to estimate the indirect damages, we define a measurement of economic hotspots which is an aggregate concept of some dependency and centrality measures. The input-output based forward and backward linkages and the hypothetical extraction analysis form representation of dependency. We also employ some centrality concepts from social network analysis. The more central an activity is, the more vulnerable it is for disaster because it is difficult to substitute for the activity. These dependency and centrality is then visualized in a GIS. By doing so we can create a map of economic hotspots. The map of economic hotspots is overlaid with actual maps of earthquake and tsunami damaged areas. This reveals the economic vulnerability against disasters.

Shalini Singh Sharma (Galgotias University, Greater Noida)

Input Output Modeling of Prices in Indian Economy in Flex-Fi-price Framework

Emergence of new market forms and economic structures since first industrial revolution in 18th century has led to the evolving of new price theories. Price theories relating to different forms of structures of markets differ not only in nuances but also in basic thrusts and details, though both supply and demand remain in center stage of these theories. Different theories, however, assign differential weight to the influence of supply/cost or demand/expectation of price change in these theories. Price theories are broadly classified by John K. Hicks in two groups:(1)Flex Price Theory; and (2) Fix Price Theory (Hicks, 1967, 1973). This paper uses the above theoretical framework to determine all prices on the assumption that all sectors of Indian economy pursue fix-price norm in the determination of market prices. Leontief model is used to generate the estimates of average cost based prices for all 130 sectors of Indian economy in 2006-07. The next stage of empirical analysis is to compare the estimated cost based prices with observed market prices. All observed market

prices which exceed cost based prices by more than 10 percent are classified as flex prices. Ten percent margin was also used by Oxford Group. Current market is characterized by much greater degree of competition now what was the status of market at the time of Oxford study. Therefore, the 10% is on liberal side.

Chandrima Sikdar (Narsee Monjee Institute of Management Studies, Mumbai) and Debesh Chakraborty (Jadavpur University, Kolkata)

Assessing the Factor Content of India's Trade with Sri Lanka Using Alternative Frameworks(1168)

The India-Sri Lanka Free Trade Agreement (ISFTA) came into force in March 2000 and got fully implemented by 2008. In the post FTA period, bilateral trade between the two economies increased at the rate of 47% per annum during 2001-2008. The two economies now enjoy a robust trade and investment relationship, with bilateral trade growing rapidly and a number of leading Indian private sector companies investing in Sri Lanka and establishing a presence in the country. Sri Lanka is India's largest trade partner in South Asia. India, in turn, is Sri Lanka's largest trade partner globally. Bilateral trade in first eleven months of 2011 amounted to US $ 4.46 billion, which is about 72 % higher than the corresponding period last year. India's exports to Sri Lanka for the same period amounted to US $ 3.97 billion while Sri Lanka's exports to India stood at US $ 481.85 million.
Against this backdrop, the present paper attempts an assessment of the structure of factor content of India's trade with Sri Lanka using the alternative frameworks of Leontief, Leamer and Reimer/Trefler. While the first two frameworks measure factor content of trade when trade in final goods are considered, the third framework measures the factor content of trade when intermediate inputs are traded and techniques differ across the trading countries. The present study is based on the GTAP 7 database and considers four factors of production – land, skilled labour, unskilled labour and capital.

Anushree Sinha (National Council of Applied Economic Research, New Delhi)

Estimating Jobs through Renewable Energy Sector

The paper attempts to use the IO multiplier to provide estimates of employment generated by the wind energy sector in a multi-sectoral framework. This paper presents the input output table for the state of Gujarat for the year 2009-10, which is being primarily constructed by use of both secondary and primary survey data of the sector to examine the pace of green job creation in Gujarat. The IO table is able to evaluate the inter dependence existing among commodity producing sectors, final users (households, government and exports) and the factors of production within an economy. In order to comprehend the relative importance of each sector in terms of its output, value added, income and employment contributions, along with the inter-sectoral linkages in the economy, input output analysis becomes highly relevant.

We construct a state level Input-Output table for Gujarat by using secondary as well as primary data. The secondary data dealt with the creation of the 7 sector transaction matrix based on the All-India Input-output Table 2006-07. The wind energy sector data are collected by primary survey and interviews with knowledgeable state officials and used to disaggregate the electricity sector and included in the Gujarat State Input-output table. Being a new and emerging sector, wind energy development has notable effects on employment across sectors. The analysis informs us about the extent to which employment is created in the various sectors , but the present methodology does not deal with the question of the profile of the workers.

The standard input-output model uses multipliers from the demand-side input-output model, in which the model is driven by demand for its outputs. The model assumes that, in a particular year, fixed amounts of given inputs are required to produce a given output. Using the demand-side model, we can generate different kinds of input-output multipliers, which are summary measures used to estimate the likely effects of economic change.

It has been observed that regular employment contributes to nearly 62.0 per cent of total employment whereas 38.0 per cent of employment is of contractual nature. Within the regular employment engineers are nearly 15.0 per cent, diploma holders are 35.0 per cent and senior engineers comprises of 12.0 per cent. Within the contractual employment, security personnel comprises of major chunk (24.0 per cent) followed by 6.3 per cent of maintenance staff and nearly 2.5 per cent each of staff involved in civil works, electrical works and crane works. We know that manufacturing and construction sectors are heavily labour intensive in India. Hence, more inputs from these sectors taken by wind energy sectors result in higher employment multiplier effect for this sector compared to electricity sectors. We examine the difference in the labour coefficients and employment multipliers to derive the indirect employment needs of wind energy and electricity sectors. The higher difference between total employment (direct and indirect) and direct employment

requirement for wind energy sector is due to higher indirect employments resulting from manufacturing, construction and services sectors. These sectors thus result in generating more of indirect employment generation from the production of wind energy.

Jaroslav Sixta (University of Economics, Prague) and Petr Musil (University of Economics, Prague)

The NACE Conversion of Input-Output Tables

The Czech Statistical Office performed a major revision of national accounts in its history in 2011. The main purpose of the revision was the change of used classifications of industries (NACE rev.2) and products (CPA 2008). The key task was to compile comparable time series of national accounts covering supply and use tables and production account and generation of income account for 1990 – 2010. The whole procedure was based on matrix computations using two transformation matrices. The different approach was used to output, intermediate consumption, wages, employees and capital formation. Some methodical issues of national accounts like imputed rent, non-market output and FISIM were easily transformed directly into corresponding industry and product. But source data and a lot of adjustments focused mainly on the differences between national accounting and business accounting had to be computed by transformation procedures. Besides that, some crucial methodical differences between old and new classifications had to be solved. Finally, all the transformed data were balanced within supply and use tables.

Francesca D.B. Solis (De la Salle University, Manila), Krista D.S. Yu (De la Salle University, Manila) and Raymond R. Tan (De la Salle University, Manila)

Evaluating the Impacts of Inoperability to Trade Relations among Regions in the Philippines

The geographic location of the Philippines makes the country susceptible to experiencing a series of natural disasters that disrupts economic activities of certain sectors and specific regions in country. Moreover, as a developing country, it is not free from experiencing disturbances aside from natural disasters, including terrorism, accidents and other possible disruptions in the various sectors of the economy. With this, it is important to assess the impacts of these perturbations to different sectors and regions in the country in order to apply proper decision-making, policy implications and allocation of relief that would best benefit the country. In this study, we want to know how a disruption to a region, sector or specific sector in a region can affect trade within the country. Herewith, we would also want to account for and assess the major impacts of these perturbations on the Philippine economy. Given these issues, this study will employ the Multiregional Inoperability

Input-Output Model (MRIIM) in order to evaluate the impacts of the perturbations on trade relations as well as the interconnected economic systems within the country. We hope to show the changes in regional trade relations brought about by the disruptions and from there draw conclusions, assess risk and formulate policy recommendations that will lead to growth for the Philippine economy.

Nathaniel Springer (University of California at Davis) and Faye Duchin (Rensselaer Polytechnic Institute, Troy)

The Global Distribution of Factor Rents from Agricultural Production in 2050

Producing enough food to meet the needs of 9 billion people will require a combination of increased yields through improved crop and livestock technologies and expanded factor use, in particular land and water. The future international division of agricultural labor will reflect the comparative advantages of regions based on their endowments of these factors and their relative costs. All regions that increase production receive additional factor earnings, but only regions with relatively low production costs receive scarcity rents. We use the World Trade Model to quantify the global distribution of agricultural rents for a set of scenarios using alternative assumptions about region-specific changes in population, diets, resource availability, and technological changes to the year 2050. Africa and Latin America emerge as substantial producers and exporters of agricultural products due to their large potential for yield improvements and expansion onto suitable land and adequate supplies of water. A crucial difference is that Latin America can claim some of the largest rents globally while Africa receives among the lowest. We discuss the plausibility and implications of this result.

Marco Springmann (University of Oldenburg)

Addressing Emissions Transfers: the Economic Effects of Combining Consumption-based Adjustments of Emissions Targets with Clean-development Investments

International trade can have significant feedbacks on the stringency and distributional aspects of national climate policies. It allows countries to outsource the production of goods, and the emissions associated with it, to less regulated regions, which makes compliance with emissions-reduction targets easier for the outsourcing region, but harder for the one producing for export. Consumption-based emissions inventories have been proposed to highlight the trade-induced separation between production from consumption and the associated distributional consequences.
A route to linking consumption-based emissions accounting with production-based climate policies

is to adjust national emissions-reduction targets for the transfers of emissions embodied in international trade. However, implementing trade-adjusted emissions targets would make the emissions-outsourcing and primarily industrialized regions bear a greater emissions-reduction burden at potentially significant economic cost.

This study analyses whether allowing the emissions-outsourcing industrialized regions to meet the additional emissions reductions by investing in clean-development initiatives in the exporting and primarily developing regions could reduce the industrialized regions' economic burden and, in light of stimulating international clean-development investments, make consumption-based adjustments of emissions-reduction targets a potential policy option. The study assesses the distributional and welfare effects on the international level by using an energy-economy model of the global world economy which is calibrated to sector-level data for the year 2007.

Konstantin Stadler (Norwegian University of Science and Technology, Trondheim), Kjartan Steen-Olsen (Norwegian University of Science and Technology, Trondheim) and Richard Wood (Norwegian University of Science and Technology, Trondheim)

The Other 10% - The Contribution of Minor Developing Nations to the Environmental Footprint of Trade: Analysis of MRIO Results and Methods to Complete Estimates of the Global Economy

Multi-Regional Input-Output (MRIO) are an important tool for analysing environmental impacts of production and consumption taking into account regional differences in production techniques. Hereby most emphasis is placed on covering most of global GDP and in the utilisation of high quality data. The remaining countries are sometimes aggregated into a so called rest of the world (RoW) section. Despite their minor share of the global GDP, the RoW plays an important part in providing resources to the global production chain. Consequently, estimated environmental footprints of trade heavily depend on the accuracy of data in the RoW.

Here we examine the contribution of the RoW through three completed projects (EXIOPOL,WIOD and GTAP/OPEN-EU project) which provide different levels of detail in representing RoW. This reveals the importance of providing regional detail in the RoW and the impact of using different methodologies in order to cover the unavoidable data gap.

We present an approach utilising a range of expected coefficients (production recipes), estimated industry output, and balancing techniques to estimate the RoW supply and use tables. Expected coefficients can be taken from one single model country or different representative countries for each industry sector, resulting in different estimates for the environmental impacts. We assess the quality of assumptions by analysing various parameters from the balancing routine. Finally we analyse methods to split between domestic and foreign demand on RoW production, as this is key to

the relative level of assignment of environmental impact to trading partners.

Kjartan Steen-Olsen (Norwegian University of Science and Technology, Trondheim), Anne Owen (University of Leeds), Edgar G. Hertwich (Norwegian University of Science and Technology, Trondheim) and Manfred Lenzen (University of Sydney)

Effects of Aggregation in MRIO-based Environmental Accounting

MRIO-based assessments carry inevitable limitations in terms of product detail, stemming from the data intensive top-down nature of the modeling approach. In the last few decades, harmonization of statistical data collection and advances in the computational capabilities of standard desktop computers has spurred efforts to compile increasingly detailed MRIO tables. Recently, a handful of research groups have constructed global MRIO models at various levels of sectoral and regional detail. The existence of a set of global models presents analysts with an unprecedented opportunity for comparison. In this paper we assess some global MRIOs, studying how model aggregation may affect analysis results by analyzing these models in their full versions as well as in a harmonized system that allows for comparisons between the different systems. Most environmental MRIO analyses today are based on one of the models assessed here, and through this comparison we aim to achieve a better understanding of the robustness of the results of such analyses.

Albert Steenge (University of Groningen)

Miyazawa's Income Distributions

This paper belongs to the special session on Miyazawa, organized by Hewings and Steenge.
Miyazawa's work on the endogenization of household categories has become very well-known, and has become the standard for much of the literature in this area. It included the analysis of a new type of income multiplier matrices with complex forms of crossover-effects, which without difficulty translate into categorization and standardization into direct, indirect and induced multipliers. Subsequent work by later scholars involved extensions to cover inter- en multiregional issues, and into novel forms of economic-demographic interaction.
In this presentation we concentrate on an aspect of Miyazawa's work that has received relatively less attention over the years. We show that it also fits in with a line of scholars investigating income distributions via specific types of endogenization processes. We provide a brief historic survey and position it in a line of pioneers and earlier writers such as Charasoff, Sraffa and Leontief, among others. We discuss the basic principle involved, Miyazawa's contribution, and a later formalization.

We present a number of numerical illustrations.

Albert Steenge (University of Groningen) and Richard van den Berg (Kingston University, London)

Tableaux and Systèmes: Early French Contributions to Linear Production Models

François Quesnay's Tableaux Economiques of the late 1750s and 1760s were the first attempts at the formal modelling of processes of circulation and reproduction in an economy. They have often been recognised as precursors to later linear production models, but also exhibit a number of properties that are less commonly found in modern models.

Less well known than Quesnay's contributions are the systèmes des richesses developed one generation later by the engineer Achilles Nicolas Isnard. While preserving some of the basic conceptions of the Tableaux, Isnard's constructs were also conceived as a tool to criticise the doctor's economic views. In fact, in some respects Isnard's models are more 'modern' than the Tableaux, but also have some unusual properties. Our paper reconsiders the similarities and differences between the models of these two pioneers in the light of the modelling choices and economic conceptions of later contributors to the history of linear production models.

Perhaps the most fundamental communality between the models of Quesnay and Isnard is that both depict the economic system as one of social reproduction-with-a-surplus. However, there are a number of specific differences that may be explained by a variety of factors.

One obvious formal difference between the contributions of Quesnay and Isnard is that the doctor's approach to the representation of circulation and reproduction is pictorial. In contrast, the engineer uses simultaneous equations (the equations describing exchange have an algebraic form and are used for a general demonstration of the concept of market equilibrium; the production equations use arithmetical examples).

Another formal difference is that while in the Tableaux it is very hard to distinguish between physical and monetary quantities, Isnard consciously chooses to make this distinction both in his analysis of 'exchange' and of 'production'. It is a choice that has faced many later theorists history of linear production models too.

One explanation for this second difference is that Quesnay's orientation was more 'empirical'. That is to say, he was concerned with (a stylised version of) the actual French economy. In comparison, Isnard's approach is more abstract, in that he does not aim to depict the French, or any other, actual economy.

Isnard is instead more interested in a different dynamic, namely the interplay between market prices, reproduction, and the distribution of the surplus. This requires him not to 'fix' relative prices (as do Quesnay, and later for example Leontief [see Steenge and van den Berg 2001]). Prices are

determined in 'the market' (regardless of costs of production) and then imposed on production. This approach is flexible not only in the sense that the surplus can have an 'infinite' different number of distributions (and hence is not associated with one sector only), but also in the sense that the distinction between prices forming in the market and the recovery of costs made in production depicts the actual sequential and repetitive adaptive dynamics of a market economy.
In conclusion, the models of Quesnay and Isnard were intended for the demonstration of different aspects of the general phenomenon of economic reproduction. As will be shown, the rich possibilities of their models are reflected in the fact that different elements were adopted or dropped by later theorists in the history of linear production models.

Robert Stehrer (Vienna Institute for International Economic Studies WIIW)

Accounting Relations in Bilateral Value Added Trade

The increasing integration of economies due to international fragmentation of production is investigated by applying indicators and methods which are widely used for a country's total trade at the level of bilateral trade.
This allows for a neat discussion on how these indicators are related to each other, the role of double counting in trade, and how these aggregates up to a country's total trade performance.
The latter aspect is particularly useful in showing that a country's overall net trade in gross terms equals its net trade in value added terms though this differs in bilateral terms.
Using the recently compiled World Input-Output Database (WIOD) selected results on value added trade comparing the indicators for EU-27, US, and China both in bilateral relations and the respective aggregates over the period 1995-2011 are presented.

Bryn Stott (Institute for Global Environmental Strategies, Hayama) and Xin Zhou (Institute for Global Environmental Strategies, Hayama)

An Impact Assessment of China's Renewable Energy and Efficiency Targets using Multiregion Input-Output Analysis

As in most areas of the world, China's strong willingness to support the development and deployment of renewable energy can be attributed not only to motivations regarding climate change but to those concerning sustained economic growth, green jobs and energy security. Since the early 1980s the Chinese government has implemented multiple policies aimed at promoting the domestic production of renewable energy. In recent years investment into this sector has greatly increased. In

2011 China invested US$51 billion in renewable energy – with photovoltaic solar panels (PV) and wind power technologies receiving by far the largest proportion: 87.7% or $39.6 billion of total investment. Targets for total renewable energy consumption under the current 12th five-year economic plan (12-FYP: 2011-2015) are set at 478 million metric tonnes of coal equivalent, representing around 9.5% of the overall energy consumption mix by the end of 2015. Subsequently this national target has been allocated regionally within China as provincial quotas. In assuming that regional targets are met, this study offers a detailed analysis of the regional impacts of China's Renewable Portfolio Standard as well outlining a number of international implications. Specifically the following are addressed: 1) how can investment in renewables drive upstream growth in employment and economic output? 2) what are the implications of a new energy mix for international trade? 3) what will be the change in China's national carbon emissions? Selected due to its suitability in describing the distribution of an industry's product throughout an economy, multi-regional input-output (MRIO) analysis is the principle method used. In accordance with the number of provinces in receipt of renewable energy targets, a MRIO table organises China into 30 regions and disaggregates each provincial economy into 38 industries. China's original MRIO table aggregates the energy industry into one sector however within this study the sector is disaggregated into eight sub-sectors of primary energy sources (coal, natural gas, crude oil products, nuclear, hydroelectric, wind, solar and biofuels). It is expected that if the targets set by the Renewable Portfolio Standard are achieved, then there naturally would be a relative reduction in carbon emissions – but that these alone would not be sufficient to meet China's emission intensity target of 17% by 2015 (compared with 2010 levels). Furthermore, given the level of investment required to increase the proportion of renewables, it is also probable that job opportunities, directly and indirectly related to the renewables sector, would result. As well as employment, increases in output are foreseen for those upstream and downstream industries connected to the renewables sector. However, a contraction in the growth of industries reliant on coal is anticipated, as is an increase in coal exports (ignoring price dynamics).

Mikio Suga (Hosei University) and Kozo Miyagawa (Keio University, Tokyo)

Skyline Analysis for the Japanese Regional Tourism Economy

This study draws skyline charts using input-output tables and tourism statistics to clarify the characteristics of industrial structures in Japan's regional tourism economies.

As developed by Wassily Leontief, skyline analysis defines the relationship between a nation's industrial structure and its stage of economic development. Through this method, Leontief (1963) demonstrated that developed countries are generally able to meet domestic demand on their own,

while less-developed countries import many goods while primarily exporting natural resources or light industry products. Our research applies skyline analysis to tourism-related industries to reveal the relationship between regional industrial structures and the development of regional tourism economies.

The skyline analysis utilized in this research differs from general skyline analysis in the way that the chart describes the industrial structure of the regional tourism economy. In order to describe sectoral self-sufficiency ratios and the trade structure, skyline analysis typically estimates productions for domestic final demand, domestic productions for exports, and productions assuming that all import goods have been produced domestically by multiplying Leontief inverse matrices by the vectors of domestic final demands, exports, and imports. In this model, however, the domestic final demand vector, the export vector, and the import vector in the Leontief's model are replaced respectively by the consumption of domestic tourism vector, the consumption of inbound tourism, and the imports generated by the consumption of domestic tourism and inbound tourism. By applying this newly developed method for analyzing the structure of the regional tourism economy to Japanese prefectural data, this study helps determine the various structural characteristics needed to promote the development of regional tourism economies.

Sangwon Suh (University of California at Santa Barbara)

Environmental Impact of Trade: A Critical Appraisal

Studies on environmental impacts of trade have received tremendous attention in recent years, and many of these studies are using input-output framework. There are, however, a number of different perspectives that can be taken in quantifying the amount of environmental impact that can be ascribed to international trades. Quality of underlying environmental and economic data is another issue that needs an attention. In this presentation, I will review some of the major studies on environmental impact of trade, and analyze how different perspectives can be taken in these analyses. The question on data quality will also be discussed. In the end, the question on whether international trades are good or bad for the environment is a complex one that needs a scrutiny from multiple perspectives. The analysis can serve as a food for discussion on the role of international trade in global environment.

Ya-Yen Sun (National Cheng Kung University, Tainan City) and Stephen Pratt (Hongkong Polytechnic University)

The Economic, Carbon Emissions and Water Impacts of Chinese Visitors to Taiwan: Eco-Efficiency and Long-Term Impact Evaluation

The tourism sector has an important place in the society, given its global economic and social value, and its role in sustainable development. The World Tourism Organization (2004) proposed 12 baseline issues and indicators to monitor and evaluate the sustainability level within each destination. Among these, economic benefits of tourism, energy and carbon management, and water availability and conservation are the top three important components that are closed linked with national and regional sustainability. The purpose of this study is to provide an evaluation that takes into account the economic impacts, the energy consumption, the carbon footprint and the water footprint of inbound tourism in Taiwan. An environmental Input-Output Model is applied to evaluate the economic contribution and the natural resource requirement for the international markets in Taiwan by nationality and travel purposes. The result not only serves as a macro-economic approach to study the relationship between industry, tourist behavior, energy use, CO2 emission and water consumption but also to evaluate the long-term economic and environment influences that alternative policies will generate by 2016. While each country wants to position themselves as the choice destinations for the inbound tourism in pursuing for additional economic receipts, our study hopes to provide a balance perspective regarding the natural resource input and waste output for sustaining rapid tourism development.

Pongsak Suttinon (Kochi University of Technology), Nattakorn Bongogochgetsakul (Kochi University of Technology), Kotomi Uemoto (Kochi University of Technology), Seigo Nasu (Kochi University of Technology) and Takeo Ihara (Chubu Region Institute for Social and Economic Research, Nagoya)

Water Policy Impacts Evaluation System under Climate Change for River Basin Management: Interregional Input-Output Model

This paper proposes the use of interregional input-output (IRIO) table as a tool to evaluate water policy impacts for river basin management under climate change. The developed IRIO table combines economic information in monetary term and water demand in physical term to meet each economic activity through a shared structure, and a set of definition and classification. This enables the system of interaction between water and economy such as development of manufacturing products, requiring extensive use of water resources as input in production process. Water demand

illustrated in IRIO table is enumerated by combining economic-based water consumption and water for household purpose. However, the future water supply to meet both consumptive water demands greatly depends on climate change impacts. In this paper, rainfall and discharge in targeted river basin are calculated using GCM climate scenarios of SRESA1b for the years 1982-2000 and 2046-2064. Water policy evaluation system is developed to show policy impacts on water deficits in not only of physical issues of number of days and size of shortage, but also of monetary issues as cost and benefit from each water policy. The calculation results are compared in case of with and without water policies to show the water policy impacts. The application methodology for water policy evaluation system is illustrated through the case of balancing water supply in an extreme case of drought base year 2005 with future climate change impacts, and water demand with future economic targets and population structure in Yoshino river Basin, Japan. The paper indicates that IRIO model provides a tool that allows decision makers to accurately evaluate impacts from water policies with consideration of future uncertainties of water supply and demand under conditions of climate change. Policy makers can make rational investment decisions by reducing risks and optimizing socio-economic benefits.

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Koji Takase (Shizuoka University) and Yasushi Kondo (Waseda University, Tokyo)

An Analysis of Consumer Behavior Including Waste Discharge and Time-use

Considering our daily life, consumer behavior includes several activities. For example, transportation, eating, laundry, spending leisure time, and even separating garbage are the components of the household consumption. To achieve some purpose, sometimes there are alternative modes. Transportation, for example, can be carried out by car, by train, and even on foot. Some modes are relatively more time-consuming and less expensive, and the others have the different attributes. In terms of the environmental loads, some modes are environmentally friendly while the others are not. Thus, in addition to the monetary aspects of consumer behavior, growing attention is made to the time use perspective in the literature. In our analysis, we will propose the concept of a consumption “technology” and developed an integrated analytical model which considers both income and time use of the consumer behavior.

The so-called rebound effects are well recognized in the literature on energy economics and industrial ecology, and such effects should be properly taken into account in analyzing consumer behavior (Hertwich (2005) JIE, among others). Takase, Kondo and Washizu (2005, JIE) have

extended the waste input-output (WIO) model to take account of the income rebound effect, that is, the rebound effect due to spending money left over by a consumer's environmentally friendly activities. Jalas (2002, Ecol. Econ.) has discussed a time use perspective on the consumer behavior and taken account of the time rebound effect, that is, the rebound effect due to making use of the time left over. In our integrated analytical model considers both income and time rebound effects, simultaneously.

The model is developed by integrating existing ones. One is the environmentally extended input-output model for evaluating the environmental loads for each consumer products. The other component of the newly developed model is an economics model of consumer behavior within the constraints of limited income and time based on the concept of the consumption "technology," a notable feature of which is similar to the idea proposed by K. J. Lancaster, R. F. Muth, and G. S. Becker in the 1960s. In the consumer model, given prices, income and time, consumers are assumed to choose their activity levels of various consumption "technologies" which maximize their utility. A consumption "technology" in the model is expressed as a set of goods and time necessary to achieve some purposes, such as eating and transportation. By connecting these models, we can evaluate environmental loads induced by products required for each consumption "technology." The model will be applied to the scenario analyses, evaluating environmental loads induced by alternative consumption patterns.

Raymond R. Tan (De la Salle University, Manila), Kathleen B. Aviso (De la Salle University, Manila), Michael B. Promentilla (De la Salle University, Manila), Krista D. Yu (De la Salle University, Manila) and Joost R. Santos (George Washington University, Washington DC)

A Fuzzy Linear Programming Model for Allocation of Inoperability in Industrial Networks Caused by Loss of Natural Resource Inputs

The inoperability input-output model (IIM) was recently been proposed as an extension of conventional input-output analysis for assessing the vulnerability of interdependent infrastructures to various perturbations, such as natural disasters, industrial accidents and deliberate attacks. IIM framework makes use of a dimensionless risk metric called inoperability, which quantifies the degree of failure of a system on a scale ranging from 0 (normal state) to 1 (total failure). This inoperability is then assumed to propagate through any given industrial network in a linear manner after being induced by initial demand or supply-side perturbations. This work presents a fuzzy linear programming (FLP) model to allocate inoperability in a complex industrial networks caused by a loss of natural resource inputs. Such losses may either be "rapid-onset" (e.g., seismic events) or "slow-onset" (e.g., climate change). The model seeks to maximize the dimensionless variable, □,

which modulates the distribution of inoperability across the sectors, as governed by input-output relationships and a priori inoperability limits for each of the sectors. We illustrate the use of this model with a simplified case study based on Philippine data. In this scenario, it is assumed that loss of natural resources vital to agricultural activities causes a disturbance in biofuel production, which in turn propagates through interdependencies to cause losses upstream and downstream of this sector.

Zhipeng Tang (Chinese Academy of Sciences, Beijing), Weidong Liu (Chinese Academy of Sciences, Beijing), Fangyi Li (Chinese Academy of Sciences, Beijing) and Peiping Gong (Chinese Academy of Sciences, Beijing)

A Study of Eight Regional Average Spatial Distances of Value Added and Carbon Emissions Indirectly Affected by Chinese Exports

Export has become the main driver of economic growth in China since China's reform and opening-up. In constant 2005 prices, Chinese exports kept an average annual growth rate of 15.8% from 1981 to 2010, which is 5.6% higher than China's GDP growth rate during the same period. This study focused on the eight regional domestic influential ranges of value added and carbon emissions affected by Chinese exports from 1997 to 2007. Firstly in terms of interregional input-output model, the indirect value added and carbon emissions of all the regions were calculated, which are affected by their exports. Then the spatial distances of these regional are defined based on the locations of provincial capitals, the average spatial distances of value added and carbon emission of eight regions in China are calculated and analyzed, which are indirectly affected by their exports. Finally, a set of regional policies and suggestions are discussed.

Cagatay Telli (Ministry of Development, Ankara) and Sefa Cavdaroglu (Ministry of Development, Ankara)

The Flow of Funds Methodology: A County Case Study on Applications and Analysis from Turkey

The mainstream indicator systems and conceptual thinking, failed to foresee the gravity of the looming crisis of 2008. Instead, analysts kept talking about the wisdom of deregulation and financial globalization which had swept away the credit risk.

The recent policy dialogue highlighted the need for close and better monitoring of financial stock positions and flow of funds in the economy both at national and international levels. A particular concern is drawn upon the issues such as the role of financial intermediation, balance sheet effects,

the degree of sectoral and institutional leverage, the vulnerabilities of domestic economies to shocks, and the importance of international financial network connections.

In this study, firstly we explore how inter-sectoral financial flow of funds accounts (FFA) of Turkish economy is generated. Compilation of flow of funds system over a developing economy, where statistical systems mostly work under imperfect conditions and data quality and availability are of great concern, is a highly complex and difficult process. In this regard we think that our study provides a valuable hands-on experience on flow of funds methodology for both practitioners and development economists. Compilation techniques, aggregation and disaggregation modules, conceptual and practical challenges faced are explained in detail in order to provide a common understanding among experts of the field. Secondly using flow of funds system we develop some policy analysis of complex issues such as financial stability and financial security.

Umed Temurshoev (European Commission, JRC-IPTS, Sevilla) and Jan Oosterhaven (University of Groningen)

Analytical and Empirical Comparison of Policy-Relevant Key Sector Measures

We consider ten widely used key sector measures (linkages) and identify groups of the most similar indicators on both analytical and empirical grounds. We derive new closed-form formulas for the generalized complete and incomplete hypothetical extraction linkages and add the up till now undefined forward counterpart of the net backward linkage.

The analytical relations and some stylized facts enable us to formulate hypotheses about the direction and strength of the relationships between various linkages. To study policy-relevant measures, our empirical tests are based on income linkages, CO2-emission linkages and employment linkages for 34 industries and 33 countries. They show that the information on the ten key sector measures may be summarized by three or four measures.

Thijs ten Raa (Tilburg University)

Performance Measurement in an Input-Output Framework

This paper fruitfully combines two complementary theories: performance measurement and input-output analysis. Our point of departure is the theory of the consumer, who maximizes utility subject to a budget constraint. His well-being can be measured by the change in the consumption bundle, valued at constant prices. Input-output analysis is invoked to impute the change in this bundle to technical change, a terms-of-trade effect and two types of efficiency change. The analysis

is extended to environmental economics.

Thijs ten Raa (Tilburg University) and José Manuel Rueda-Cantuche (Pablo de Olavide University, Sevilla)

The Problem of Negatives in Input-Output Analysis: A Review of the Solutions

Many economic models (e.g. computable general equilibrium models, econometric input-output models) revolve around a matrix of technical coefficients. However, these matrices can be estimated only once every five years as long as they are calculated from input-output tables and these are only published on a 5-yearly basis. Alternatively, use and make (or supply) tables are being regularly published on a yearly basis. However, they need to be converted into input-output tables as a previous step to form the matrix of technical coefficients. In doing so, this paper aims to shed light on the construction process of input-output tables and to guide economic modellers in making a decision on the way to make such conversion and how to deal with the subsequent problems, particularly with negative technical coefficients.

Mun-Heng Toh (National University of Singapore)

Using Input-Output Techniques and Data Envelopment Analysis to Evaluate the Economic and Environmental Resource Usage of Singapore Industries

In this paper, the main purpose is to evaluate the performance of industries based not only on economic variables like value-added, exports and employment, but also on environmental resources (such as energy and water) consumed in production. It is a situation of measuring performance when there are multiple outputs and multiple inputs. Input-Output Technique is used to provide several measures direct and indirect usage of resources by industries. Data Envelopment Analysis (DEA), a linear programming based method, is then used to derive the efficiency index that will compare each industry to the best practices in the economy. The results from the DEA enable suggestions to be made for 'inefficient' industries to strive for economic and ecological efficiency.

Satoshi Tsuchiya (Tottori University), Yuya Kitano (Tottori University), Keishi Tanimoto (Tottori University) and Hirokazu Tatano (Kyoto University)

Global Economic Impact Analysis due to Malfunction of International Ports: Spatial Computable General Equilibrium Approach

This paper develops a methodology to analyze the global economic impact due to malfunction of critical infrastructure, especially international ports. The model consists of an international SCGE model and intra-regional overland transportation network model. As a case study, the impact due to a malfunction of Nagoya port is estimated. It is revealed that the production of goods in Japan decreases in most sectors. However, the economic loss strikes not only the affected country but also other countries especially those which have close ties with Japan. Moreover, it results in the change of world trading network and also the shift of productive factors from the affected country to other countries. Also, the difference of outputs from modeling districts in one country is considered as a sensitivity analysis in wider sense.

Masako Tsujimura (Keio University, Tokyo) and Kazusuke Tsujimura (Keio University, Tokyo)

Foundations of Flow-of-Funds Based National Accounting

In April 2009, in the midst of the financial crisis and global recession, the Group of Twenty (G-20) finance ministers and central bank governors called for exploration of information gaps and provide appropriate proposals for strengthening data collection. In response, International Monetary Fund (IMF) and Financial Stability Board (FSB) recommended to develop a strategy to promote the compilation and dissemination of the balance sheet approach, flow of funds, and sectoral data more generally. It is well known that it was Morris Copeland who systematically drew the ground design of the money-flows accounts (MFA), or flow of funds accounts as we now call it. Although the term “flow of funds” implies the use of a time dimension associated with movement, spending, and consummation of transactions, the present-day flow of funds accounts, as the consequence of the drastic remodeling by the Fed in the 1950s, covers only the creditor-debtor relationship rather than the more general payer-payee relationship. The objective of this paper is to reconstruct a truly flow-of-funds based national accounting system. Among five alternatives, historical cost accounting has the most relevance to the flow-of-funds based national accounting because the book value of the assets and liabilities are the amount of funds that have changed hands in the acquisition process. The system is entirely founded on the Roman law concepts of jus in rem and jus in personam and the quadruple entry system. It is expected that this system will ultimately enhance the understanding of economic bubbles and other phenomena that relate to both real and financial economy.

Makiko Tsukui (Tokyo International University), Shigemi Kagawa (Kyushu University, Fukuoka), Ryoji Hasegawa (Osaka International University) and Yasushi Kondo (Waseda University, Tokyo)

Repercussion Effects of Final Consumption on Production and Environmental Loads in the 47 Prefectures of Japan: Multi-regional Waste Input–Output Approach

Final consumption in a particular region directly and indirectly affects not only economic benefits (production, employment, etc.) but also environmental loads (CO2 emissions, waste generation, etc.) in other regions through spatial economic interdependence. Thus total, combined direct and indirect, environmental loads, which are called consumption-based emissions, have been studied by many researchers (e.g., Peters and Hertwich, 2008 for trade-induced emissions). The role of international trade on the greenhouse gas emissions of countries has been well understood through the empirical investigations. However, the role of interregional trade on waste generation and greenhouse gas emissions of cities has not been well understood due to lack of basic input-output database. For this paper, we compiled a 2005 multi-regional waste input–output table for the 47 prefectures of Japan; prefectures are the first-level administrative subdivisions of Japan, and their populations vary from about 600 thousand to 13 million. Using this table, we will discuss the interdependence between prefectures in terms of final consumption, production and waste generation. We will also investigate increases in environmental loads, such as CO2 emission, landfill usage, and transportation of waste between regions. The results would clarify the difference between regions in which tertiary industries are dominant, such as the Tokyo metropolitan area, and regions especially in which the main industries are primary or second manufacturing industries. From the results, we argue how the metropolitan lifestyle has affected the greenhouse gas emissions and waste generation in rural areas and vice versa.

Arnold Tukker (Netherlands Organization for Applied Scientific Research TNO, Delft)

CREEA – Compiling and Refining Environmental and Economic Accounts

The main goal of the EU FP7 CREEA project is to refine and elaborate economic and environmental accounting principles as discussed in the London Group and consolidated in the future SEEA 2012, to test them in practical data gathering, to troubleshoot and refine approaches, and show added value of having such harmonized data available via case studies. This will be done in the following priority areas, i.e. waste and resources, water, forest and climate change / Kyoto accounting. The project has a budget of around 3 Million Euro and is performed by many of the key institutes in Industrial Ecology in Europe: TNO, JRC IPTS, Leiden University-CML, Central Bureau of Statistics, NTNU, Statistika Centralbyran, University of Twente, ETH, 2-0 LCA consultants, Wuppertal Institute, SERI,

and the European Forest Institute

Most data gathered in CREEA will be consolidated in the form of Environmentally Extended Supply and Use tables (EE SUT) and update and expand the EXIOPOL database. In this way, CREEA will produce a global Multi-Regional EE SUT with a unique detail of 180 sectors and products (50 additional ones compared to EXIOPOL), 30 emissions, 80 resources, and 43 countries plus a rest of world.

A unique contribution of CREEA is we transform the IEA database to a global energy SUT, and use all kinds of physical data in conjunction with waste statistics and the mass balance principle to create a global physical SUT. This leads, to our knowledge for the first time, to an integrated global MR SUT that has economic, energy and physical layers.

The presentation will explain the approaches used for detailing and harmonization of country SUT, linking SUT via trade, and the approach for constructing the energy and physical MR SUT. Although we cannot guarantee we will make this deadline, in June 2013 a draft version of this database should be available and in that case the presentation also could include some basic case studies.

Arnold Tukker (Netherlands Organization for Applied Scientific Research TNO, Delft), Arjan de Koning (Leiden University), Richard Wood (Norwegian University of Science and Technology, Trondheim), Stephan Moll (European Commission, Eurostat, Luxemburg) and Maaike C. Bouwmeester (University of Groningen)

The Price Corrected Domestic Technology Assumption – A Method to Assess Pollution Embodied in Trade Using Primary Official Statistics Only

Environmentally extended input output (EE IO) analysis is increasingly used to assess the carbon footprint of final consumption. Official EE IO data are however at best available for single countries or regions like the EU27. This gives problems in assessing pollution embodied in imported products. The popular 'domestic technology assumption (DTA)' leads to errors. Improved approaches based on Life Cycle Inventory data, Multi-regional EE IO tables, etc. rely on unofficial research data and modelling, making them difficult to implement by statistical offices. The DTA can lead to errors for three main reasons: exporting countries can have higher impact intensities; may use more intermediate inputs for the same output; or sell the imported products for lower/other prices as those domestically produced. The last factor is relevant for sustainable consumption policies of importing countries, where the first factors are mainly a matter of making production in exporting countries more eco-efficient. We elaborated a simple correction for price differences in imports and domestic production using monetary and physical data from official import- and export statistics.

The method is applied on a case study for the EU27, using time series of the first available

consolidated EU27 EE SUT/IOT developed by Eurostat with help of the authors. We show that our method of a 'price adjusted DTA' gives a meaningful correction of pollution embodied in trade compared to one calculated using the DTA only. We compare our results to pollution embodied in trade with Europe as provided by authors using full MR EE IO databases (such as GTAP: Peters et al., Davies and Caldeira) and EXIOBASE.

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Eriko Ueno (Gakushuin University, Tokyo)

Assessing the Economic Impact of Defense Spending during Vietnam War Era on the U.S. Manufacturing Sector

This paper estimates the economic impact of U.S. defense spending during Vietnam war era on the U.S. manufacturing sector of the economy by using total transaction tables, direct and total requirements matrices, and industrial composition per dollar of purchases by final demand categories tables. The official 85 level U.S. input-output tables for 1963, 1967, 1972 and 1977 are integrated into 23 sectors based on the Standard Industrial Classification (SIC) system, which focuses mainly on the manufacturing sector of the U.S. economy. The column vector which represents the detailed descriptions of the composition of both military and civilian government final demand for the U.S. during Vietnam war is obtained from the official 85 level U.S. input-output table for 1972. The backward and forward linkages to indicate the strength of the relationship between defense spending and output are presented. The result of this paper presents that the Economic impact analysis in the I-O framework shows the butterfly effect of defense spending in the whole U.S economy. U.S. defense spending has affected on not only the defense sectors and related industries but also the non-defense industries such as agricultural, food kindred and textile industries.

Natalia Ustinova (Federal State Statistics Service of the Russian Federation, Moscow) and Irina Masakova (State Committee for Statistics of Russia, Moscow)

Compilation of the Intermediate Consumption of the Supply and Use Table Based on the Input-Output Survey for 2011: Russian Experience

In 2012, the Federal State Statistics Service conducted a sample survey of the cost of production in all sectors of the economy. The purpose of this survey was to obtain information for the compilation

of the benchmark Supply and Use table for 2011.
This paper deals with the Russian experience on the calculation of intermediate consumption of industries by products based on the input-output survey and other data sources used for compilation of SUTs. The paper contains some figures characterizing the results of this survey, describes the data sources, main steps and methods for the calculation of the intermediate consumption for different types of businesses. Description of techniques of the calculation of intermediate consumption is accompanied by examples of the process compilation.

V

Bart Van den Cruyce (Belgian Federal Planning Bureau, Brussels)

Estimating Interregional Trade Flows Using VAT Data, Some First Results for Belgium

The paper reports on the estimation of interregional trade flows within Belgium. Trade flows between the Brussels Capital Region, the Flemish and the Walloon Region are estimated at the industry level starting from Value Added Tax (VAT) data. The VAT data contain the year totals of sales between all domestic firms subject to VAT legislation. This allows to follow about 3/4 of the interregional trade flows. The remaining interregional trade flows are based on a regionalized Supply and Use table for 2007. The estimation of trade flows starting from administrative data poses all sorts of problems, including encoding errors in the data, the treatment of fiscal representatives and multiregional firms as well as the consistency with other regionalized variables like international imports and exports, value added, consumption and investment data. The focus of the paper is methodological. Some preliminary results are shown for the years 2000, 2005 and 2007.

Paul J.J. Veenendaal (CPB Netherlands Bureau for Economic Policy Analysis, The Hague)

Trade Redirection in Global Value Chains

Trade developments in global supply chains can be fruitfully analyzed with global input-output tables. Yet, an analytical framework is still missing that allows a full understanding of the similarities and differences between gross trade and value added trade. This paper presents such a framework. The focus of the empirical analysis is on redirected trade accounting where redirected trade is defined as the reshipment of intermediate imports to the final destination.
In its most basic form the framework describes a quadrangular trading scheme in which four

different types of countries are distinguished: the origin, the direct trading partner, the final output producer and the final destination. The origin exports to the direct trading partner, the final producer produces final output and the final destination uses the final output. Alternatively, these countries can be seen as the first country of the value chain (the origin), the second country of the chain (direct trading partner) and the last but one (final producer) and last country of the chain (final destination). The direct trading partner combines the imports from the origin with its own inputs to produce new output. If this new output is final output to be used abroad the direct trading partner happens to be a final producer which reships intermediate imports in the form of final output exports to the final destination. If the new output is final output to be used at home the direct trading partner happens to be a final producer and the final destination at the same time and the origin is redirecting the imports that it needed for its intermediate exports to the final producer. If the new output is intermediate output to be used as an input by a foreign final producer to produce final output for its own use, the direct trading partner is redirecting intermediate imports to the final destination. If the new output is none of these it will be sent to the third country of the chain and the four possibilities mentioned above will apply again for this trading partner. This is where the basic framework is extended beyond the quadrangular scheme and also the third, fourth, fifth, etc., country of the value chain become part of the analytical framework.

From the GTAP-datasets for 2001, 2004 and 2007 we construct global input-output tables in which 57 industries and 70 countries are distinguished. Recent developments in Global Value Chains are revealed via an analysis of the developments in trade redirection at the industry level. Both redirection of intermediate imports by the final producer and redirection by countries in their first, second, third, etc. position in the chain to final producers that also are the final users are distinguished. In other words, we reveal - at the industry level - all redirection of intermediate imports by the last but one country in the chain.

In addition we use the analytical framework to critically discuss some recently proposed measures that indicate Global Value Chain activity, in particular generalizations of the Hummels VS measure and measures of double counting.

Charles Vörösmarty (City University of New York) and Faye Duchin (Rensselaer Polytechnic Institute, Troy)

I/O Economic Models: Quantifying the Role of Earth System Dynamics

Whether explicit or implicit, issues of spatial and temporal scale pervade the earth system sciences. A broad spectrum of scales characterizes individual scientific disciplines as well as environmental applications, matched by an equally broad admixture of space-time resolutions crossing disciplinary

boundaries. This situation arises because of differences in the history and culture of individual disciplines, with unique nomenclatures describing experimental domains and methodologies: even when they address similar or overlapping problems, it is over decidedly different temporal and spatial domains. As a result, the micro scale means something radically different to a modeler of ocean currents than to a microbial ecologist. Long-term to a meteorologist means something completely different than the same word to a forest manager. As earth systems scientists begin to collaborate with economists, new kinds of challenges emerge for reconciling spatial and temporal scales.

Traditional earth science research has generally attempted to explain the functioning of individual components of the earth system (e.g., atmosphere, terrestrial ecosystems, watersheds) and created focused sets of measurements and experiments (e.g., temperature at a point, soil moisture with depth, trace gas emission from microcosm flasks, carbon density in a stand of trees) to test hypotheses made at finely distinguished, local scales. This approach is critical for understanding the inherent nature of processes at the level of detail typical of a single discipline. At the same time, single disciplines have also relied on coarser-scale models to place local-scale dynamics into broader perspectives, attempting to understand their potential interactions and synergies over larger space and time domains. These macro-scale perspectives seek to understand the dynamics of whole systems, and in the earth sciences this quite literally means whole continents if not the entire planet.

The intermediate or meso-scale has until now received far less attention. Yet it is at this intermediate scale that state variables and dynamics need to be defined to satisfy rising demands for actionable responses to integrated earth system science questions like how best to mitigate and adapt to climate change. Meso-scale perspectives become increasingly valuable provided that they can provide a level of tractable simplification inherent in the coarse scale based on a justifiable conceptual abstraction from the highly detailed process behaviors occurring at the fine scale.

This presentation reports our approach to resolving several scaling challenges and highlights the utility of the meso-scale for interdisciplinary environmental science modeling. We focus on the example of an ongoing study about the provision of ecosystem services using a linked regional earth system science and economic modeling framework. The component earth system models are now being integrated with an input-output model of the regional economy, selected for this project for its meso-level of detail. While many challenges remain to accommodate spatial and temporal units that are meaningful for all the models, the meso-level economic model facilitates a smooth overlap with the definitions of physical stocks and flows characteristic of the earth system models.

W

Kylia Wall (Australian Bureau of Statistics, Canberra) and Meagan Phelan (Australian Bureau of Statistics, Canberra)

Treatment of Margins within the Australian Input-Output Tables

The treatment of trade and transport margins is integral to the accurate representation of the flow of goods within domestic and world economies. Understanding the margins associated with trading and transporting products will empower statisticians and economists compiling and analysing Input-Output tables, and also assist policy makers in making well informed decisions on complex, cross-cutting issues. The aim of this paper is to identify each of the margins represented in the Input-Output tables compiled by the Australian Bureau of Statistics, and to clarify them within the Australian economic context. Treatment of these margins under the System of National Accounts 2008 (SNA 2008) and the UN Input-Output handbook will be discussed, and instances in which the Australian Input-Output Tables differ to these overarching frameworks are examined. The paper illustrates the Australian treatment of margins across a number of 'real world' scenarios, and highlights where Australian margins treatments and definitions sit within the context of similar I/O frameworks internationally.

Ayu Washizu (Waseda University, Tokyo), Keiichiro Asakura (Ryutsu Keizai University, Ryugasaki City), Satoshi Nakano (Hitotsubashi University, Japan) and Koji Takase (Shizuoka University)

Input-Output Analysis of the Introduction of Renewable Energy and Smart Grid Systems

We developed the new input-output table for analyzing the effect by renewable energy and smart grid systems spreading. In that table, we established the following renewable energy sectors; home photovoltaics, large-scale solar power system, wind power generation on the land and ocean, minor water-power generation, geothermal generation, electricity generation and heat use by biomass combustion facility and methane fermentation equipment. Furthermore some of activities of smart grid systems will be separated from ICT sectors and electric machinery sectors, and the other activities will be newly established.

Using the table, we analyze the economic effect at the time of achieving the renewable energy introduction aim in 2030 which an energy environmental meeting of National Policy Unit holds up.

Furthermore we analyze the effect which the following three energy systems will bring about.

(1) The system which can use photovoltaics effectively by suitable introduction of smart grid

systems (HEMS or BEMS) without performing output control of photovoltaics, and installation of an excessive storage battery.
(2) The wind power generation system accompanied by a suitable electric power system planning which can transmit electricity to the metropolitan area with much electricity demand from the good wind-power-generation appropriate place.
(3) The micro grid system of farm/fishing village which utilized minor water-power generation and biomass energy appropriately, and which made dependence to system electric power the minimum.
HEMS: Home Energy Management System
BEMS: Building Energy Management System

Kirsten S. Wiebe (GWS, Osnabrück)and Manfred Lenzen (University of Sydney)

To RAS or not to RAS – What is the Difference in Outcomes in Multi-Regional Input-Output Models?

Using environmentally extended multi-regional input-output models makes it possible to calculate consumption-based carbon emissions based on the data of production-based/territorial emissions. The Global Resource Accounting Model (GRAM), which is based on OECD data, is one of the currently applied models to calculate consumption-based carbon emissions. What differentiates GRAM from other state-of-the-art models in this field is that it does not use a matrix balancing technique, such as RAS, after setting up the global intermediate and final demand matrices. This choice was made to change the original data as little as possible. This simpler solution technique might however yield different results. The proposed research aims at identifying the difference between the current solution of GRAM and the solution of a RASed version of GRAM, thus contributing to the assessment of currently used methodologies in this research field.

Dominik Wiedenhofer (Alpen Adria University, Klagenfurt), Dabo Guan (University of Leeds) and Jan C. Minx (Potsdam Institute for Climate Impact Research, Berlin)

CO_2 Requirements of Consumption in China: Inequality between Income Levels and Urban/Rural Living

During the last decades a growing share of the population in China participated in rapid industrialization and strong economic growth. This was accompanied by increasing migration into the industrializing coastal areas and expanding cities, in search for higher incomes and the promise of an affluent lifestyle. At the same time a large proportion of the rural population is still living

below or close to the poverty line, most often prone to low economic prospects in their own regions. In recent years China also became the largest annual emitter of CO2 emissions, to a large extent driven by the massive growth of export oriented production. The extent to which Chinese households contribute and benefit from these trajectories as well as their impact on the environment are only partly known yet, especially regarding urban/rural differences and income disparities. A differentiation of rural and urban households by levels of income can generate very interesting insights into inequalities in CO2 emissions embodied in consumption.

This study builds on detailed data of the consumption patterns of Chinese households, for 5 rural and 8 urban household types, disaggregated by income levels, for 2007. Official Chinese Input-Output tables and fossil fuel related emissions statistics are used to estimate the CO2 requirements of household consumption. To also cover emissions embodied in imports we furthermore used the GTAP8 model. This approach allows us to estimate the fossil fuel CO2 requirements of household consumption for urban and rural households, taking into account different expenditure patterns and income levels.

Thomas Wiedmann (University of New South Wales, Sydney), Manfred Lenzen (University of Sydney), Joe Lane (University of Queensland, Brisbane) and Arne Geschke (University of Sydney)

The Collaborative "Mother" Approach to Compiling Large-Scale Multi-Region Input-Output Databases

Typically, every multi-region input-output MRIO application focuses on different research questions and therefore requires a good sectoral and regional resolution in different parts of an MRIO table. For example, studies of impacts on land and water resources require high detail in agricultural sectors, studies on employment require high detail in service sectors, and studies on biodiversity require high detail on some developing countries. Our literature review has shown that generally none of the existing MRIO databases caters to the widest possible variety of research needs, which is a result of teams compiling MRIO databases largely in isolation. The innovation of this work – using input-output frameworks through collaborative virtual laboratories – addresses this limitation by applying a new concept to MRIO compilation: the "Mother" approach. The basic idea of this approach is to construct one MRIO table (the "Mother" table) that caters to the widest possible variety of research questions, and from which all existing MRIO tables (the "daughters") can be derived.

The Mother approach to MRIO promises significant savings in terms of human and financial resources because of its collaborative nature, timely deployment because of automation, comprehensive and detailed tables because of the combined input form multiple teams, and

flexibility in sector representation because of the inclusive mother-daughter relationship. In addition, it provides harmonisation of fragmented, dispersed and mis-aligned raw data (an achievement long overdue at least in Australia), and consistency of outputs because users utilise common analytical tools.

Jidong Wu (Beijing Normal University), Ning Li (Beijing Normal University) and Wei Xie (Beijing Normal University)

Physical Damage and Economic Consequences of Climate Change on the Coastal City Areas of Shanghai, China

Coastal cities, characterized by densely population and economic activities, are vulnerable to climate change, i.e. the effects from sea level rise and storm surge. Scenario analyses provide a useful way for modeling the potential effect of the climate change risk. Shanghai is a low-lying city, and also as China's most developed city, is sensitive to climate change. Considering the change of future hazards (i.e., sea level rise, extreme precipitation, land subsidence, and storm surge), economic exposure and vulnerability of assets, physical damage and economic losses of climate change on Shanghai in 2030, 2050 and 2100 are estimated. A regional input-out model is used to modeling the economy recovery post-disaster and evaluating the economic losses of extreme climate events, i.e. floods. Physical damage and related ripple effects to the whole economy are profound, especially in 2100. Estimates of changes in losses from floods due to climate change are given, the contribution from increasing exposure and value of capital at risk to future losses is likely to be the same of the contribution from climate change in 2050. The tradeoffs between engineering defensive measures expenses and sustainable development outcomes will challenge the current disaster risk management pattern. In confronting with the climate change risk, more efforts are needed to improve the quality of the future projections about hazard, exposure and adaptation efforts, and also needed to pay attention to the uncertainty risk related to multi-hazard amplification effect.

X

Weibo Xing (University of International Business and Economics, Beijing), Shantong Li (Development Research Center of the State Council, Beijing) and John Whalley (University of Western Ontario, London)

China's Interprovincial Trade and Domestic Market Integration: An Analysis Based on Provincial Input-Output Tables 1997-2007

Interregional trade reflects the degree of China's internal market integration. In the theory of trade, Gravity Equation is generally used to analyze interregional trade patterns and border effects, which is difficult to quantify. With inter-provincial trade flow data, which is estimated from the provincial input-output tables of China in 1997, 2002, and 2007 respectively, this paper uses Gravity Equation to estimate the provincial trade pattern and border effect in China. The empirical results show that the Gravity Equation can characterize the Chinese inter-provincial trade; while the large border effect also reflects there is a big home bias in the intra-national trades. In addition, this paper also estimates China's internal border effect at industry level. Finally, the sensitivity tests point out that the specification of internal trade distance is very important.

Daju Xu (Shandong Jiaotong University, Jinan), Kuishuang Feng (University of Maryland, College Park) and Klaus Hubacek (University of Maryland, College Park)

Structural Decomposition Methods: A Comparative Analysis

Structural decomposition analysis (SDA) generally refers to decomposition analysis based on input-output (IO) analysis. It is frequently used to analyze changes in resources use or environmental pollution and identify the key driving forces for change over time. Many methods are used for SDA. However the results of the analysis are dependent on the type of SDA used. Thus the aim of this paper is to show that, if every factor changes very small, then the commonly used methods, such as two polar decomposition, the average of two polar decomposition, the average of all elementary decompositions, and Montgomery decomposition, are close to each other. In addition, from the solution of a linear equation of n variables point of view we point out that the number of decompositions is infinite. Apart from the two 'ideal' decompositions, which means that it satisfies the requirement of factor reversal imposed in index number theory, complete decomposition and Montgomery decomposition, we give infinite other ideal decompositions. Finally, this paper provides an empirical example using data on China's carbon emissions.

Yan Xu (University of Groningen), Erik Dietzenbacher (University of Groningen) and Bart Los (University of Groningen)

International Trade and Net Damages of Air Pollution in the United States

This paper measures the net benefit/damage from air pollution in the United States through international trade in the year 2002. Using the industrial level marginal damage in the US, we estimate how much dollars of damages from US air pollution are reduced by importing from the other countries (i.e. relocation of pollution) and how much dollars of damages are increased by consumers outside of the US. The contribution of this study is transforming the environmental effects of trade from tons of various pollutants into values in dollar. With this transformation, the total effects could be estimated by adding values of net benefit/damage for each pollutant. There are six pollutants involved in this study: NOx, SOx, VOC, NH3, PM2.5 and PM10. Marginal damages in each sector are estimated by an integrated-assessment model from Muller and Mendelsohn (2009). A multi-regional input-output (MRIO) model quantifies the international trade between the US and the other 40 countries/regions (39 countries and a rest of the world). Trade flows in intermediate and final products are distinguished, with country and sector specific trade flows obtained from the World Input-Output Database (WIOD).

Y

Norihiko Yamano (OECD, Paris) and Bo Meng (Institute for Developing Economies-JETRO, Chiba)

Re-measuring Comparative Advantage in Global Value Chains: An International Input-Output Approach

Given the increasing presence of fragmentation production and vertical specialization trade in global value chains, the gross-export-based indicator of Revealed Comparative Advantage (RCA) can no longer reflect the reality of relative advantage of a certain country in international trade. This paper uses the input-output based concept of "Trade in Value-Added" to propose some alternative indicators for measuring a country's "real" RCA. Using the OECD input-output data for 1995 to 2009, our proposed RCA indicators show not only a country's comparative advantage in terms of its ability of value-added creation, but also its location attractiveness for foreign firms in global value chains. In addition, using the bilateral RCA indicator newly proposed in the paper, we also show

how the border effect and physical distance still impact on a country's selection of international procurement activities.

Masato Yamazaki (Nagoya University),Yoshinori Sone (Nagoya University), Atsushi Koike (Nagoya University) and Kazuhiro Tatano (Nagoya University)

Economic Restoration after a Natural Disaster: A Computable General Equilibrium Study

This study aims to explore the pattern of economic restoration after a natural disaster using a multi-regional recursive dynamic computable general equilibrium model. The model divides Japan into eight regions, with 23 industries in each region. A natural disaster is modeled as an exogenous decrease in the stock of capital. The process of economic restoration is modeled as capital accumulation in the damaged area through investment. Household savings are the available source of the investment.

The simulation study examines two factors influencing the economic restoration of a damaged area, the substitutability between regional supplies and capital mobility across regions, and shows that both factors have a relatively large impact on the pattern of economic restoration. Based on the simulation study, low substitutability between regional supplies increases the value of capital stock remaining in the damaged area. As a result, household income in the damaged area increases, leading to vigorous investment for economic restoration. Capital mobility across regions, allowing investments to flow into the damaged area, accelerates economic restoration. However, economic growth in non-damaged areas slows down with the correspondingly lower investments there. Through parametric studies, this study also shows the range of substitutability of regional supplies and capital mobility that leads to a significant impact on economic restoration.

Devrim Murat Yazan (University of Twente, Enschede)

Environmental Performance of Biorefinery Supply Chains

Bio-refineries have gained increased attention by the recent technological improvements on bio-material and waste energy recovery. In particular, advancements in lingo-cellulosic waste processing helps feedstock cost reduction in second generation biomass markets.

This paper firstly aims at measuring and evaluating the environmental contribution of recent technological improvements in bio-refineries from a supply chain perspective. In particular, the benefits of loop-closing on bio-materials and waste energy are computed.

Secondly, this paper investigates whether a self-sustainable bio-refinery supply chain can be

designed according to an internal equilibrium between energy use and consumption within the chain. An enterprise input-output (EIO) model is adopted to trace the flows of materials, energy, and wastes and to compute the environmental performance of each scenario. In addition, EIO model proposed serves as a material planning tool for companies involved in bio-refinery chain since it also evaluates the returns of secondary wastes.
Results of this paper are expected to contribute to the design and environmental efficiency problems of bio-refineries which are still not in desired levels.

Kiyoshi Yonemoto (Takasaki City University of Economics)

Input-output and Trade Structures of the Regions of Fukushima, Japan: Before and After the Disaster

The study explores the changes in input-output and trade structures of the regions of Fukushima prefecture, Japan, as a result of 2011 Tohoku earthquake, tsunami and the accident of Fukushima Daiichi Nuclear Power Station. The study is based on 2005 multiregional input-output tables of Fukushima prefecture and its extended version, which takes into the trades among regions, constructed by Yonemoto and Kanno (2012). According to the latest information on the effect of the disaster, trade coefficients (intra-prefectural) and import coefficients (inter-prefectural) are modified. Then, for several scenarios of recovery demands and policy interventions, total outputs and compensation for employees are calculated. Yonemoto and Kanno (2012) has found that, using the data released immediately after the disaster, the effect of an increase in the final demands of the devastated regions (on the entire prefectural economy) is larger than before, while the inverse (the ones of the other regions on the devastated regions) is smaller. Also, it has compared several policy instruments such as “public works,” “income subsidy,” and “assistance for utility sector.” Using new data released in two years after the disaster, the study is updated and new findings are to be shown.

Krista D.S. Yu (De la Salle University, Manila), Raymond R. Tan (De la Salle University, Manila), Kathleen B. Aviso (De la Salle University, Manila), Michael A.B. Promentilla (De la Salle University, Manila) and Joost R. Santos (George Washington University, Washington DC)

A Vulnerability Index for Post-Disaster Management

With the continuous effects of climate change, the number of disaster incidences has increased over the years, which inevitably leads to a disruption in the economy. Through the inoperability input-output model (IIM), the degree of failure in a system

can be quantified on a scale from 0 (normal state) to 1 (complete failure). This paper aims to develop an extension to the IIM by proposing a vulnerability index, which will provide policy makers with a tool on measuring the efficiency of the allocation of post-disaster funds. The vulnerability index aims to capture the impact of investments to various sectors in times of disaster in order to yield the maximum returns to the entire economy. A Philippine case will be used to illustrate the concept of the index.

Z

Biao Zhang (Chinese Academy of Sciences, Beijing) and Xiuli Liu (Chinese Academy of Sciences, Beijing)

Empirical Study on Driving Factors of Water Consumption Growth in China

The growth of water consumption in China between 1999 and 2007 is studied in this paper. We expand the classical IPAT model by combing with the structural decomposition analysis (SDA) to analyze the growing water consumption caused by water consumption coefficient, production structure, final demand structure, total final demand structure, population and the GDP per capita. Then we continue to study the impact of final demand on water consumption. Because the water conservancy input-output table in 2007 is yet to finish, now we just got the results from 1999 to 2002. The results are as follows: first, the GDP per capita is the largest driver for the water consumption increasing and the final demand structure is the largest driver for the water consumption decreasing; second, at the industry level the growth of energy of water consumption is mainly driven by the manufacturing industry, especial the heavy industry, though the agricultural water accounts for a significant proportion of total water consumption; third, the impact of export accounts for the largest proportion among consumption, investment and export. The complete results will be exhibited in the final full paper.

Haiyan Zhang (Rutgers University, New Brunswick) and Michael L. Lahr (Rutgers University, New Brunswick)

Chinese Household Energy Use from 1987 to 2007

China has achieved notable success in keeping near double-digit economic growth in the past two decades. The rapid GDP growth has been driven by exports and investment. Household

consumption's share of GDP is very low compare to many developed and developing countries. It accounted for just 35.6% of GDP in 2009, far lower than either the U.S. (71.1%) or India (57.5%). China's current investment- and export-led economy has caused a "lack of balance, coordination and sustainability" especially in the wake of the 2008 global economic crisis. Thus Beijing has been trying to boost domestic demand in an effort to recover from the nation's economic slowdown. If it is effective in this attempt, how will the economic structure change impact China's energy use? At part of an attempt to answer this question, this paper seeks to understand how changes in household consumption patterns during the past two decades have affected China's energy use. The structural decomposition approach is used to decompose energy used indirectly by households into six factors: changes in total population, changes in the urbanization rate, changes in energy efficiency, changes in sub-industrial structure, changes in household consumption structure, and changes in per capita household consumption. In doing so, this paper hopefully yields insights into how changes in China's technology, urbanization, and lifestyle have affected the amount of energy used to support households through their use of goods and services. Also, it provides policy suggestions on how China might guide such lifestyle change toward a low carbon economy as domestic demand replaces exports and investment as the main driver of China's economy.

Hongsheng Zhang (Zhejiang University, Hangzhou), Shuzhong Ma (Zhejiang University, Hangzhou) and Bo Meng (Institute of Developing Economies-JETRO, Chiba)

The Determinants of the U.S.-China Trade Balance: An Empirical Study Using the International Input-Output Based Measure of "Trade in Value-Added"

There has been great political and economic attention paid to the long term trade imbalance in the U.S., and particularly to the bilateral trade deficit with China. In this context, identifying the determinants of the U.S.-China trade balance has been a key issue for policymakers on both sides. However, in most existing studies, the nature and significance of international fragmentation production in the determination of bilateral trade balance has not been considered explicitly. This is mainly because that the conventional gross-trade based measure of bilateral trade balance used in these works can cause a crucial "double" counting problem when intermediate inputs cross multiple borders. In this paper, we first apply the new concept of "Trade in Value-Added (TiVA)" to the measure of bilateral trade balance using the panel data of the World International Input-Output Database (WIOD) from 1995 to 2009. The calculation results are then used as an input data to the econometric model based on the Johansen Co-integration Test in order to re-identify the determinants of the U.S.-China trade balance. The TiVA based result shows that the macroeconomic forces and Foreign Direct Investment (FDI) in China are most important responsible for China's

trade surplus with the U.S. in the short run. While in the long run, FDI and the real exchange rate play a larger role. In addition, it is apparent that the TiVA based estimation result shows higher significance comparing with the traditional gross-trade based measure.

Hongxia Zhang (Renmin University of China, Beijing), Jian Gong (Renmin University of China, Beijing) and Tian Liu (Renmin University of China, Beijing)

The Method to Account for the Factor Content or Value Added Embodied in Trade Flows Based on International Input-Output Model

Input-Output model is one of the most popular methods to calculate the amounts of embodied factors in trade flows, including exports and imports. However, the measures based on national IO model in literature do not take the production corporations among different countries into consideration, while the methods based on international IO model in literature have the problem of double accounting (Dietzenbacher, 2011). This paper investigates how to determine the amounts of embodied factors in trade flows correctly on the base of international input-output model, and proposes a consistent method from three different angles, which can solve the double accounting problem. The method can also be used to compute the value added in trade.

Jie Zhang (Centre for Regional Tourism Research, Nexoe) and Bjarne Madsen (Centre for Regional Tourism Research, Nexoe)

Tourism Satellite Accounts and Modeling for Business Tourism – Case of Denmark

Business tourism is an important part of tourism revenue for many countries, especially in the cities and urban regions. In Denmark, business tourism accounts approximately one third of tourism revenue. Business travellers' expenditure includes routine business travel expenditure and also the expenditure related to travels for purpose of meetings/conferences, education, training and exhibition. Business tourism is divided into inbound business tourism and domestic business tourism, and they are further divided into same-day and overnight business tourism.

This paper focuses on two issues in the aspects of business tourism: 1) methodologies in compiling regional tourism satellite accounts for business tourism; 2) measuring the economic and employment effects of business tourism by using a regional macroeconomic model. The discussion on the methodologies focuses on how to construct business tourism satellite accounts by using national supply and use tables and the tourist interview data. The inbound business tourist consumption and domestic business tourist consumption are estimated and linked by different accounts in the national

use tables. The economic activities concern conferences and exhibitions have their own sector and commodity definition that are also linked into national supply and use tables.

The discussion on the modeling for economic impacts of business tourism consists three parts. The inbound business tourism consumption in a country territory is a part of private consumption, even if it is also a part of export. Domestic business tourism consumption is linked with intermediate consumption. Some participants to conferences and exhibitions are local residents; their consumption is related with local private consumption. The Danish regional macroeconomic model gives an evaluation of tourism impacts based on these three parts of consumption in the destination regions. The consumption patterns and location of business tourists decide the magnitude of regional economic impact; however, the regional linkages by interregional trade, shopping and commuting have also effects on the regional multipliers.

Nan Zhang (Hiroshima Shudo University)

A Statistical Framework of Global-Flow-of-Funds and Calculation on Financial Stress

This paper aims to propose new statistical monitoring system for measuring global-flow-of-funds. Firstly, we inspect the influence of global-flow-of-funds (GFF) and the continual growth of macro economy on the stability of financial systems, and build a statistical monitoring system for global-flow-of-funds while referring to the FSIs frameworks of International Monetary Funds. Secondly, we dynamically link real economics with financial economics, and combine domestic flow of funds with international capital flows, to construct the statistics observation system of GFF, and built a composite index (CI) that reflects the risks involved in external flow of funds. Thirdly, we created a Chinese finance stress index that corresponds well with the current status of Chinese external flow of funds. Fourthly, we expanded the empirical analysis based on above statistical methods. By the result of the study, we can test the strength of the shock to the financial system by the synthetic element of external flow of funds and using the trend index and financial stress index, and also can observe the situation of short-term financial stability.

Yaxiong Zhang (State Information Center, Beijing), Jianqin Yuan (State Information Center, Beijing) and Monan Zhang (State Information Center, Beijing)

The Industrial and Employment Structure Change of China Under GVCs Measurement

The dramatic increase of external trade has contributed to China's economic growth, thus changed the industrial and employment structure greatly. This paper applies the international input-output

data to investigate the current position of China in the GVCs at industrial level with comparison with other economies. Then we study the contributions of China's export to the industrial structural change and employment under the GVCs measurement. Finally, we summarize the policy implications.

Zhuoying Zhang (Chinese Academy of Sciences, Beijing), Minjun Shi (Chinese Academy of Sciences, Beijing) and Hong Yang (Swiss Federal Institute of Aquatic Science and Technology, Dübendorf)

Changes in China's Virtual Water Trade Based on an Interregional Input-Output Analysis

Interregional product trade entails flows of virtual water which refers to the water used for the production of products. In the context of increasingly frequent economic interaction among different regions in China, the impacts of interregional virtual water trade on regional water resources conditions warrant a scrutiny.

This paper conducts a quasi-dynamic input-output analysis to investigate changes in China interregional virtual water trade based on China Interregional Input-Output 2002 and 2007. The results show that in both 2002 and 2007, the main virtual water outflow areas remain in Xinjiang, Guangxi and Hebe, while the main inflow areas in Shandong, Jiangsu, and Guangdong, although their absolute amount of flows distinctively changes. The scale of interregional virtual water trade notably changes between 2002 and 2007. The interregional virtual water flow of 2002 mainly occurs among geography adjacent provinces, whereas in 2007, active interregional virtual water trade is observed between the "big regions" of considerable distances. No pronounced relationship between regional water resources endowments with virtual water trade is observed, showing water has not become a detriment factor in shaping interregional virtual water trade pattern.

This study depicts an informative picture of China interregional virtual water trade in both temporal and spatial dimensions. It contributes to a better understanding of China regional water condition and shed lights on the combating strategies coping with water resources crisis in the future.

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Regional Carbon Emissions Embodied in International and Domestic Trade: Case of China's Industrial Center Based on Multi-regional Input-Output Model

There is ample evidence showing that the rich countries consume most of goods and services and at

the same time gain most of the economic profits but that the poor are bearing emissions. In this study we argue that the inequality of economic gains and consequence of CO2 emissions does not only exist on the global level but that we find the same patterns within a country's boarders using China as the case study. China, as the world's biggest emitter, attracts a lot of attention regarding its economic growth, technical progress and environmental degradation. Rather than a homogenous country, China is a vast country with substantial regional differences in physical geography, regional economic development, demographics, infrastructure, and lifestyles. Our results show that the rich coastal areas consume and gain most of the economic benefits which not only cause emission in their own regions, but also impose emissions in poor regions, such as the Central and West, through inter-regional supply chains. The central and south coastal regions gain profits from advanced infrastructural investment and exports, but impose a large amount of emissions on the central and west regions which provide the raw materials and low cost products for the coastal area. It implies that the coastal regions have responsibility for the emissions in other parts of China. We suggest that China should use the similar strategy in Kyoto Protocol that set up higher emission reduction target for rich regions in China, such as Beijing-Tianjin, Central-Coast and South-Coast regions. It is because they are the most economic developed regions, thus have ability to achieve higher target. At the same time, China should follow the Clean Development Mechanism in the Kyoto Protocol that rich region can gain carbon credit through investing low carbon technologies in the poor regions.

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Accounting for the Carbon Footprints and Embodied Primary Resources using Multi-region Input-Output Tables

From 1971 to 2010, world trade grew fast by 10% per year on average (World Trade Organization 2011). The rapid growth of international trade contributes not only national economic growth but also increasing environmental pressures, such as raw material extraction and depletion, carbon emissions, water resource deterioration and landscape change and soil degradation. Most of these environmental pressures do not constitute as part of the traded products and remain as hidden burdens to the producing countries. These are usually called as upstream burdens.

The main purpose of this paper is to address the cross-border upstream burdens in the supply chain of iron and steel products focusing on raw materials extraction, steel scraps recycling and carbon emissions. Materials and primary resources used in the upstream productions of traded products are called materials embodied in trade and carbon emissions generated from the upstream productions

are called emissions embodied in trade. Accounting for indirect materials and emissions embodied in trade is important to national decision makers who concern about the life-cycle impacts of domestic production and consumption.

First, when domestic policies aim solely at the improvement in domestic resource efficiency, the global impacts, such as climate change and resource depletion due to the outsourcing of raw materials and components to other countries, cannot be addressed properly. Japan can be considered as one of the most efficient countries in resource and energy use in the world. However, taking indirect material use and emissions into account, Japan's efficiency profiles can be different. For example, from 1980 until 2005, Japan had continuously the highest net amount of materials embodied in imports, most of which were from developing countries which had much lower resource efficiencies (Dittrich, 2010). To understand the material flows and emission sources along the supply chain is therefore important to policies addressing not only the nation-wide material use efficiency and emissions but also global resource efficiency and emissions.

Second, due to the existence of the hidden upstream burdens, the true costs of production are not fully reflected in the transaction costs. This is so-called environmental burden shifting via trade. A worse case is that environmental burdens will continuously shift from developed countries to developing countries and the latter ones lack both technologies and financial capacity to prevent and remedy the ecological damages. Analysis of the material flows and emission sources along the global supply chain is therefore necessary to help assess trade patterns in terms of ecological impacts.

This study focuses on iron metal because it is one of the fundamental materials supporting modern economic growth. Iron and steel production is one of most energy-intensive sectors and dependent on iron metal which is a non-renewable resource. As both an importing and exporting country, Japan plays an important role in global iron and steel production and consumption. Report from the World Steel Recycling (2011) shows that there has been significantly increasing of scraps used in steelmaking process, which can help reduce both virgin material use and carbon emissions. Focusing on both the virgin iron metal and steel scraps used in Japan's iron and steel making, this study includes international trade among ten regions, which include two major iron ore producing countries (Australia, Brazil), six steel producing countries (China, India, Japan, Korea, the EU and the US) and two major oil and gas producing country groups.

We constructed a global multi-region input-output (MRIO) model based on the GTAP 7 database. To capture the virgin vs. secondary material use, we singled out iron ore mining sector, steel scraps, pig iron, steel making using iron ores (blast furnace) and the technology mainly using steel scraps (electric arc furnace). We calculated materials and emissions embodied in the downstream uses of iron and steel products and compared the total resource efficiency and emissions embodied in the final consumption across countries. The international trade patterns of iron ores, steel scraps and iron

and steel products are assessed in terms of capital flows, material flows and carbon emissions. Policy implications are derived to address (i) the hidden flows of trade; (ii) total resource efficiency and emissions taking account of resource endowment and comparative competitiveness of countries; and (iii) how Japan can contribute to increase global resource efficiency and reduce global emissions.

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