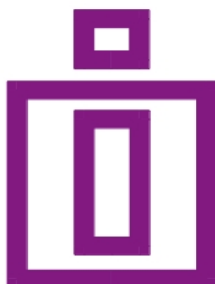


# 19th International Input-Output Conference

*BOOK OF ABSTRACTS  
AND LIST OF PARTICIPANTS*

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## **The use of supply-use tables for the identification of key sectors using unbiased input-output multipliers**

Topic: SUTs: issues and applications

Author: Antonio F. Amores

Co-Authors: José Manuel Rueda-Cantuche

From an axiomatic point of view, Kop Jansen and ten Raa (1990) and Rueda-Cantuche and ten Raa (2009) singled out the product technology and the fixed industry sales structure assumptions as the best two models for the construction of either product or industry input-output tables, respectively. However, there is one hard to neglect criticism that has prevented them for a more widespread use in input-output analysis, i.e. the resulting negative coefficients. At this point, this paper proves that under these two assumptions, unbiased and consistent backward and forward input-output multipliers can be respectively estimated econometrically from supply and use tables instead of from input-output tables. The advantages of our econometric approach are twofold, i.e.: not only it circumvents the problem of negatives but also provides unbiased multipliers. We hope this paper allows for a more general use of the two axiomatically best methods in input-output analysis. As an example, this paper analyses the repercussions of the estimated bias in the determination of the key sectors of an economy, as postulated by Rasmussen (1956). As shown in the paper, the estimated bias may induce to wrongly identify key sectors in the Turkish economy for the year 1998.

## **Worldwide economic effects of changes in international trade due to natural disasters: the case of Japan earthquake and tsunami**

Topic: Modelling disasters

Author: Valeria Andreoni

Co-Authors: Iñaki Arto, José Manuel Rueda-Cantuche

The economy of Japan is the third largest in the world after the United States and China. Japan also plays an important role in international trade: it is the fourth exporter and the fifth importer of goods in the world, with a share of 4.6% and 4.4% respectively (WTO, 2010 ). In addition, Japan provides key components for different industries like transport equipment, motor vehicles or electronics, playing an important role in the world supply chains of these products.

Japanese production capacity has been affected due to the catastrophic events that followed the earthquake of 11 March 2011. As a consequence, Japanese international trade patterns and levels are changing and affecting other economies in different ways. In this paper we explore these effects using a multiregional input-output model.

We analyze worldwide effects of different scenarios of trade including:

- A reduction of Japanese exports of components involving disruptions to the global manufacturing supply chain
- A fall of Japanese exports of final goods combined with a substitution by products from other regions.
- A decline of Japanese intermediate imports due to the contraction of Japanese output.
- An increase of Japanese imports of final goods to substitute the reduction in domestic production.

Keywords:

Natural disasters, economic effects, international trade, multi regional input output, Japan

## **Fragmentation, vertical specialization, manufacturing exports and economic growth in Mexico**

Topic: Issues in input-output economics

Author: Wilmar Ascarraga

Co-Authors: Gerardo Fujii

There is a widespread belief that exports, especially manufacturing ones, contribute to accelerate economic growth. This approach was diffused in many countries due to the high dynamism of some economies of Asia. According to this proposition, this fact was derived from the encouragement given to manufacturing exports. These ideas were disseminated in Latin America since the eighties of the last century, which led to the economic opening of the region and the promotion of exports. In the recent decades, one country that has shown a high growth of manufacturing exports, particularly of medium and high-technology, is Mexico. However, the country's economic growth has been unsatisfactory.

The present work attempts to explain this paradox. With this aim, the relationship between exports and economic growth is focused on the multiplier effects of exports on intermediate goods-producing sector.

The empirical evidence of this paper is the 2003 Input-Output table for Mexico, which is studied using graph theory. This allows to:

- Know the intersectorial level of integration and direct influence (direct causality).
- Identify, quantify and analyze the paths of economic influence transmitted in the productive structure (indirect causality).
- Hierarchize sectors by levels so those belonging to higher levels are in a privilege position to pull economic sectors located at lower levels (strict causality).

These aspects allow to solve the limitations of input-product analysis and to contribute better understanding of the relationship between productive articulation, exports and economic growth. One corroborates the conclusions calculating the vertical specialization, outsourcing of Mexico and comparing them with countries of the OECD and Asia.

## **Services Intensities in the Iranian Economy: An Input-Output Approach**

Topic: Analysis of specific sectors: country case studies

Author: Seyed Iman Azad

Co-Authors: Najmeh al sadat Azad, Nasim Fathi

Service sector play the important role in the Iranian economy, so that in the recent years the value-added of service sector allocated more than 50 percent of gross domestic output. Even though, perception to service sector is different in process of development, but at the present time dominant sector of global economics is service sector. In despite of higher share of service sector in Iranian economy, mentioned sector has been always interpreted as an unproductive sector by some of policy makers and researcher. It seems that, such a perceptions in the case of service sector could not show the realistic picture of importance and role of this sector in the situation of economic evolutions. In this paper ,we tried to introduce an index by estimating direct services intensity and Direct plus Indirect Services Intensity in the framework of input-output in order to evaluating interrelation of service sector, specially sub-sector of manufacturing service with other sector and

sub-sector of industry in Iran's economy. Mentioned study holds on the input-output table of 2001, from statistics center of Iran. Result of this paper shows that 28.3 percent and 27.3 percent of economic activities in 2001 in the view of intensities of direct service and intensities of direct service and indirect service placed in the category of key sector in the Iranian economy. Therefore intensities of service in Iranian economy are more or less remarkable.

Keywords: Tertiary Sector, Producer Services, Direct Services Intensity, Direct plus Indirect Services Intensity, Input-Output Table.

## **The measurement of productivity: contributions to the analysis from IO economics**

Topic: Productivity and efficiency and economic growth

Author: Rossella Bardazzi

This paper is devoted to the study of labour productivity at the sectoral level by comparing different methods which may be used to measure the content of labour per unit of output. This topic is part of the broader issue of understanding the drivers of economic growth, therefore an extensive literature has been devoted to productivity measurement and statistical offices and organizations have prepared large manuals to explain how to compute meaningful productivity indices and statistics. IO concepts and tools may prove to be very important when outsourcing and vertical integration take place but, generally, statistics at sectoral level largely disregard this information and neoclassical growth models usually ignore intermediate goods and analyze economic growth entirely in terms of value added (on this topic, see recently Jones, 2011). However, the analysis of productivity has a long history in input-output economics as reminded by a special issue of *Economic Systems Research* devoted to this topic (September 2007).

Our aim is to emphasize assumptions implied in conventional indicators to measure productivity which are not novel but are not acknowledged by mainstream economics. We will discuss the concept of real value added because, as mentioned in the OECD productivity manual, productivity measurement poses a problem of valuation both in the framework of consistent KLEMS calculations and in the value added based measures as "productivity is commonly defined as a ratio of a volume measure of output to a volume measure of input use" (OECD, 2001, italics ours). We will follow the line of reasoning proposed by Almon (2009) and will provide an empirical application with a comparison between indexes rooted in growth accounting methodology and measures computed by the IO approach to underline the shortcomings of the most popular indicators at the industry level.

Almon C. (2009), "Double trouble: the problem with double deflation of value added and an input-output alternative with an application to Russia", in *Energy Policy and International competitiveness*, Bardazzi R. and M.Grassini eds, Firenze University Press.

Jones C. (2011), "Misallocation, economic growth, and input-output economics", NBER wp 16742.

## **Impact of Removing Energy Subsidy on the Environment Improvement (Air Pollution)**

Topic: Energy consumption and CO2 emissions

Author: Fatemeh Bazzazan

Changes in government policy such as current reform of energy subsidies in Iran and other countries in which energy per capita consumption is very high, would have two positive impacts: to

increase government's income and the other reduce pollution due to decrease energy consumption. This paper would investigate the latter. For this purpose a link will be provided between energy demand functions by using econometric models and the other environment input-output model to estimate environment improvement and reduction on pollutions due to removing subsidy. Two types of energy demand functions are considered for gasoline, and gas. Pollution impacts cover different types of air pollutions.

## **The Economic Importance of Housing Sector in Tehran Province- Extraction Method Approach**

Topic: Country case studies

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The Economic Importance of Housing Sector in Tehran Province- Extraction Method Approach

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Tehran is the most important province of economic activities in Iran. More than one fourth of economic activities are located in Tehran province. There is the fact that financial resources are limited and huge investment are required in different economic sectors, policy makers and regional planners are looking for activities those can bring more growth or create more jobs. According to many studies housing sector is one of the main sectors, this paper study the relative importance of this sector. We apply Hypothetical Extraction Method (HEM). To do so, regional input-output table for Tehran is required. We used Tehran input-output table 2001 which has been provided by Bazzazan et. al (2007). Table has been aggregated into 18 main economic sectors of the province in which construction sector is considered separately.

The results demonstrate that housing sector cannot be deemed as the main key sector of the province, since the main productive portion of this sector has been absorbed by the final demand and has been excluded from the production cycle. As a result, the housing sector has a relatively low importance compared to other economic sectors of the province. The amount of reduction in total economic taken amounts of the province is very trivial in comparison with the past circumstances (less than one percent).

Keywords: Housing, Hypothetical Extraction Methods, key sector, inter-sectoral linkages, regional Input-Output table.

## **Can Natural Gas Substitution in Transportation Sector Reduce Green House Gases (GHGs) Significantly: An Input-Output Analysis**

Topic: Evaluating environmental policies

Author: Niaz Ahmed Bhutto

Co-Authors: Selim Cagatay, Nisar Ahmed Siddiqui

Over the last three decades, sustainable development has remained core debate for international organizations, governments, NGOs, political figures, academicians, researchers, and common public. Much a do has been done in last few decades like international treaties to address the issue of climate change with special focus on global warming and Kyoto Protocol is the prominent among all treaties. As the Kyoto Protocol runs out in 2012, there is need of a new climate protocol that can keep the countries on the track of sustainable development which was emphasized in the United Nations Climate Change Conference held in Canun, Mexico December 2010. This same issue was discussed one year before in the UNFCCC conference in Copenhagen, Denmark.

Turkey has never left behind in joining the hands with other countries in incorporating the sustainable development in her development plans and planning. Turkey's economy is growing faster; its transportation sector is even growing faster to meet the demand of the country. Transportation sector plays very important role in the growth of the Turkish economy but this sector contributes too much in GHGs emissions than in the growth of the country. This conflict can be resolved partially by substituting natural gas for other fossil fuel types used in transportation sector. The aim of this study is manifold. Firstly to estimate the sole contribution of GHGs emissions from fossil fuel consumption by the year 2012 from transportation sector by using the input-output table. Secondly to find out reduction in GHGs emissions after substituting natural gas by 40 percent in this sector in the year 2012. Thirdly, this study will also estimate the reduction in the import bill of the Turkey as natural gas is the cheapest source of energy among all if net calorific value is considered. Lastly, this study will give recommendation based on findings in lines with the sustainable development.

## **International material resource dependency in an input-output framework**

Topic: Modelling resource dependency  
Author: Maaike Corinne Bouwmeester  
Co-Authors: Jan Oosterhaven

Besides sustainability concerns, strategic resource interests coupled with increasing resource depletion have contributed to a rising concern with resource security. Governments issue reports to identify strategic material resources and actively design strategies to ensure the supply of natural resources and re-use of materials already in the economy. We assess natural resource use, trade linkages and dependence among the 43 countries present in the EXIOPOL database. Material resource requirements along the international supply chain are quantified using an environmentally extended international input-output model, which allows considering direct and indirect, domestic and international resource use. We focus specifically on fossil fuel carriers, metals and mineral resource use. Dependency on foreign resource suppliers is examined by looking at the natural resources required directly and indirectly in satisfying final demand by country. Key is the extent to which these resources are imported and whether the majority of the imports is sourced from a small or large set of trade partners. Three measures of resource dependency are analyzed. Resource dependency is measured as total material requirements (direct and indirect) per unit output. International material dependency is defined as the percentage of the material requirements that is sourced abroad. Finally, the concentration of international material dependency is measured by the Herfindahl index calculated over the international resource multipliers. When resources are mainly imported from one or a few trade partners, countries may want to reconsider whether strategic interests should be factored into their procurement strategies.

## **Methodological aspects of international environmental accounting of CO<sub>2</sub> and water use in input-output models**

Topic: Modelling global water issues  
 Author: Maaïke Corinne Bouwmeester  
 Co-Authors: Jan Oosterhaven

An increasing awareness of embodied emissions and resources in traded products has resulted in attempts to track emissions and natural resource use along the international supply chain. An international input-output (IIO) model is identified to be the appropriate methodological framework to undertake this type of environmental accounting, because direct and indirect, domestic and international environmental impacts can be analyzed in one framework. In this paper, two features of IIO models that influence the results of impact analysis will be studied based on the EXIOPOL database; specification and aggregation errors. Regarding the specification errors, we focus on the deviations in environmental accounting that result from (1) assuming that domestic environmental coefficients can be used to calculate the resources or emissions embodied in international trade and (2) using a single-country framework versus using a multi-country framework to calculate the environmental impacts. The EXIOPOL project offers two dimensions to analyze aggregation errors. In building the database, much work has been devoted to detailing the sectors that are important from an environmental point of view. This additional detail allows us to investigate the size of errors made when environmental analysis is undertaken using more aggregate industries. We will also compare an IIO model, with the countries included individually, to a model where all countries are aggregated to one region, for example, the EU27. Due to the extent of the database we can provide distributions of the deviations instead of point-estimates. This allows us to investigate whether deviations are larger depending on the specific country or sector that is analyzed. We will test the specification and aggregation errors made by focusing on CO<sub>2</sub> emissions and water use. Investigating two quite different environmental extensions provides for a generalization of our findings regarding the different kinds of errors.

## **Treatment of the Intra-EU Trade Flows to Obtain Consolidated European Union and Euro Area Use Tables**

Topic: Organized session: Estimation of the Carbon Footprint for the EU27  
 Author: Maaïke Corinne Bouwmeester  
 Co-Authors: Jan Oosterhaven, José Manuel Rueda-Cantucho

A procedure consisting of a series of seven steps has to be performed to arrive at a consolidated EU use table when starting from a simple aggregation of individual EU country tables. A prerequisite of the latter table is the distinction between intra-EU and extra-EU trade flows, both for imports and exports. Due to the change in geographical detail from individual EU member countries to the EU level, the former international intra-EU trade flows now have to be interpreted as domestic transactions of the EU. The main objective of the procedure is to balance the intra-EU import matrix with the information on intra-EU exports. The fact that the mirror flows do not match is due to a range of issues. A structural discrepancy is caused by the difference in valuation as imports are valued in cost-insurance-freight prices, while the exports in the table are recorded in basic prices. The first step of the procedure corrects for the taxes less subsidies incorporated in the value of imports. The second, third and fourth steps adjust the intra-EU and extra-EU import matrices or the intra-EU and extra-EU export matrices to correct for the double-counting of transit trade flows. In the fifth step all values of the intra-EU import matrix are rescaled to match the total of the intra-EU export vector – a requirement in order to be able to



balance the intra-EU import matrix with the values of the intra-EU export vector. In the sixth step the matrix is balanced using the GRAS algorithm, which effectively redistributes trade and transport margins from the goods in which value they were included to the rows representing the trade and transport services. The final step consists of merging the balanced intra-EU import table with the domestic table, which can now be done without violating the accounting identities that reign supply-use frameworks.

## **The role of capital environmental responsibility of CO2 emissions in Spain**

Topic:

Author: Maria Angeles Cadarso

Capital stock and investment are usually forgotten in the analysis of climate change and emissions. But they play a role because emissions are not the same if commodities are transported most by train or by airplane, for example. The aim of the paper is to analyse the role of capital in CO2 emissions in Spain. First, we calculate the responsibility of a sector on the country emissions taking into account not only the emissions embodied in intermediate inputs but also the emissions embodied in its consumption of fixed capital. In order to allocate the responsibility of emissions we adopt the perspective of consumer responsibility instead of producer responsibility applied to sectors. It is to say, a sector is responsible of emissions that result from the process of production of all intermediate inputs and also the portion of fixed capital it requires for production, direct and indirectly. We think this criterion for sector allocation is fair and it widens the range of sectors implied in the reduction targets and the possibilities of achieve them.

## **Estimating and comparing multiplier matrices: the role of resources and the role of technology.**

Topic: Theory and application of CGE modelling

Author: Manuel Alejandro Cardenete Flores

Co-Authors: Ferran Sancho

We study and compare the properties of different multiplier matrices. Each multiplier matrix responds to a set of distinct behavioral assumptions. Three main scenarios are introduced. The first one is the traditional input-output set-up. The Leontief inverse, as is well known, picks up direct and indirect interaction effects under the usual assumptions. In the second scenario we compute the multiplier matrix of an applied general equilibrium model where resource constraints are in effect. We compute the jacobian matrix of the reduced form to estimate multiplier effects of exogenous government spending. This matrix is then compared to the standard Leontief inverse. Because of its general equilibrium nature, however, output and substitution effects are both at play. To isolate output and substitution effects we introduce the third scenario. It corresponds to a universal Leontief general equilibrium model. Since no substitution is allowed only output effects are at work. This yields a third multiplier matrix that can be compared to the second one (to decompose output and substitution effects, with fixed resources) and to the first one (to isolate the role of given resources, with no substitution effects under a Leontief characterization of the economy).

## **COMPARING THE ECONOMIC IMPACT OF TOURISM USING DIFFERENT INPUT OUTPUT MODELS. AN APPLICATION FOR GALICIA.**

Topic: Analyses of specific economic sectors

Author: Andre Carrascal

The main particularity of Tourism is to be defined from the demand side, instead from the supply side like the other economic activities. For this reason, Tourism impact studies are usually performed with demand models based on input output (IO) methodology.

In spite of this fact, the Leontief model presents some limitations such as: no assumption of supply constraints (even workers), constant return to scale, fixed commodity input structure or homogeneous sector output. In addition of the traditional ones, we also could consider that it only defines the behavior of the productive agents and it does not recognize all the interdependencies between regions.

Therefore, the aim of this paper is to compare the results obtained with the classic demand model (Leontief model) with other models that attempt to solve some of those limitations. For instance, we implement an expanded model considering the households (induced impacts model), a two-region model that allows us to estimate the spillover and the feedback effects (interregional model) and our own model based on the supply and use tables, in order to correct the possible obsolescence of the data offered by the Symmetric Table (rectangular model). For practical purposes, we will perform the analysis for a regional economy like Galicia.

## **Structural Decomposition Analysis of water uses in Spain**

Topic: Applications of water IO

Author: Ignacio Cazcarro

Co-Authors: Rosa Duarte, Julio Sánchez Chóliz

The structural decomposition analysis (SDA), which was defined by Rose and Chen (1991) as "the analysis of economic change through a set of (static and comparable) changes in key parameters of an input-output table", has been used to study variations in impacts and resource use (see Rose and Casler, 1996, Hoekstra and Van der Berg, 2002, for a review). Behind the variation of water uses in a country, there are components such as intensities, technology, and levels and composition of the demand changes, and thus those are the factors examined, decomposed in more specific ones (i.e., final consumption, net exports, Gross Capital Formation). In the application for Spain, a relatively homogenous series of water uses for 1997-2006 (constructed from the Satellite Water Accounts of the National Statistic Institute) is extended backwards with historical agrarian and water use information, and linked to a time series of input-output tables in constant prices (complying with the EUKLEMS aggregates). The rebound effect in agriculture is tested, i.e. if improvements in water use lead to increasing the surface of crop cultivation, or if they lead to put in production more water intensive crops. In the results, the most important effects are the "final use level", and then the "eco-technological" ones, resulting the "final demand structure" (variations in the composition in demand) negligible in the latter period. The decrease in the participation of the agrarian sector in the economy is well known, and hence decreases in water uses of that activity, the one generating more direct water abstractions could be expected. But interestingly, after 2001 the reductions in water abstractions would not only be explained by the decrease in the participation of the sector in the economy (as % of Added Value), but also by reductions in water withdrawals per euro of Added Value take place.

## **Determinants of India's foreign trade during reform**

Topic: Indian Trade

Author: Debesh Chakraborty

Co-Authors: Paramita Dasgupta, Arpita Ghose

Since Leontief's (1953) testing of Heckscher-Ohlin hypothesis and its paradoxical finding, several studies have been made throughout the world on the determinants of factor content of foreign trade of various countries. A vast theoretical literature has also been emerged attempting to resolve the Paradox. In India too, Bharadwaj (1962), Prasad (1965) and Sengupta (1989) conducted studies on the determinants of the factor content of its foreign trade concluding in support of the hypothesis. However, these studies were conducted prior to the Economic Reform of 1991. In this paper an attempt has been made to measure the factor content of India's foreign trade and verify the validity of the Heckscher-Ohlin hypothesis focusing on the period of Reform. The period covered in the study is from 1989-1990 to 2003-2004. Using three factors of production - capital, labour and natural resources, first, the factor contents of trade are measured in the light of two alternative theoretical frameworks provided by Leontief (1953) and Leamer (1980). In these frameworks the study confirms the Heckscher-Ohlin presumption regarding India's trade with the rest of the world. However, paradox has been witnessed in cases of India's trade with the EU, North America and Japan. Then the paradox has been studied by taking into account the productivity differences between India and its trading partners as attempted by Trefler (1993). The findings of the study are expected to throw light on the ongoing debate on the factor content of foreign trade.

## **Structural analysis of the Indian economy in the conventional and augmented input-output frameworks**

Topic: Various approaches to structural analysis

Author: Debesh Chakraborty

Co-Authors: Paramita Dasgupta, Partha Pratim Ghosh

The paper attempts to explore the structural changes of the Indian economy over the decade of the 1980's through 2006(7). Along with the Conventional Input-Output open model the structural relationships have been studied in an Augmented Input-Output framework. In the Augmented model the private consumption demand for the non-durable consumer goods is endogenised while the other components of final demand are treated as exogenous. The structure of the Indian economy has been studied by identifying the key sectors of the Indian economy using weighted backward and forward linkage measures. The results are found to be different in two models. The results based on the Conventional model reveal structural change towards more or less modern production structure of the Indian economy while those based on the Augmented model reflect traditional and service oriented along with modern industry oriented character of the Indian economy. The Augmented model shows fewer variations in the linkages and the resulting key sectors of the economy while rendering the economy traditional and service oriented along with a modern industry oriented character. The policy implications based on two models do differ. The results based on the Conventional method suggest the policies that would focus more on industrial sectors. On the other hand, Augmented model suggest that importance should be given to the traditional, service oriented as well as modern industrial sectors. Thus the Augmented input-output model seems to reflect better, the structural change of a developing country like India where different industries are not as interrelated as they are in a developed country. Thus, the choice of the method of structural analysis for an economy is an important research agenda in the literature on structural studies.

## **Estimating Structural Change Factors in the Ukrainian Economy**

Topic: Structural change

Author: Oleksandr Chebanov

Structural proportions and their changes are some of the main indicators affecting the development of an economic system. In the countries with transition economy characterized by original accumulation of capital, it can be very useful to understand optimal values of both structural proportions and structural changes for effective governance of the economic system.

In this paper we study the dynamics of deviations of actual proportions from their optimal values in the structure of Gross Value Added (GVA) distribution between industries and in the structure of industrial prices. We propose a grouping of the main factors affecting the change of these deviations in time. We suggest two models for estimating the influence of the factors on the dynamics of these deviations (one model is for the GVA structure and the other is for the price structure) which are based on Input-Output analysis and a production function modified for transition economy. We present and discuss estimations of the abovementioned deviations and factors for the Ukrainian economy. The Input-Output Tables and other statistic data for the period of time from 2000 till 2007, which are contained in the official publications of the State Statistics Committee of Ukraine, have been used as the information base for our analysis.

## **Balanced System of U.S. National Accounts and Structural Distribution of the Aggregate Statistical Discrepancy**

Topic: Foundations of the Supply-Use model

Author: Baoline Chen

This paper demonstrates the empirical feasibility and computational efficiency of a generalized least square (GLS) method that systematically collects and incorporates all available information on the reliability of initial data in reconciling a large disaggregated system of national accounts. Using data from 2002 U.S National Income and Product Accounts, Input-Output accounts, and GDP-by-industry accounts, the GLS method produced a statistically meaningful balanced system of accounts and estimated statistical discrepancy by industry and by expenditure category, according to the relative reliabilities of initial data. Balanced estimates from the GLS method enhance the credibility of national accounts estimates and help trace the aggregate statistical discrepancy to its sources.

Keyword: Data Reliability, Accounts Reconciliation, GLS Estimation

JEL classifications: C61, C63, C67, C82, E01

## **Economically Sustainable Demography: Reversing Decline in Portuguese Peripheral Regions**

Topic: Using SAMs

Author: Luís Cruz

Co-Authors: Eduardo Anselmo Castro, Pedro Nogueira Ramos

This paper proposes an integrated demographic and economic model to forecast population change up to 2030 in depressed Portuguese Peripheral Regions (PPR), corresponding to 14 NUTS III regions, where population is declining and ageing. The ultimate goal of our study is to uncover policy strategies to revert these areas demographic decline.

The projections for PPR population changes depend both on population's natural increase and net migration. The key idea of this modeling framework is the hypothesis that net migration (for population under 65 years) depends on employment, assuring the integration of the demographic and economic components of the model. Accordingly, we use regional IO models, considering a SAM-type frame (with two kinds of households: over and below 65 years) to project – under scenarios analysis – employment's progress in PPR. For this, our first (and perhaps major) task involves building the SAMs for these small PPR, as such data are not available in Portuguese official statistics. Then, the population below 65 final consumption is considered as endogenous to the SAMs. Finally, (what if) scenarios on future economic activity up to 2030 are implemented. This will be done through an iterative process where the employment flows generated in the SAM model are made consistent with the migrations estimated within the demographic model component.

## **The Factor Content of Trade: Time-series Evidence**

Topic: Organized session: WIOD 2: Empirics of International Trade

Author: Gaaitzen de Vries

Co-Authors: Neil Foster, Robert Stehrer, Marcel Timmer

This paper provides time-series evidence of the Heckscher-Ohlin-Vanek (HOV) theorem during an era of emerging global production networks. We use world input-output tables, which consist of national input-output tables of forty major economies (including Brazil, Russia, India, and China) linked through international trade statistics for the period 1995 to 2006. These tables are combined with data on employment by industry and detailed labor-skill categories to test predictions by the HOV theorem. Our results suggest the fit between the measured and predicted factor content of trade is good but worsens over time. During the past decades, the traditional HOV theorem may break down due to the changing nature of international trade.

## **Development of Supply and Use Tables at the previous year's prices: Estonian experience**

Topic: On the compilation of national accounts

Author: Iljen Dedegkajeva

This paper deals with the Estonian experience in the compilation of the supply and use tables at the prices of the previous year. Statistics Estonia has recently published constant price estimates for the years 2001-2007 produced within the detailed supply and use framework. The established system follows mostly the principles and standards for the measurement of constant price annual national accounts data in the European Union. Major outcome of this work is the introduction of the double deflation method for the constant price estimates of production-based GDP. This paper gives a short overview of the system (i.e. integration of current and constant price data, level of product detail and price information used for deflation, estimation procedures for the main national accounts variables, balancing). The paper discusses the key principles of the constant price estimation such as consistency of valuation and consistency in deflation and provides examples of consistent deflation undertaken for domestic output and export sales within output, and for domestic and imported components of intermediate consumption and GFCF. The results of constant price GDP estimates for the years 2001-2007 calculated by single deflation (old methodology) and by double deflation (present methodology) are also provided.

Iljen Dedegkajeva,

Head of Input-Output Table Service, Statistics Estonia

## **The impact of energy resources price increase on inflation in Russia in 2000-2010**

Topic: Analyzing the role of energy

Author: Arteom Denisov

Monetary instruments don't give sufficient and stable results in decreasing inflation in Russia. That's why it is proposed that one of the reasons is a significant number of monopolistic and oligopolistic markets in Russian economy. Companies on such markets have the power to increase prices and transfer the increase of their costs to consumers. Price shock on one of the markets could result in growth of prices in a whole economy.

Energy resources extraction (oil, gas, coal) are such sectors. There are a few large companies in each of these sectors, they have market power and they use it. Also oil and gas price increase in 2000s could have impact on inflation in Russia. Giving Central Bank policy of stable ruble, export sales could result in increase of money supply and inflation.

The Input-Output Price Model is used to test this hypothesis. In the first, production chains were identified using technical input coefficient matrix and price correlation matrix. In the second, the response to change in price in sectors of one chain was measured depending on technical input coefficients and the degree of concentrations on the markets of resources and products. So inflation effect of one sector was estimated. Finally, the overall impact of energy resources price increase was estimated.

## **Decomposition of final demand by products into primary input contents - methodology and applications**

Topic: Decomposition Analysis

Author: Ana Maria Dias

This paper presents a methodology for decomposing final demand (by demanded product and type of demand) into its primary input contents (value added components, imports and taxes), direct, indirect, and total, using coefficients calculated from a system of symmetric input-output tables (product by product) built under ESA95 rules. An application is made to Portugal and the relationship between the level of unit import contents of final demand and its macroeconomic impact is analyzed, considering a number of public policies evaluated through an input-output based model for Portugal.

## **A correct method to determine the factor content of trade**

Topic: Organized session: WIOD 4: Methodological Contributions

Author: Erik Dietzenbacher

Co-Authors: Bart Los

The factor content of trade calculates the difference in the amount of a certain factor (e.g. labor, capital, land) that is embodied in the exports of a country and the amount embodied in the country's imports. If a single-country input-output table is used, all exports are typically viewed as final goods and the answer is relatively simple. Because the recent waves of globalization led to increasing

shares of intermediate inputs in total trade flows, trade theorists started paying a lot of attention to incorporating intermediates into their recent empirical work. It has well been recognized that for including trade in intermediate goods, world input-output tables (WIOTs) are necessary. Several measures to determine the factor content of trade using a WIOT have been proposed. In this paper, we will argue that they suffer from double-counting. We will propose a proper factor content of trade measure that avoids the double-counting problem and give indications of the empirical magnitude of the difference between this measure and the incorrect measures proposed so far.

## **An Integrated Keynes-Leontief “Macro-Econometric and Input-Output Model“**

Topic: Issues in CGE and econometric modelling

Author: Zorikto Bato-Dugarovich Dondokov

The objective of this paper is to present a new model, which is based on the integration of the Keynesian multiplier with the Input-Output Framework. According this model the private consumption is considered as an endogenous component of Input-Output Model. This approach gives an opportunity to consider household's consumption as Consumption Matrix (CM), not a vector as in standard Leontief's framework. Specifically, a number of conditions for construction of CM are formulated.

The basic data used for this study has been the Russian input-output tables for 1997, 2000 and 2003. Using the integrated model we have presented some numerical results that can be contrasted with those derived from the standard IO method. The difference of the results supports the view that the proposed accounting procedure allows to carry out more exact calculations for an estimation of the sector multipliers.

Key words: Keynesian Macro-Econometric Model, Input-Output Model, Consumption Matrix, Russia.

## **The Use of Modified Input-Output Model for Tax Policy Evaluation: The Russian Case**

Topic: Country case studies

Author: Zorikto Bato-Dugarovich Dondokov

The first purpose of this paper is to present a new approach, which develops a standard Input-Output model. The main emphasis is on the problem of householder's consumption. Within the IO framework, a model, formally similar to the Keynesian multiplier, is proposed to construct the matrix of technology of consumption (MTC). The second purpose of this article is to demonstrate the application of MTC to the tax policy evaluation in Russia.

Key words: Input-Output model, Keynesian multiplier, technology of consumption, tax policy, Russia

## **Water Scarcity in the World Economy: Improving the Hydro-Economic Interface**

Topic: Modelling global water issues

Author: Faye Duchin

Co-Authors: Carlos A Lopez-Morales

With growing demand for water, uncertain supplies, and competition among end uses, there is increasing concern about impending water scarcity especially in arid and semi-arid regions, where

about a third of the world population lives. Since the vast majority of freshwater withdrawals are for agricultural purposes, attention is focused on better management of water for the production of food.

The paper reviews the emerging literature, focusing on four key concepts. First are the definition, measurement, and representation of a region's supply of water and the constraints it may impose on economic activities. Second is the representation of the uses and availabilities of "blue" water, from stocks like lakes or aquifers, and "green" water, as soil moisture from precipitation. Third, the import of "virtual" water, the total amount of water embodied in a product, mainly food, is considered a viable substitute for water-stressed regions. However, such a strategy needs to be evaluated in the broader context of comparative advantage in a world economy reliant on multiple factors and changing factor costs. Finally, the choice of the geographic unit for analysis needs to reconcile information on water availability and ecosystem integrity at the watershed level and the larger political boundaries useful for representing economic systems. We describe an approach for maintaining vital spatial detail about the water-related attributes mentioned earlier into models of the world economy operating mainly at the country level. This involves the introduction of what we call the rectangular choice-of-technology model.

## **A General Framework for Determining Factor Use, Factor Rents, and Goods Prices in a Multisectoral Model**

Topic: Organized Session: Rents and Physical Resource Constraints in Input-Output Models  
Author: Faye Duchin

The need to deal with pending resource shortages motivates the explicit inclusion of factor constraints and factor rents in input-output models. The framework described in this paper accommodates any number of goods, factors, and technologies for the production of each good, and it has the following properties. All quantities, rents, and prices are determined simultaneously in a single computation; unlike most input-output models, more than one technology at a time may be used to produce a given good; and rents and prices, like quantity results and the choices among technologies, depend on the level and composition of consumption demand. For concreteness, the paper reports results of two empirical studies about the future demand for food, both involving endowments and requirements for land and water (among other factors), with dryland and irrigated agriculture practiced under different climatic (geographic) conditions.

## **A multi-region input-output analysis of global virtual water flows**

Topic: Modelling global water issues  
Author: Kuishuang Feng  
Co-Authors: Stephan Pfister, Sangwon Suh, Jan Christoph Minx, Klaus Hubacek

Virtual water flow is recognised as an important indicator for redistribution of water from water-rich countries to water-poor countries. Recently, most of studies on global virtual water flows are based on the process analysis (PA) and exclusively focused on agricultural commodities. Environmental input-output analysis (EIOA) has become a popular tool for assessing the virtual water flows along the global supply chain, which provides detailed information on sectoral interaction within a country and among different countries. In this study, we apply a 113 world regions' multi-regional input-output model (MRIO) to assess global virtual water flows at sector level. The MRIO model allows us to track both direct and indirect water requirement of 57 commodities (14 agricultural products, 32 industrial products and 11 services) in international trade. We distinguish green, blue and grey water: green water refers to the total rainwater evapotranspiration from fields and



plantations, which has high comparative advantage but low opportunity cost; blue water is fresh surface and groundwater which generally has higher opportunity cost compared to the green water; grey water is the water required to dilute pollutants to such an extent that the quality of the water remains above agreed water quality standards. The results can be used to demonstrate how usefulness of the international trade for rebalancing the world water resources. In additions, the results can be used to informing national and international environmental strategies in terms of integrated water resource management from both supply and demand sides.

## **EPSIM - An Integrated Sequential Interindustry Model for Energy Planning: evaluating economic, electrical, environmental and health dimensions of new power plants**

Topic: Trade and supply chains

Author: Andre Fernandes Tomon Avelino

Co-Authors: Joaquim Jose Martins Guilhoto, Geoffrey J.D. Hewings

Energy is the input on which modern society depends the most for life standard maintenance besides economic and social activities, however, it is also one of the major sources of greenhouse gases (GHG) emissions, especially the electric sector, due to a world energy matrix concentrated on oil and coal resources. Hereby, impact analysis is essential for policy making focused on sustainable energy systems, once it provides ex ante evaluations for the diverse effects of new projects, being especially important in relation to large infra-structure investments as power plants. In Brazilian case, although the current electrical matrix is primarily renewable and has low GHG intensity, the required expansion of generation capacity leads to rediscuss power plants' alternatives and their externalities. Due to the transient and heterogeneous demand of these projects, economic, environmental, energy and social impacts must be assessed dynamically and spatially. This study introduces a social-environmental economic model, based on Regional Sequential Interindustry Model integrated with geoprocessing data, in order to identify economic, pollution and public health impacts in state and county levels for energy planning analysis. Integrating I-O framework with electrical and dispersion models, dose-response functions and GIS data, this model aims to expand policy makers' scope of analysis and provide an auxiliary tool to assess energy planning scenarios in Brazil. Moreover, a case study for wind power plants in Brazil is performed to illustrate its usage.

## **Matrix adjustment with non reliable margins: a Generalized Cross Entropy approach**

Topic: Some important issues regarding the matrix

Author: Esteban Fernandez Vazquez

Co-Authors: Geoffrey J.D. Hewings

When survey input-output tables are not available, some non-survey technique is applied to estimate the target matrix. From known information about the row and column margins, the cells of the matrix are estimated using as a priori information other table supposedly similar to the target matrix. The adjustment process, however, usually lies on assuming that we have perfect knowledge on the row and column margins of the target matrix, which could be considered as a non-realistic supposition. This paper explores the possibilities of changing this assumption and proposes alternatives matrix adjustments based on Generalized Cross Entropy that can base on non-reliable margins.

## **A decomposition of CO2 production emissions in the Andalusian economy**

Topic: Consumer responsibility and households' carbon emissions

Author: Patricia D. Fuentes Saguar

Co-Authors: Manuel Alejandro Cardenete Flores, Clemente Andrés Polo

The aim of this paper is to analyze the energy sector in Andalusia, a Spanish region, and its importance from the viewpoint of final energy consumption, trying to determine which demands are the most costly to satisfy in terms of emissions of pollutants to the atmosphere. To do this, we apply an additive multiplier decomposition methodology to the Andalusian Social Accounting Matrix for the year 1995. The method implemented allow us disaggregate the Andalusian energy sector's revenue-generating process into different effects depending on the source of the demand. To gain a better understanding of the behaviours of the different branches of the economy, we divide Andalusian productive activities into two groups, which we call subsystems (energy subsystem and complementary subsystem). We then apply the multiplier decomposition methodology to each one separately. This way, we can identify the influence that the final demand of each of these groups has on income generation and energy sector emissions in the Andalusian economy. The information obtained from this exercise allow know which sectors are the final main responsible of the emissions, and confirm that Construction and some branches of the services sector are the most costly in terms of CO2 emissions.

## **AISHA : A Tool for Constructing Time Series and Large Environmental and Social Accounting Matrices using Constrained Optimisation**

Topic: Organized session: Presenting Eora: A Balanced World MRIO

Author: Arne Geschke

Co-Authors: Keiichiro Kanemoto, Manfred Lenzen, Daniel Moran

AISHA is a tool which facilitates building complex input-output models. Users provide traditional or environmentally extended input-output matrix data along with concordance matrices. The software merges these datasets, applies a constrained optimization algorithm to reconcile partially-determined and conflicting data, and produces a balanced multi-region input output table. The AISHA tool can handle large IO tables with up to 20,000 total sectors. This paper describes the software capabilities and details the matrix balancing and constrained optimization algorithms. The AISHA tool has been used to build the Eora global MRIO model but can also be used to vastly simplify the process of building or updating other large or small IO tables.

## **A critical review of the literature on integrated macroeconomic & input-output models**

Topic: Issues in CGE and econometric modelling

Author: Partha Pratim Ghosh

Co-Authors: Debesh Chakraborty, Arpita Ghose

Keynes (1936) wrote his magnum opus, *The General Theory Of Employment, Interest And Money* during the Great Depression of the 1930-s. At about the same time, Leontief (1936) came up with his seminal article that culminated in the genesis of the Leontief Input-Output System. These two revolutionary ideas provided the foundations on which researchers developed two major strands of economy-wide quantitative methodologies, namely Macroeconometric Modeling and Input-Output

Models. Over time, both approaches have developed a rich tradition of empirical studies, focusing specially on economic analysis and policy prescriptions for managing the economy. Klein (1978, 1986) advocated the integration of these two systems into a framework that incorporates substantive structural details, allowing for both structural and macroeconomic policy. Several countries have developed models using this integrated approach, in the light of Klein's ideas. The present paper makes a critical review of these Integrated Macroeconometric And Input-Output Models with respect to their objectives, methods of estimation and their results. The review includes, among others, selected developed countries such as the USA, Canada and Japan and several developing nations of the world. Models reviewed from developing countries include, among others, Bangladesh, Nepal, Sri Lanka, India and Iran from Asia, Egypt and Nigeria from Africa and Brazil and Mexico from Latin America. This critical review will contribute to the further development and refinement of the Keynes-Leontief-Klein type of models, which have become especially relevant in the light of the economic crisis in the present era of globalization.

Key Words: Integrated Macroeconometric and Input-Output Models, Keynes-Leontief-Klein Models, Economic Policy.

JEL Classification Number: B22, C50, C5

## **Modeling of Russian Economy Structure with GE-IO Approach**

Topic: Decomposition Analysis

Author: Vadim Manavirovich Gilmundinov

\* The study has been funded by Grant for young Russian scientists of President of the Russian Federation, Grant Agreement &#8470;: MK-2148.2010.6

The study is devoted to identifying the main factors determined changes in the structure of Russian economy, which characterized by growing raw orientation. For this purpose we have developed I-O approach by synthesizing with the concept of general equilibrium. To assume macroeconomic restrictions in our I-O model we have developed the mathematical model of four quadrant of I-O table. This enabled us to simulate changes in the industrial structure of Russian economy, detect and estimate the most significant factors determining the structural changes, namely: international competition, limited finance resources, and dynamic of aggregated demand. Based on the results of the calculations, we could expect the growing role of intangible services sector in the Russian economy and the need for improved measures of state support of Russian manufacturing sector.

## **Overlapping Leontief: A Boolean approach to economic thought**

Topic: Important issues in IO theory and practice

Author: Maurizio Grassini

With the language of matrix algebra and vector spaces, the 'theory of production' has blown up as much as to become a distinctive body of mathematical economics. Frequently, it is used as yardstick to classify a number of economic models. In particular, the theory of production may be considered as the foundation stone to measure mathematical and conceptual equivalences between models. Among them, Leontief's model is used to be inserted in a group of models where its peculiarities tend to fade away behind the veil of prevailing theoretical assumptions. Sraffa and von Neuman models described in their seminal papers and the Leontief model are outlined in their scientific environment which indicates their place in the field of economic thought. This paper will discuss a

questionable practice which can be defined as Boolean approach to economic thought. The intersection of these three models is generally detected in the 'theory of production'. This paper emphasizes the importance of the historical, academic and scientific program behind any identifiable 'model' such as those referred to Sraffa, von Neuman and Leontief. In particular, the Boolean approach mentioned in the title refers to the practice to adopt an intersection – in this case, the theory of production – to move from a theoretical field to another one ignoring the observable economy they refer to which makes these models basically not comparable .

## **Green tax reforms and the mitigation of the rebound effect: the evaluation of a likely fourth dividend**

Topic: Evaluating environmental policies

Author: Ana-Isabel Guerra

This analysis presents empirical evidence about the possible economy-wide impacts of Green Tax Reforms as well as of “hybrid” policies that combine them with energy efficiency policies. In doing so we have used a static applied General Equilibrium Model for the Spanish economy. Our results indicate that there are some complementarities between Green Tax Reforms and energy efficiency policies. In fact, according to our results, the simultaneous implementation of these policies might reinforce the likelihood of the first dividend (a reduction in CO2 emissions levels), the second dividend ( an increase of overall efficiency levels in the economy) and the third dividend, i.e. the employment dividend, while mitigating the economy-wide rebound effects from energy efficiency policies—the fourth dividend. We evaluate two types of Green Tax Reforms. The first one compensates the increases in environmental taxes with declines in the social security contributions paid by employers. The second one considers that these increases go with a reduction in the indirect taxes on domestic production. These two likely Green Tax Reforms have not been chosen ad-hoc but rather using a novel approach that allows computing the tax interaction effect. This effect is considered as a key issue on determining the derived economy-wide impacts of this type of policies. Our findings indicate that the social security contributions paid by employers lead to the largest tax interaction effects and consequently they are appropriate candidates for Green Tax Reforms in the Spanish economy.

## **Impact of China's Domestic Carbon Emission Trading Scheme**

Topic: Carbon footprinting and trade

Author: Jianwu He

Co-Authors: Shantong Li

In December 2009, as a participant in the Copenhagen Accord, China pledged to carry out a domestically binding target to reduce its economy's carbon intensity by 40 to 45 percent by 2020 compared to 2005 levels. To achieve this target, Chinese government is planning to utilize more market-based means and will begin domestic carbon trading programs during the period of 12th Five-Year Plan. By now, literature review shows that there is no study focusing on economic effect of China's domestic carbon trading. With different provincial economic structure and growth, there exists substantial difference for energy consumption and carbon emission between provinces in China. In 2008, the highest provincial carbon emission per GDP is about six times of the lowest provincial carbon intensity. Therefore, it is expected different carbon emission trading scheme will result in different effect on different provinces, and there will be some impact on income disparities between the provinces. In this paper two domestic carbon emission trading schemes are designed:

one is the emission quota based on provincial carbon emission per capita, and another is the emission quota based on accumulation of provincial carbon emission. We utilized China's multi-regional and 30 provinces computable general equilibrium (DRC-CGE) model developed by the Development Research Center of the State Council of China. This model is recursive dynamic. The model is calibrated to the 2002 provincial Social Accounting Matrix (SAM) developed from the 2002 provincial input/output tables. The paper will address macroeconomic impacts of domestic carbon emission trading schemes in China and also the impacts on provincial economic development as well as income disparity between provinces.

## **The Exiobase DBMS for the storage SUTs and transformation into trade-linked input-output tables: some illustrative applications**

Topic: Organized session: EXIOPOL

Author: Reinout Heijungs

Co-Authors: Arjan de Koning

Within the European FP6 funded project Exiopol, a database management system has been developed. The purpose of Exiobase is to:

- Store the collected single country supply–use tables and extensions.
- Transform the single country tables into a trade-linked international supply–use table.
- Transform the international supply–use table into several different kinds of input–output tables ready for analysis.

The actual analysis is carried out in CMLCA; the life cycle analysis software tool developed by CML which is suitable for LCA, EIOA and combinations thereof. Focus points during the development of Exiobase were: portability between different platforms, speed and memory performance, exchange of data with other tools and flexibility.

The final result of Exiobase as imported in CMLCA can be analyzed easily. One example of such an analysis is a contribution analysis, a break-down of the results into its constituents. If one decomposes the CO<sub>2</sub> emissions as a result of the final consumption expenditure by private households in Austria in 2000 by the country in which these emissions take place, we see that domestic sources (industries plus households) are responsible for 63% of the CO<sub>2</sub>. 37% of the CO<sub>2</sub> emission is thus embodied in imports. Main foreign countries where CO<sub>2</sub> is emitted for Austrian private consumption are Germany (7.7%), Russia (4.5%), and Italy (2.2%).

## **Dynamic analysis of the official EU27 IOT and its environmental extensions**

Topic: Organized session: Estimation of the Carbon Footprint for the EU27

Author: Reinout Heijungs

Co-Authors: Arjan de Koning

Within the context of the EUROSTAT Lot4 project, the official EU27 input-output table on a 60\*60 resolution from EUROSTAT, together with the environmental satellite, has become available.

These have been subjected to several types of analysis. As these tables are available for a series of years, the emphasis has been on analyses relating to

- \* trends of economy and environment
- \* decoupling and dematerialization
- \* eco-efficiency

\* structural decomposition

The analyses have been carried out with the freely available CMLCA software, that has been developed from an LCA software into an (E)IOA software within the context of the EXIOPOL project.

In this presentation some highlights of these analyses will be presented.

## **Offshoring and the Skill Structure of Labour Demand in Belgium**

Topic: Modelling jobs and data issues

Author: Bart Hertveldt

Co-Authors: Bernhard Michel

The traditional concern regarding the impact of offshoring on developed countries is about the worsening of the labour market position of low-skilled workers. Indeed, just like technological change, offshoring is generally believed to be skill-biased, shifting labour demand from low-skilled to high-skilled workers. This paper addresses this concern for Belgium by estimating the impact of both materials and business services offshoring on the demand for labour by skill category. In the case of Belgium, this is of particular interest given its great openness and the fact that previous research (Michel and Rycx, 2009) has found no significant impact of offshoring on total industry-level employment.

Following the standard measurement of offshoring in the literature, offshoring intensity by industry is computed as the share of imported intermediates (both materials and business services) in total non-energy intermediates. This is done by drawing on a time-series of constant price supply and use tables (SUT) for Belgium, which are consistent with the latest national accounts. The offshoring intensities are also split by region of origin of the imports using detailed trade data. This allows to specifically identify offshoring to low-wage countries. The data on employment and wages by skill category for the labour demand estimations come from social accounting matrices (SAM) for Belgium.

Estimating a system of factor demand equations, we want to determine whether offshoring is a threat for low-skilled workers, whether there is a difference in this respect between materials and business services offshoring, between offshoring to low-wage countries and offshoring to high-wage countries and between manufacturing and service industries. Moreover, we will also be looking at whether the impact on labour demand by skill category is linked to the age-structure of the workers in each skill category and whether it is influenced by the industry-level use of ICT-capital.

## **An Input and Output Analysis of Changes of Guangdong Province's Industrial Structure in China**

Topic: Regional IO: examples from SE Asia

Author: Li Hong

Co-Authors: Jianwen Yuan

Based on theories of input and output analysis, the paper analyses the present situation of the industrial linkage in Guangdong Province's economic system in China by measuring the diffusion coefficient and inducing coefficient of different industries, and tries to find out the regulative features of changes of industrial structure by analyzing the status and role of different industries in Guangdong Province's economic development. At last, it makes analytical studies on how to

promote the level of Guangdong Province's industrial structure, and makes proposals on the strategic development of Guangdong Province's industrial development.

## **Aggregate effects and measuring regional dynamics**

Topic: Organized US-BEA Session: The Measurement of New Economic Dynamics

Author: Kyle Hood

When a state experiences a labor demand shock, how does it recover? Do workers out-migrate to states with relatively higher wages, or do firms create jobs to absorb the unemployed and take advantage of low wages? Labor demand shocks can be both location-specific (i.e., independent of shocks in all other geographic regions) or aggregate in nature. If different states exhibit different sensitivities to aggregate events, then aggregate shocks will also create differences between state-level labor markets to which firms and workers may respond. In this case, it becomes imperative to properly model common shocks when measuring regional dynamics: First, a regional recovery may be brought about by a sequence of aggregate shocks that would otherwise be attributed to migration; and second, the recovery from aggregate shocks may be vastly different to the recovery from a location-specific shock.

In this paper, we address these concerns as they relate to the measurement of regional labor market dynamics. In order to do so, we present a model that permits us to decompose the variation in local labor markets into a common component, reflecting evolutions in response to aggregate shocks, and an idiosyncratic component, reflecting evolutions in response to location-specific shocks. We then apply the conventional VAR toolkit to the separate components in order to describe the recovery process. We find that differences between the responses to the two different types of shock are stark. Recovery from an idiosyncratic shock occurs within 5-6 years, with job creation accounting for about 25% of therecovery, indicating that firm migration plays a more important role than previously thought. Conversely, the recovery from a common shock is highly protracted, with employment reaching its long-run level after no less than ten years. We also find that location-specific labor demand shocks exhibit far more variance than the aggregate labor demand shocks, meaning that while short-run variation in local labor market conditions is largely driven by location-specific events, much of the long-term variation in state-level labor markets is driven by aggregate events.

## **Health Care Spending in the Long Run: An Application of the Inforum LIFT Model**

Topic: Health IO

Author: Ronald L Horst

Co-Authors: Douglas Shannon Meade, Douglas E Nyhus, Jeffrey F Werling

We use the Inforum LIFT (Long-term Interindustry Forecasting Tool) model to investigate the structural and fiscal implications of continued increases in health expenditures over the next 75 years. Alternative patterns of health-care spending growth are considered and examined for sustainability. The model illustrates various ways that relative health and non-health demands, supplies, and prices can, and cannot, be reconciled over the long term.

The LIFT model is unique among large-scale models of the U.S. economy. It employs the inter-industry—macroeconomic approach to economic modeling to provide both the dynamics and

high-level accounting of the macro models and the industry structure featured in the general equilibrium approach. It combines an inter-industry input-output formulation with extensive regression analysis in a “bottom-up” approach to modeling. Parameter estimates for structural equations largely are based on time-series regressions. Forecasts and simulations are made year-by-year, allowing analysts to examine both the ultimate economic impacts of policy changes or economic shocks and the dynamics of the economy’s adjustment process.

This paper describes recent developments of the LIFT model and provides an important example of its application. This version of LIFT incorporates the integrated industry and national accounts of the U.S. Bureau of Economic Analysis. It contains variables for output and inter-industry flows, final demand, and international trade for 120 commodity sectors comprising the entire economy; personal consumption for 92 spending categories; equipment and software investment by 65 purchasing industries; and labor compensation, returns to capital, and prices for 65 industries.

## **The Development of the Brazilian Amazon Region and Greenhouse Gases Emission: A Dilemma to Be Faced!**

Topic: Analyzing greenhouse gas emissions in Mexico and Brazil

Author: Denise Imori

Co-Authors: Joaquim Jose Martins Guilhoto, Caio Waisman

The purpose of this work is to verify the existence of possible tradeoffs between policies direct to reduce the emissions of greenhouse gases with the ones direct to foster the development of the Brazilian Amazon Region, which is one of the poorest regions in the country. In order to achieve this goal, this paper uses an interregional input-output (I-O) model at the State level, estimated for the Brazilian economy for the year of 2004. The I-O model is used to make a comparison between the economical and the environmental relevance of each sector in the economies of the States in the Amazon region and on the rest of Brazil. This study considers the greenhouse gases emissions not only from the economic activities by itself, but, also for the more important factor of the land-use changes in the Brazilian Amazon region. A fact of most importance, given that in 2005, about 60% of the Brazilian emissions of greenhouse gases were due to the land-use change in the Brazilian Amazon Region. Moreover, in the Brazilian Amazon region, especially in the last decades, the deforestation was linked mainly to economic factors than to policies conducted by the government. The results show that the sectors with the greatest importance in terms of emissions are cattle and food production. Also, they are also the most prominent for the region's economic development. This poses a dilemma that needs to be faced not only by Brazil, but also by the developed nations, as the burden of the reduction in the greenhouse gases emission in the Brazilian Amazon region cannot be only put on the poor population of the region!

## **An evolutionary perspective on production networks in the Asia-Pacific region**

Topic: Trade and supply chains

Author: Satoshi Inomata

The complementarity of production system is both the cause and outcome of deepening economic interdependency between countries. The paper traces the development of cross-national production networks in the Asia-Pacific region over the last two decades.

The conventional approach to this kind of problem-settings is the linkage analysis, which



generally concerns to measure the "strength" of interconnectedness among industries, by calculating the magnitude of backward and/or forward linkages between countries. In this paper, however, an alternative approach for the evaluation of cross-national production networks is introduced in addition to the above-mentioned traditional apparatus, by employing the input-output model of Average Propagation Length (Dietzenbacher et al. 2005). The APL is formulated as a weighted average of the number of production stages which an impact from industry  $j$  goes through until it ultimately reaches industry  $i$ , using the share of impact at each stage as a weight. It represents the average number of production blocks lining up in every branch of all the production chains, or, in short, an industry's level of fragmentation.

Using these two types of information, namely, the "length" and "strength" of linkages, the evolution of cross-national production networks in the Asia-Pacific region is visualised by using the time-series dataset of the Asian International Input-Output Tables.

## **Water Footprint Analysis in Kanto basin zone, Japan by compiling the Kanto Interregional Input-Output Table**

Topic: Water IO: country case studies

Author: Taku Ishiro

We have a detailed picture of water inducement of Kanto region, Japan as water footprint. To analyze waterfootprint in Kanto region we compile the Kanto Interregional Input-Output Table. Previously we have interregional input output table in Japan among Kanto Hokkaido Tohoku Chubu Kinki Chugoku Shikoku Kyushu and Okinawa made by Ministry of Economy Trade , and Industry. However we don't have interregional input output table within the Kanto region, compared to Kinki region which is made by KISER. Therefore it is significant to compile the Kanto Interregional Input-Output Table. We decide the range of Kanto region ,Tokyo Kanagawa Chiba Saitama Ibaraki Gunma Tochigi Niigata Nagano Yamanashi and Shizuoka. Therefore we compile the Kanto Interregional Input-Output Table as 11 regions by 28 sectors. Kanto region include Tokyo Metropolitan area which have 30 Million inhabitants. Basically the estimation about interregional trade of Kanto region is operated by the census of commodity distribution in Japan. Secondly we estimate the water use by sector about 11 region by census of manufactures.

The method of calculation of regional water footprint is based on the model of interregional inducement by input output analysis.

The result is that Tokyo Metropolitan area such as Tokyo Kanagawa Saitama Chiba leave water footprint towards surrounding area such as Ibaraki Tochigi Niigata Shizuoka. The result have important information that some region use their water for other region. The result also gives useful information for regional water management.

## **Accounting foundations for interregional commodity-by-industry input-output models**

Topic: Interregional analysis

Author: Randall Jackson

Co-Authors: Walter Schwarm

Several procedures for generating interregional commodity flow matrices have been developed in the US recent years (see, e.g., Canning and Wang 2005, Jackson et al. 2006, Lindall, Olsen and Alward 2006). Despite the fact that these methods derive from the commodity-by-industry framework, very little attention has been given recently to the fundamental conceptual issues that

must be confronted to generate a consistently defined interregional model or to conduct an interregional impacts assessment using an appropriate interregional framework. This paper revives the focus on interregional modeling issues initiated by Oosterhaven (1984), identifies and elaborates on these and additional issues, and traces the development of the accounting foundations from single-region inter-industry through interregional commodity-by-industry accounts. Its contribution lies in the provision of a high-level perspective on these frameworks that in the process both clarifies and simplifies key conceptual issues and operational decisions.

## **Sense and sensitivity of structural decomposition analysis**

Topic: Issues and examples of SDA

Author: Peter Rørmoste Jensen

In a number of years Structural Decomposition Analysis (SDA) has been an important tool for Statistics Denmark to break down the observed changes in especially physical variables like energy consumption or CO<sub>2</sub>-emissions into the changes in their physical and economic determinants. Working with this methodology we have observed that some of the methodological choices to be made prior to using this method can affect the outcome and probably even the conclusions of the analysis. The purpose of this paper is to identify and measure the sensitivity of the analysis to a number of those choices and discuss the sensibility of the method in light of its sensitivity to various factors.

In the most cited article in this area Dietzenbacher and Los (1998) the authors addressed the question of sensitivity as well. They concentrated on the sensitivity to different solutions of the non-uniqueness problem and to the choice of aggregation level. This study looks at the same aspects but the list of factors to which the SDA may be sensitive is extended. The study is based on empirical evidence from various Danish SDA's carried out on a mixture of physical and economic variables.

An SDA requires that economic variables are represented in quantities rather than in current prices. It usually means that variables are measured in prices of a fixed base year. But in recent years variables measured in previous years prices have been introduced as well. The final type of quantity variables is fixed prices, chained values. This study carries out SDA's based on all three types of quantity variables and the sensitivity of the calculation to the choice between the methods is quantified. As it is normally not possible to apply simple summation rules to variables in fixed prices, chained values, the third type requires the development of special matrices. Thus, in this paper it is shown how input-output matrices and vectors can be compiled in fixed prices, chained values and then subsequently adjusted in such a way that they can be applied in input-output models just like traditional fixed price matrices.

## **Correlations among direct input coefficients and its applications to update IO tables: a empirical investigation**

Topic: National accounts

Author: Xu Jian

Co-Authors: Xiaolin Lu

Coefficient change in input-output model has attracted wide attention, but there is relative little research on correlations among change in direct input coefficients. This paper applies some

important correlation measures including Pearson's correlation coefficient, Spearman's rank correlation coefficient and Kendall coefficient to investigate correlations among direct input coefficients based on Chinese national input-output tables for 1992,1995,1997,2002 and 2005. Several coefficient groups consisted of those direct input coefficients with strong correlations each other are identified and the reasons of existing correlation are proposed. Identifying correlations among direct input coefficients has important meanings in many aspects. For example, it will provide new information when updating IO tables. This paper improve traditional updating procedures by introduce coefficient correlations information. Better performance of new procedure is proved.

## **CO2 Embodied in International Trade of China with Implication for Global Climate Policy**

Topic:

Author: Xuemei Jiang

The international trade creates a mechanism for consumers to shift environmental pollution associated with their consumption to other countries. As the world second largest trader and biggest producer of carbon dioxide, China has been one of the most frequently-used test cases in literatures when assessing to what extent the trade influences the national responsibilities of CO2 emissions. Their empirical results, however, show strong differences in both aspects of exports and imports under different assumptions. In this paper, we propose that the impact of trade on China's total emissions should be evaluated in a systematic way, in which the evaluation of exports is dependent on the assumption for imports. Based on a series of input-output tables, the empirical analysis is conducted to provide a range of the measured impacts of trade on China's emissions during 1997-2007. Furthermore, China is just one of the developing countries which take account for emissions consumed by developed countries through trade surplus. It is also discussed the implications from China's case on global emissions reduction, regarding the policy focus in future protocol of climate change.

## **Forecasting replacement demand of durable goods and the induced life cycle emissions: a dynamic waste input-output approach**

Topic: LCA application

Author: Shigemi Kagawa

Co-Authors: Shinichiro Nakamura

In developed countries, replacement demand of durable goods such as automobile is not only an important driving force of economic growth but also a key factor in the reduction in environmental impacts such as emissions and waste. Considering that the future replacement demand largely depends on engineering scrappage reflecting physical wear and tear which increases with products age and/or use (Greenspan and Cohen, 1999), this study proposed a novel method to forecast the replacement demand of durable goods and the life cycle environmental impacts by incorporating product lifetime distributions reflecting the engineering scrappage (Kagawa et al., 2008) into the waste input-output analysis (Nakamura and Kondo, 2009). Using the forecasting method, we estimated industrial outputs, employments, and life cycle CO2 emissions induced by future automobile replacement demand and secondary resource flows and landfill consumptions associated with scrapped automobiles for the period 2000-2025 in Japan. We finally argued how to manage CO2 emissions and resource flows brought about by the future automobile replacement demand.

## **The Carbon Footprint and Carbon Leakage of Prefectures: A Case Study of Japan**

Topic: Carbon footprinting and trade

Author: Shigemi Kagawa

Co-Authors: Ryoji Hasegawa, Makiko Tsukui

The local governments in Japan recently have been increasingly concerned with environmental problems in their own regions according to the trends of decentralization. It is essential to estimate environmental effects of regional economic activities and establish effective energy policy at the regional level. However, those effects are still unclear because basic data is lacking. In this paper, we constructed the multi-regional input-output table with inter-regional shipments among 47 prefectures in Japan using the intra-regional input-output tables compiled by the local governments and applying a non-survey technique. Using the multi-regional table, we estimated the carbon footprint and carbon leakage of the Japanese 47 prefectures and argued the regional emission responsibilities from the point of view of both consumer responsibility and producer responsibility.

## **Development of Input-Output Accounts within National Accounts: Compilation and analysis of tax matrices within the input-output accounts for Slovenia**

Topic: National accounts

Author: Janja Kalin

In the Slovenian Statistical Office we have been now for a decade regularly compiling SUT and IOT at current prices. In recent years we have started with the compilation of tables at constant prices. In the paper it will be presented our current work and new practices in this field, data sources, methods and techniques used. We will focus on some actual important compilation areas, new users' demands and challenges, connected also to increasing data demand for the compilation of different satellite accounts. We will discuss data availability and its suitability for the compilation process and the integration and importance of this work within the compilation process of national accounts.

## **RHOMOLO: A Dynamic General Equilibrium Modelling Approach to the Evaluation of the EU's Regional Policies**

Topic: Interregional analysis

Author: d'Artis Kancs

Co-Authors: Andries Brandsma

This paper describes a new dynamic general equilibrium framework (RHOMOLO) being developed at the European Commission for evaluating the EU Cohesion Policy. The model is constructed using the concept of Dynamic Spatial Computable General Equilibrium (DSCGE), which solves for Walrasian equilibrium in a sequence over time.

RHOMOLO is a micro-founded comparative static general equilibrium model employing the utility and production functions to describe the household, firm and government decisions by incorporating the modelling of (dis)economies of scale, external economies of spatial clusters of activity, continuous substitution between capital, labour, energy and material inputs in the case of firms, and between different consumption goods in the case of households. Firms operate under economies of scale in markets with monopolistic competition of the Dixit-Stiglitz type. The RHOMOLO model utilises the notion of the representative economic agent, which aims to capture the behaviour of

each population group or sector through that of a single aggregate agent. The behaviour of each such an aggregate agent is driven by optimisation criteria, such as maximisation of utility or minimisation of costs. The model is neo-classical and assumes average cost pricing and no excess profits.

RHOMOLO has a detailed geographical dimension and full inter-regional input-output structure of economies. It models the EU economy as consisting of NUTS2 regions which are linked (both to each other and to the rest of the world) by trade, labour, capital and income flows.

The modelling of labour and capital flows is strongly influenced by the availability of data, as the availability of data at NUTS2 level is limited. Intra-country migration data are available at NUTS2 level; hence RHOMOLO models only intra-country between-region migration flows. Capital flows (FDI) data are available only at the country level; hence the model covers only country-to-country flows of capital. For their investments, countries draw from a pool of funds which consists of domestic savings and of savings coming from other EU countries and the RoW. This pool is assumed to be distributed among the regions and sectors by an 'investment bank' funding physical capital investments according to a specified investment rule.

Similarly, the modelling of interregional trade flows is largely determined by data availability. The only data available at regional level are data on the total origin-destination flow of commodities between the regions by type of commodity. There is neither information about trade between regions in services, nor information about differences in the geographical mix of the commodities bought by different sectors and households in the region. The lack of data results in a simplified structure of the model, which assumes no trade in services between the regions. There is also no difference in the geographical mix of the commodities bought by various sectors and households in a particular region. Under this assumption, the decisions of both sectors and households about buying commodities from a particular EU region are modelled as the decision of a representative agent.

The RHOMOLO model contains four spatial effects: (i) The market-access effect: monopolistic firms want to locate themselves in a big market and export to smaller markets. (ii) The variety effect: monopolistic firms (and consumers) want to locate themselves in a big market with the greatest variety to increase productivity (utility for consumers) via a larger choice of intermediate inputs. (iii) The cost of living effect: goods tend to be cheaper in a region with more economic activity since consumers in this region import less and reduce their transport costs. (iv) The market-crowding effect: monopolistic firms have an incentive to locate themselves in regions with few competitors. Whereas the first three effects are agglomeration forces, the last effect is dispersionary. Trade costs, commuting costs and the regional availability of land and housing determine the relative strength of these forces.

Using an example of transport infrastructure investments, the paper shows how changes in transport costs trickle down through the inter-regional input-output structure of economies, affecting regional (as well as national) economic development. Transport costs affect prices directly and affect logistical costs and labour costs that influence the production process. The interaction between regional labour supply and demand and wages results in both national and regional changes in vacancies and unemployment. Changes in regional production affect intermediate demand, consumption and variety through the variety effect, the market-access effect, and the market-crowding effect.

## **Building Eora: a Global Multi-region Input Output Model at High Country and Sector Detail**

Topic: Organized session: Presenting Eora: A Balanced World MRIO

Author: Keiichiro Kanemoto

Co-Authors: Arne Geschke, Manfred Lenzen, Daniel Moran

There are a number of initiatives aimed at compiling large-scale global Multi-Region Input-Output (MRIO) tables complemented with non-monetary information such as on resource flows and environmental burdens. This paper describes the construction of the Eora model, a MRIO model which: represents all countries at a detailed sectoral level, allows continuous updating provides information on data reliability, contains table sheets expressed in basic prices as well as all margins and taxes, provides confidence intervals, and contains a historical time series. We achieve these goals through a high level of procedural standardisation, automation, and data organisation.

## **The Relationship Between The Tabulation Method Of Real-Time Input-Output Table And The Modernization Of Enterprise Management**

Topic: Issues in input-output economics

Author: Ning Kang

This article is market oriented and is based on the approach of formulating either an input-output planning model beforehand as to accomplish a real-time analysis instructing the business operation of enterprises, or an input-output statistic model afterwards as to accomplish a real-time analysis inspecting the enforcement of business plans. The basic data of product variety, quantity and corresponding quantity of material in both models can be figured out. Provided that all the "Nine Must-dos" regarding enterprise management modernization, even part of them, can be practiced, the serial accounting approach of the "Nine Must-dos" will be able to cope with the crisis similar to Enron Event. Provided that the "Nine Must-dos" are adopted globally, the macro-scale input-output model, input-occupancy-output model and dynamic input-output model formulated either on a regional basis or a national basis can be reference to the making of economic policies, setting up a supporting system of social management technology to guide economic construction and development, so that the root of international financial crisis can possibly be eliminated before it is going to spread.

## **Efficient Size of Regional Population: an Interregional CGE Model Approach**

Topic: Theory and application of CGE modelling

Author: Euijune Kim

Co-Authors: Geoffrey J.D. Hewings, Nam Kyung-Min

This paper identifies if the population size of the Seoul Metropolitan Area (SMA) in Korea is efficient in terms of national economy, developing a recursive interregional Computable General Equilibrium (CGE) model with population module. In the general equilibrium framework, explicit benefit and cost by population increase are estimated as the industrial value added and inflation functions by region. The efficient size is computed as a range of population to positively contribute to economic growth of nation rather than only that of the SMA. Also, the optimal size is regarded as the population to maximize the GDP. Implicitly, it can maximize difference between the aggregate agglomeration benefits and costs.

The CGE model is developed for simply four industrial sectors of two regions, namely the SMA and the rest of Korea (ROK). The model specifies the behaviors of economic agents of six producers, two regional households, two regional governments and a national (central) government, and the rest of the world. The model is applied to various regional population alternatives of the SMA for fifteen periods. With total national population size fixed, the model can estimate the marginal increase of the relative share of the SMA or the marginal decrease of the relative share of the ROK population on the national and regional income growth. It reveals the range of efficient population size of the SMA and its optimal sizes by scenarios. The counter-factual analysis finds that de-concentration of population is desirable for the national economic growth of Korea. As the population share of the SAM to nation increases more than roughly 38%, the economic growth rate could start to decrease.

## **A New Method for Triangulation of Input-Output Tables for Comparing Industrial Structures and Investigating Clusters of Industries**

Topic: Various approaches to structural analysis

Author: Yasushi Kondo

Understanding the industrial structure of a national or regional economy is one of the central issues in economics. Because an input-output table (IOT) provides a complete and detailed picture of the economy from the point of view of inter-sector transactions, there has been a great need for summarizing and visualizing IOTs in a way that facilitates specific analysis and interpretation. The triangulation of an IOT, which dates back to at least the 1950s, is one such method, known for providing understanding of the hierarchical structure of industrial sectors. Its importance has recently been rising, largely due to more researchers and practitioners using input-output tables for tackling environmental issues, and with variants of IOTs like inter-sector energy flow and material flow accounts becoming available. This paper proposes a new method to triangulate IOTs for comparing the industrial structures of economies and investigating clusters of industries within an economy. The method for comparing the industrial structures is consistent with a maximization of the Kendall rank correlation coefficient as a measure of similarity of hierarchies, while the Spearman rank correlation coefficient has been used in the literature without paying attention to a maximization of it. The method for investigating clusters can achieve a block-triangulation, for which expert knowledge of industrial structures or physical characteristics of products is not necessary. The application of the proposed method to the Japanese IOTs demonstrates its usefulness and exemplifies how it provides insight into industrial structures.

## **Embodied and induced technological change and the price of carbon**

Topic: Organized session: WIOD 3: Environmental Applications

Author: Kurt Kratena

The aim of this paper is the analysis of driving forces for technological change that increases energy efficiency and reduces carbon emissions in production. This analysis is based on dynamic factor demand models with K,L,E,M inputs in production. From the solution of the dynamic optimization model we derive an investment function that depends on factor prices and on policy conditions. The model is estimated based on WIOD and EUKLEMS data for different industries across EU countries.

The modelling framework allows for different sources of technological change: factor bias, embodied and induced technical change. In the case of emission mitigation policies in terms of a price for

carbon, we derive the energy demand reaction from substitution effects as well as from different sources of technological change.

## **Environmental Policy and Fiscal Consolidation**

Topic: Modelling monetary policies

Author: Tobias Heinrich Kronenberg

Many governments are currently trying to reduce public expenditure and/or increase public revenue. Their focus on fiscal consolidation may come at the expense of environmental policy goals, for example in the case of environmentally motivated subsidies. This paper argues that fiscal consolidation can be reconciled with environmental policy if appropriate policies are chosen. Based on a literature survey it assembles a list of “win-win” options. These include, for example, the phasing-out of environmentally harmful subsidies. The effects of five selected policy measures are simulated using an applied general equilibrium model of the German economy.

For each policy measure, we consider the effect on the public budget, the macroeconomic impact (GDP, employment) and some environmental consequences (energy use, GHG emissions, material consumption). The results show that fiscal consolidation can go hand in hand with environmental policy, at least to a certain extent. The paper is partly based on a project commissioned by the Federal Environmental Agency of Germany.

## **On The Intertemporal Stability of Bridge Matrix Coefficients**

Topic: Some important issues regarding the matrix

Author: Tobias Heinrich Kronenberg

An increasing number of input-output analysts use micro data from household surveys in order to model the consumption patterns of households as a function of other variables like prices, income, and socio-demographic factors. These surveys usually adopt a different classification (COICOP) than the input-output tables (CPA/NACE). A bridge matrix is required to convert the data from COICOP to CPA/NACE (and vice versa).

This procedure is unproblematic when a bridge matrix is available for the year(s) to which the model refers. If a model is used to construct forecasts or scenarios of the future a problem arises, because the coefficients relating consumption purposes and commodity groups may change over time. This problem has not been adequately addressed in the literature.

The present paper examines a time series of annual bridge matrices from 1991 to 2006 for Germany. It uses descriptive statistics, visualisations, and econometric techniques to identify trends and patterns in the development of coefficients over time. It concludes that modellers may treat many coefficients as (approximately) constant over time, but certain key coefficients are not constant and should receive more attention.

## **Structural Decomposition Analysis on China's Domestic Value-Added Generated by Chinese Exports**

Topic: Issues and examples of SDA

Author: ZHU Kunfu

Co-Authors: Quanrun Chen, Cuihong Yang



Base on extended IO model in non-competitive imports type capturing processing trade, this paper proposes a structural decomposition analysis(SDA) model to analyze the effect of Chinese exports total domestic value-added(DVA). From SDA model, there are three kinds of influencing factors determining total DVA generated by Chinese exports, such as the exports scale and structure, the rate of direct exports DVA, the linkage effect between production for domestic demand and exports. The result indicates that the exports scale enlarging is the key factor for total DVA of Chinese exports increasing from 2002 to 2007.

Keywords: extended IO model in non-competitive imports type capturing processing trade, structural decomposition analysis, Chinese exports, domestic value-added

## **The Concept of Rent in Economics**

Topic: Organized Session: Rents and Physical Resource Constraints in Input-Output Models

Author: Christian Lager

In national accounts and in input-output analysis one component of value added is the operating surplus. That component is a residual and is identified by deducting all other components from value added. It contains, in principle, interest and profits as well as all kinds of rents and royalties. This paper intends to clarify the meaning and stress the importance of these factor incomes. The main focus is on rent for scarce natural factors of production. First, a classification of these factors is provided. It turns out that – for analytical purposes – it makes sense to distinguish (i) renewable, (ii) depletable and (iii) indestructible natural resources. According to classical scholars rent is paid for the use of the original and indestructible powers of the soil, i.e. Ricardian Land. The Smithian notion of absolute rent, the Ricardian concept of (intensive, extensive and external) differential rent as well as Thünen's idea of spatial rent will be discussed. Whereas the classical authors applied the concept of rent also to depletable resources (e.g oil, coal or mineral deposits) the neoclassicals displaced that idea by Hotelling's rule. Kurz and Salvadori have demonstrated that, both, Hotelling's rule as well as the classical concept of differential rent can be applied to depletable resources depending on the acceptance of some alternative restrictive assumptions. The concept of rent is, however, not limited to natural resources. In the semblance of the principle of marginal productivity it has been applied by the neoclassical school to all factors of production.

## **The Wage as Rent: The Factor-Price Frontier revisited**

Topic: Organized Session: Rents and Physical Resource Constraints in Input-Output Models

Author: Christian Lager

The Sraffian concept of a factor-price frontier which provides a technological relation between the real wage rate and the rate of profits has been used by several economists (e.g. Hicks, Morishima, Samuelson, Leontief). The classical scholars tend to take the real wage rate as given and, therefore, determine the rate of profit endogenously. Sraffa, on the contrary, argues that the rate of profit is given (determined by the financial system) and the wage rate is endogenous. This paper prefers a different route. If one accepts the proposition, that the real wage rate is flexible and increases (decreases) if there is excess demand (supply) of labour then, in the long run, the wage rate is either at its minimum (subsistence) level (as in the classical case) or is determined as a rent for scarce, i.e. fully employed labour (as in the neoclassical case). In that case the real wage rate assumes either its maximum level or is determined at a switch point of coexisting methods of production. These switch points can be considered as long run equilibrium positions which may be stable or – in the

presence of re-switching – unstable. In the latter case persistent unemployment at a minimal wage rate is possible.

## **Comparing Input-Output Tables of Different Economies: A New Application for Decomposition Techniques?**

Topic: Issues and examples of SDA  
 Author: Michael L Lahr  
 Co-Authors: Ling YANG

Many measures have been used to compare input-output (I-O) arrays. Most were originally developed to analyze the accuracy of econometric forecasts or at least for comparing vectors of similar dimension. As a result the measures are not entirely satisfactory for comparing matrices. For example, if two economies are the same with the only difference that one has more productive labor (i.e., compensation's share of output is lower), we would expect a "good" measure to reveal that the two economies are essentially the same. Vector-based measures need not show the degree of similarity if they, indeed, reveal the similarity of the economies at all. For this reason the Structural Decomposition Approach (SDA) to analyzing two economies was developed. Interestingly however, when comparing I-O tables of two different regions or when comparing estimated annual accounts to benchmarks for the same year, I-O analysts have uniformly reverted to familiar vector-based measures. For the first time, we use SDA to compare two tables for the same year (the 2002 Washington State to the 2002 U.S benchmark table; and the 2002 annual US table to the 2002 US benchmark) . We compare these findings to those from popular vector-based equivalents.

## **CGE Analysis of the Impacts of a Carbon Tax on China's Economy**

Topic: Theory and application of CGE modelling  
 Author: Jinghua Li

This paper introduces carbon tax into a Computable General Equilibrium (CGE) model to quantify the impact of the implementation of carbon tax to reduce carbon dioxide emissions in China. Benchmark data combining physical energy, emissions data and economic data in the form of a Social Accounting Matrix (SAM) in the year 2007 is compiled. The simulation suggests that carbon tax can reduce the CO<sub>2</sub> emission effectively. Meanwhile, GDP, domestic supply and import increases while demand for compound product has an ascending tendency. The shrinking production scale of firms leads to a decline of enterprise and the residents' income, while government revenue climbs up. At sectors level, carbon tax decreases the demand and supply of energy products with high carbon intensity, and affects the non-energy sectors in different ways.

## **The Prospects of China's Economic Development in 2030-Based on the DRC-CGE Model**

Topic: CGE applications  
 Author: Shantong Li  
 Co-Authors: Jianwu He, Zhaoyuan Xu

Since the late 1970s, with the opening up and the economic system reform, the Chinese economy has made tremendous progress and substantial enhancement in economic power. From 1978 to

2010 the average growth rate is 9.8% per year. Various social undertakings have also made considerable progress, China's reform and development undertaking enters into a new historical stage, Chinese economy has been facing new opportunities as well as more complex challenge. It will be another crucial stage for the development of China from 2010 to 2030.

This paper uses DRCCGE model based on 2007 Input-Output Table to simulate three scenarios of China's economic growth in the future. The results shows that the economic growth is expected to reach about 8% during 12th Five-Year Plan and China has the potential for rapid growth in the long run; The main risk for China in the future is the poor coordination of economic development, high pressure of resources and environmental pressure; The key to keep sustained economic growth is to achieve transition of the pattern of development

## **Depreciation of Business R&D Capital**

Topic: Organized session: The Measurement of Intangible Capital

Author: Wendy Li

R&D depreciation rates are critical to calculating the rates of return to R&D investments and capital service costs, which are important for capitalizing R&D investments in the national income accounts and harmonizing BEA statistics with those of the productivity program of BLS. Although important, measuring R&D depreciation rates is extremely difficult because both the price and output of R&D capital are generally unobservable. To resolve these difficulties, economists have adopted various approaches to estimate industry-specific R&D depreciation rates, but the differences in their results cannot easily be reconciled. In addition, many of their calculations rely on unverifiable or oversimplified assumptions. As of now, measuring R&D depreciation rates remains an unresolved problem.

To incorporate the effect of industries' technological and competition environments, as well as gestation lags, I develop an R&D investment model to derive industry-specific R&D depreciation rates for four R&D intensive industries, the pharmaceutical industry, the IT hardware industry, the semiconductor industry, and the software industry. Based on Compustat company-based dataset, the model has produced results that not only align with recent research results that R&D depreciation rates should be greater than 15% but also indicate the dynamic technological changes across industries. The data cover the period from 1989 to 2008. The constant industry-specific R&D depreciation rates are:  $11.82 \pm 0.73$  % for the pharmaceutical industry,  $37.64 \pm 1.00$  % for the IT hardware industry,  $17.95 \pm 1.78$  % for the semiconductor industry, and  $30.17 \pm 1.89$  % for the software industry. The industry rankings of these R&D depreciation rates are consistent with the conclusions in most recent literature. Time-varying industry-specific R&D depreciation rates are also presented in this paper, and they further enhance our understanding about the dynamics of technological change and competition across industries.

## **water and energy nexus in energy production: assessing water consumption and CO2 emissions of wind power in China**

Topic: Energy consumption and CO2 emissions

Author: Xin Li

Co-Authors: Klaus Hubacek, Yim Ling Siu, Kuishuang Feng

Between 2002 and 2007, China's primary energy consumption increased from 1,482 million tonnes coal equivalence (Mtce) to 2,656 Mtce. At the same time, China's contribution to the global CO2

emissions increased from 14% to 21%. It is estimated that power generation accounts for more than half of the Chinese CO<sub>2</sub> emissions. Many studies have been carried out on energy consumption and CO<sub>2</sub> emissions during the life cycle of various power generation technologies, but there are very few studies focusing on China. Furthermore, in most of studies, the nexus between water and energy are ignored. Water consumption of power plants such as nuclear power plants and carbon capture and storage power plants which are considered as important alternatives to diversify the future power system in China is substantial. The choice of such water-intensive power generation technologies might exacerbate the challenge of water supply in water scarcity regions. Hence, it is indispensable to evaluate other environmental implications, in addition to carbon emissions, of various power generation technologies in order to achieve climate change mitigation objectives at national level as well as meet other environmental targets rather than shifting from one problem to another.

In this paper, we adopt input-output based hybrid life cycle analysis to evaluate water consumption of Chinese wind power. To the best of our knowledge, it is the first study to adopt IO based hybrid LCA to analyse the energy and water nexus in the Chinese power system. The most recent 2007 national IO table with 135 sectors and an 800kW wind turbine LCA data from Ecolnvent are used in this analysis. China now has the largest wind power generation capacity in the world. Besides, 200 GW of wind turbines are planned to be installed by the end of 2020. Although wind power is considered as nil emission during its operation, the upstream emissions and water consumption should not be ignored. The results would help to understand the environmental impacts of wind power and also to provide quantitative evidence for the future energy planning in China.

## Revisiting the Phillips curve:A CGE-MCDM approach

Topic: Issues in CGE and econometric modelling

Author: CARMEN LIMA

Co-Authors: Francisco Javier André, Manuel Alejandro Cardenete Flores

In this paper we provide a new reading of a classical economic relation: the short-run Phillips curve. Our point is that, when dealing with inflation and unemployment, policy making can be understood as a multicriteria decision making (MCDM) problem. Hence, we use so-called multiobjective programming in connection with a computable general equilibrium (CGE) model to determine the combinations of policy instruments that provide efficient combinations of inflation and unemployment. This approach results in an alternative version of the Phillips curve that we label as efficient Phillips curve. We apply our methodological proposal within a particular regional economy, Andalusia in the south of Spain. We test if the observed policy is efficient and, if not, we analyze to what extent it could be Pareto improved. The aim of this paper is not a doctrinal positioning on economic thought about the existence or not of the Phillips curve, but a methodological framework to revisit the Phillips curve as well as an applied exercise with real data. In fact, this tool could be used to give some keys for policy advise and policy implementation with the intention of fighting against the Andalusian high rate of unemployment.

JEL Classification: C61, C68, D78, R13

Keywords: Multicriteria Decision Making, Computable General Equilibrium Model, Efficient Frontier, Multi-objective.

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## **An Input Output Based Method for Considering the Risk of Man-made Disaster in Life Cycle Assessment**

Topic: LCA application

Author: Chen Lin

This study proposes a new method to employ the hybrid input output model for considering the risk of man-made disaster in Life Cycle Assessment (LCA). In any production process of a certain product, there is a certain probability (more or less) to cause a man-made environmental disaster. This environmental disaster not only cause pollution directly, but also induce the inoperability of production

processes in an economy (the economy can be local or global). For instance, a terrible leak of toxic chemicals to rivers will cut off water supply and thereby cause the inoperability of local agriculture production. Thus, for the LCA of a product, we should also consider economic and environmental costs induced by this inoperability. This study employs econometric methods to evaluate the probability of occurrence of man-made disaster in a product's production process and then develops a hybrid input output model to measure the loss by the man-made disaster caused inoperability. Finally, the risk and aftermath of the man-made disaster are taken into account to revalue a product under the framework of hybrid LCA.

## **Embodied energy intensities in Chinese Provinces**

Topic: Embodied CO<sub>2</sub> emissions in trade

Author: Martin Soeren Lindner

Co-Authors: Klaus Hubacek

In order to counteract global resource depletion China is said to play a key role in reducing energy intensity of goods, products and services. Having just missed its own target of 20% efficiency reduction by unit of GDP, effective policies need to be set in place that aim at reducing intensity of industries and sectors with high embodied energy. We use a hybrid unit input-output model with disaggregated energy sectors represented in energy units to analyze indirect and direct energy intensities embodied in product flows of three provinces in China for the year 2007. Each province has a distinct economic standard, so that the study reflects the disparate socio-economic differences prevalent in China. Results show that indirect embodied energy makes up a much higher fraction in products than direct embodied intensities, and this ratio is higher in products of the well developed province Zhejiang. We conclude that economically well-off provinces in the east drive to a large extent high energy intensity of the Central and western region.

## **Comparison of direct and indirect energy consumption between China and the United States**

Topic: Energy consumption and CO<sub>2</sub> emissions

Author: Hongtao Liu

Co-Authors: Joaquim Jose Martins Guilhoto, Karen R. Polenske, Youmin Xi

As green house gas reduction and energy consumption are set to become two important issues in governments of both industrialized countries and developing countries, policy makers strive to reduce total domestic energy use. We evaluate and compare the direct and the indirect energy consumption both in the People's Republic of China (China) and the United States of America (US)

by looking at a series of hybrid energy input-output tables (1997, 2002, and 2007). We also apply structural decomposition analysis (SDA), to identify the factors causing energy intensity (energy consumption per unit gross domestic product) to differ between the countries analyzed, which lead to potential energy-saving options. Our results show that, besides the differences in direct energy consumption, huge differences also exist in indirect energy consumption between the two countries. Differences in indirect energy consumption are mainly due to differences in technology. Technological change and industrial structure change are key factors to explain the inequality of energy intensity, while there is a significant trend towards the convergence of sectoral energy efficiency between the two countries.

## **Grey Neural Network and Input-Output Combined Forecasting Model and Its Application in Sub-sector Energy Related Carbon Dioxide Emissions Estimation in China**

Topic: Neural networks, critical supply paths and resources

Author: Xiuli Liu

Co-Authors: Geoffrey J.D. Hewings

In this study, grey Neural Network and Input-Output Combined Forecasting Model (GNF-IO) was built to forecast coal, crude oil and natural gas that consumed by 42 industries in China in 2011. Applied the model, carbon dioxide emissions related with coal, crude oil and natural gas consumed by 42 industries in China in 2011 were estimated. According to the analysis and estimation results, the sub-sectors energy conservation policy recommendations were presented.

## **Relationship between income classes and CO2 emissions in Brazil**

Topic: Analyzing greenhouse gas emissions in Mexico and Brazil

Author: Ricardo Luis Lopes

Co-Authors: Kleber Defenti Bernardino

The main propose of this study is to verify and evaluate the overall level of energy and CO<sub>2</sub>-eq emissions by income classes in Brazil, as well as changes and contributions of the brazilian energy matrix associated with these emissions, considering the final demand of families consumption in three income classes, seeking to relate the level of CO<sub>2</sub>-eq emissions in each class with the corresponding efficiency and energy consumption. So are estimated the levels of CO<sub>2</sub>-eq emissions of the income classes through the construction of the Matrix Input-Output and make the conciliation of energy data from National Energy Balance with economic data. The results show that the efficiency of carbon sector presents trend of improvement in almost all sectors. This is because Brazil has used increasingly to cleaner energy sources and consequently with lower levels of efficiency of CO<sub>2</sub>-eq. When assessing the efficiency of carbon class, it was found that even with the improvement in rates of carbon efficiency and sectoral rates of carbon in classes is a trend that the lower income classes have a level of demand for carbon emissions higher, thus a greater volume of carbon emissions for real spending than higher-income classes.

## **Policies and Technologies for a Sustainable Use of Water in Mexico: A Scenario Analysis**

Topic: Applications of water IO  
 Author: Carlos A Lopez-Morales  
 Co-Authors: Faye Duchin

Water stress in Mexico is intimately linked to agricultural activities as irrigation claims 70% of national water withdrawals. The Mexican mix of irrigation technologies is dominated by flood techniques, utilized in 93% of irrigated land, while alternative drip and sprinkler systems, both with higher application efficiencies, are utilized in only 7% of irrigated land. This paper studies the extent to which public policies can induce the adoption of alternative irrigation technologies to promote a sustainable use of water. The framework is a multi-regional input-output model formulated as a linear program that solves for cost-minimizing allocations of output that are constrained by regional factor availability. The model features endogenous choice among alternative agricultural technologies and determines commodity prices based on factor costs and on scarcity rents for limiting factors of production.

The study defines and quantifies sustainable endowments of water at the regional level and performs a scenario analysis that combines the implementation of water policies with the availability of alternative irrigation technologies. The paper finds that water policies can promote water sustainability although at the expense of increasing the national price of agricultural output. In the scenario in which technology adoption is absent, water sustainability generates an increase of 36% in the agricultural price relative to a baseline. In the scenario in which technology adoption is possible, either the pricing of irrigation water or the establishment of use caps generate enough adoption to support sustainability at increases in the agricultural price smaller than 10%. Water pricing for irrigation water can generate enough public revenue for the government to cover for the total costs of technology adoption, which are computed including the financial costs of upfront investments.

## **Globalization and China's Growth: A Longitudinal Analysis of Impacts on Worldwide Energy Use**

Topic: Organized session: WIOD 3: Environmental Applications  
 Author: Bart Los  
 Co-Authors: Erik Dietzenbacher, Frederik V R Neuwahl, Robert Stehrer, Marcel Timmer

Reduced transport costs and improved communication technology have led to an increasingly tight network of trade flows across many parts of the world, as well as lots of foreign direct investment. China's growth is an immediate consequence of its success in ensuring a crucial position in this network. This paper attempts to quantify the impact of China's take-off on worldwide energy use in the period 1995-2006. Two main questions will be addressed.

First, to what extent did relocation of production activities from the Rest of the World to China lead to changes in energy use, taking into account that energy efficiencies vary across the world? Second, to what extent did rising purchasing power of substantial parts of the Chinese population lead to increased energy use, in China itself and elsewhere in the world? In view of the fact that both relocation and growing consumer demand in China will most probably be continuing phenomena for the next decade, answers to these questions shed useful light on policy questions regarding depletion of (non-renewable) energy sources.

The analysis is based on the WIOD-database (currently being developed), which consists of annual

full intercountry input-output tables including 40 countries covering about 85% of world GDP and industry-level data on energy use of several types (coal, oil, natural gas, solar, etc.). Input-output analysis allows for indicators that explicitly take into account that the energy use associated with assembly activities that are well-represented in China's coastal zone is likely to be different from vertically integrated production, although the final product may be identical. Energy used in the production of the raw materials and components that are traded to China can explicitly be linked to the assembly activities that combine these into final products.

## **The World Input-Output Database (WIOD): Introduction and Selected Database Construction Issues**

Topic: Organized session: WIOD 1: Introduction

Author: Bart Los

Co-Authors: Abdul Azeez Erumban, Robert Stehrer, Marcel Timmer, Gaaitzen de Vries

The World Input-Output Database project consortium started its activities in Spring 2009. The first aim of the project is to construct a time series of annual international input-output tables for the period 1995-2006 (with projections for 2007-2009) and to construct compatible satellite accounts regarding labor inputs, capital inputs, energy use and environmental data. The tables cover 40 countries, the value added of which amounts to approximately 85% of world GDP.

In this presentation, the project will be introduced briefly. Next, some of the most important issues regarding the construction of the input-output tables will be discussed. This part can be seen as a follow-up to some of the presentations that were given during the special sessions on the WIOD project at the Sydney 2010 IO-conference. Finally, some plans for further improving the database during the remainder of the project (until May 2012) will be presented.

## **Efficiency analysis of a multisectoral economic system**

Topic: Analyzing productivity

Author: Mikulas Luptacik

“Recessions are easily recognizable from a decrease in GDP. What really should interest us, however, is the difference between the potential of an economy and its actual performance” said Stiglitz in 2002. In the literature two approaches of productivity and efficiency analysis can be found, namely neoclassical approach and a frontier approach know as data envelopment analysis (DEA). Under neoclassical approach we refer to the seminal paper by DEBREU (1951), measuring the efficiency of the economy by a coefficient of resource utilization and to the books by ten RAA (1995) and (2005). DEA approach allows to decompose productivity growth into a movement of the economy towards the frontier and a shift of the latter. Neoclassical approach imputes productivity growth to factors, but cannot distinguish a movement towards the frontier and a movement of the frontier. In the paper by ten RAA-MOHNEN (2002) a synthesis of both approaches is provided.

The problem addressed in the present paper is concerned with efficiency analysis applied to a single economy represented by the Leontief input-output-model extended by the constraints for primary factors. First, the efficiency frontier is generated using a multi-objective optimization model instead of having to use data from different decision making units. The solutions of the multi-objective optimization problems define efficient virtual DMUs and the efficiency of the given economy is defined as the difference between the potential of an economy and its actual performance and can be obtained as a solution of a DEA model. It can be shown that the solution of the above defined DEA model yields the same efficiency score and the same shadow prices as the models by ten RAA



(1995), (2005), despite the different variables used in both models. Using duality theory of linear programming the equivalence of the approaches permits a clear economic interpretation. In the second part of the paper this approach is extended to the Leontief augmented model including emissions of pollutants and abatement activities. In this way the eco-efficiency of an economy can be analyzed.

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## **Quantifying the Impacts of Industry Preparedness Strategies with a Risk-Based Input-Output Model**

Topic: Modelling disasters

Author: Cameron MacKenzie

Co-Authors: Kash Barker

Supply chain risk management has been a popular topic with both practitioners and researchers, and different models have been proposed to help companies prepare for and react to a disruption in their supply chain. However, less attention has been given to exploring the wide-spread economic consequences that preparedness strategies have on a region following a disruptive event. Such strategies that may be used to mitigate supply chain risk include holding inventory, sourcing from multiple suppliers, maintaining surge capacity, and using alternate modes of transportation. We use a risk-based input-output model that integrates a priori preparedness decisions (e.g., inventory, alternate transportation routes, different suppliers) for the ultimate occurrence of a disruptive event. We examine the conditions that incentivize industries to prepare for a disruptive event and how those decisions impact their reactions to a supply chain disruption.

We extend the Dynamic Inoperability Input-Output Model (DIIM) to quantify how these strategies affect economic production within a region following a supply chain disruption. The DIIM is derived from the traditional input-output model and is parameterized by Bureau of Economic Analysis data as well as other regional sources. Instead of modeling industry output, the DIIM models the temporal propagation of industry inoperability, or the extent to which logical interdependencies lead to lost productivity. We propose a decision analysis model of supply chain preparedness strategies that is integrated with the DIIM to measure the efficacy of such strategies across multiple industries. We deploy the model with a data-driven multi-regional case study.

## **Interregional dispersion of impacts from regional economic shocks: A CGE explanation**

Topic: CGE applications

Author: John Robert Madden

Co-Authors: James Giesecke

The ultimate effects on regions of economic shocks are influenced by a variety of interregional factors such as changes in competitiveness with other regions, interregional input-output linkages and factor mobility, particularly via interregional migration. There are circumstances where the first two of these factors may have opposing effects, and elucidating which might dominate requires a numerical model of the underlying regional structure. To investigate these issues we simulate a number of regional economic shocks with a multiregional computable general equilibrium model. We carefully interpret the results, disentangling the effects resulting from the various mechanisms which link regions. We demonstrate the importance to our results of the type of shock, the model closure and the speed of lagged responses in wages and interregional migration.

### **Module SIOT: Session 1**

Topic: Supply and Use Tables and links to Symmetric Input-Output Tables  
Author: Sanjiv Mahajan

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### **Module SIOT: Session 2**

Topic: Supply and Use Tables and links to Symmetric Input-Output Tables  
Author: Sanjiv Mahajan

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### **Module SIOT: Session 3**

Topic: Supply and Use Tables and links to Symmetric Input-Output Tables  
Author: Sanjiv Mahajan

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### **Module SIOT: Session 4**

Topic: Supply and Use Tables and links to Symmetric Input-Output Tables  
Author: Sanjiv Mahajan

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### **Household Consumption and CO2 Emissions: The Influence of Technological factors and Composition of Final Demand**

Topic: Consumer responsibility and households' carbon emissions  
Author: Alfredo José Mainar Causapé  
Co-Authors: Rosa Duarte, Julio Sánchez Chóliz

Obviously, there is a fundamental relationship between the composition and amount of household

final demand and CO<sub>2</sub> emissions generated by an economy. Therefore, a way for analyzing the evolution of these emissions is to study the influence of technological factors and those related to the formation of demand. This analysis can be enriched by adding other decompositions that allow simultaneous studies of determinants of demand effects. Thus, in this work, the evolution of CO<sub>2</sub> emissions is break between the effects of technological changes and effects of change in final demand, decomposing the latter into four factors: the consumption patterns of households, income distribution, economic growth and population. In this way, it manages to combine qualitative factors of change in consumer habits with factors that explain the scale effect involving economic development and the increasing number of consumers.

The way to analyze the influences of these factors will be the decomposition of the evolution of CO<sub>2</sub> emissions in the sum of effects of variations in each of these factors, using the Structural Decomposition Analysis (SDA). To better capture the effects of these factors, will be considered European countries and United States, by reference to the years 1995, 2000 and 2005.

### **Using input-output model with fuzzy parameteres for analysis of sectoral structure of Ukranian industrial region**

Topic: Some important issues regarding the matrix

Author: Ganna Makarkina

Co-Authors: Tamara Merkulova

Using input-output model for analysis of sectoral structure of Ukranian industrial region is considered under conditions of lack of information about the exact values of the input-output coefficients. Coefficients are represented as fuzzy parameters in this model. For that, the classification of coefficients of Donetsk region's input-output matrixes for 2001-2003 is made using cluster analysis; each class is defined as a fuzzy variable with its membership function. Assessment of adequacy of input-output model with fuzzy coefficients is implemented for the following cases: (1) analysis of the effect of changes in final demand of basic sectors onto the gross output of sectors in the Donetsk region; (2) analysis of the effect of raising wages in some sectors onto the prices in all region's sectors; (3) analysis of the effect of increasing energy prices onto prices of all other region's sectors.

### **Downstream emissions and the carbon trade balance between world regions**

Topic: Drivers of CO<sub>2</sub> emissions

Author: Alexandra Penedo de Sousa Marques

Co-Authors: Tiago Domingos, Joao Rodrigues

Emissions embodied in a country's final consumption, as a measure of a country's responsibility on climate change, have been suggested as an alternative to direct emissions, based on the premise that processes causing greenhouse gas (GHG) emissions benefit humans by providing consumer goods and services. But, in the economic process, for every buyer there is always a seller. An obvious symmetrical approach to the emissions embodied in a country's final consumption (upstream emissions) is to consider the emissions embodied in its value added (downstream emissions). Here we compute the emissions embodied in the value added of goods internationally traded between world regions, and show the main world fluxes of downstream embodied emissions. For that we built a multi-region input-output model based on GTAP database. We find that Developed Economies and Fossil Fuel Exporters are the regions whose payments to primary factors of production are most dependent on emissions generated elsewhere. Developed Economies receive downstream emissions mainly via the value added of manufactured products' exports. Fossil

Fuel Exporters receive downstream emissions mainly from Developed Economies, through the value added of fossil fuels' exports. This sector has a high downstream intensity. The accounting of downstream emissions allows the determination of the extent to which an agent's income depends on carbon emissions. This approach, combined with upstream emissions, allows a fairer sharing of responsibility between consumers and producers that could solve the issue of "common but differentiated responsibilities".

## **Structural Spillovers and Feedbacks in North American. An international and national approach.**

Topic: Globalization, trade and spill-overs

Author: Marco Antonio Marquez

A national economic strategy has been the formation of trade blocs under the theory of comparative advantage. However, empirical evidence shows that the multipliers of trade on economic structure not all countries are as predicted by theory. The model Multi-Regional Input-Output is a theoretical tool to analyze the structure of a trade bloc because it argues that the spillover and feedback effects are determinants of growth among trading partners, further, the size of the multipliers of these effects, identifies the joint force that each sector in the block structure. This paper analyzes the effects of stroke and feedback for International Coefficients Matrix in North America, built in the Chenery - Moses model and the UNCTAD data.

## **International Productivity and Factor Price Comparisons**

Topic: Analyzing productivity

Author: Kathryn Gail Marshall

Using OECD input-output tables for a diverse group of 33 countries in the year 2000, I attempt to replicate Treffer (1993)'s findings that substantiated productivity-adjusted factor price equalization. I compute factor payments for aggregate labor and capital using value-added data adjusted for self-employment by sector, a correction which differs notably for low income countries from a widely used economy-wide self-employment correction. I find a distinctive bias in the relationship between factor productivity and factor prices depending on whether a country has a high or low wage to rental ratio compared to the United States. I explain this bias by industry-based differences in production technology together with less than unitary elasticity of substitution between factors.

## **Embodied CO2 emissions of German imports - How do technology assumptions affect the results?**

Topic: Embodied CO2 emissions in trade

Author: Helmut Mayer

When determining the energy and CO2 content of goods requires taking account of the production and emission conditions in the manufacture of those goods. This means not only considering the production conditions in the domestic manufacture of goods but also including the production conditions at the countries of origin of the imports. Often the multiregional I/O-analysis is looked at the best way to incorporate the technology of the countries of origin and to take account of the upstream linkages between the countries. However the multiregional approach requires a high

degree of effort in terms of data collection and processing. Furthermore, not all countries of origin (regions) have sufficiently detailed and up-to-date input-output tables. Inadequate disaggregation of sectors can lead to substantial deficiencies in the mapping of flows responsible for the generation of CO<sub>2</sub> emissions. Establishing the I/O analysis on monetary flows only also involves a risk to ignore the consequences of price heterogeneity of certain energy flows.

At the calculations of the CO<sub>2</sub> content of German imports another model has been pursued. Based on the I/O table for Germany, detailed data on the production and energy consumption of the energy intensive branches for the most significant countries of origin are taken into account. A calculation was implemented for fourteen countries, for which detailed import data were evaluated. The calculations take place on the basis of a hybrid computational approach, which facilitates the use of data for quantity energy input from the international energy balance sheets and from details taken from process chain analysis.

On basis of those calculations the factors influencing the results (technology assumption, level of disaggregation, hybrid or monetary approach, emission coefficients) for embodied CO<sub>2</sub> of imports are analysed.

## **Using the Inforum LIFT and Mudan Models to Investigate the Effects of Cap & Trade Legislation on International Leakages**

Topic: Globalization, trade and spill-overs

Author: Douglas Shannon Meade

The inter-industry- macroeconomic approach to economic modeling attempts to provide both the dynamics and high-level accounting of the macro models and the industry structure featured in the general equilibrium approach. The LIFT (Long-term Interindustry Forecasting Tool) model is a version of this approach for the U.S. economy, and Mudan model is a similar model for China. This paper provides brief descriptions of the LIFT and Mudan models and presents an exercise using the two models in the dynamically linked Bilateral Trade Model (BTM).

This study investigates the deployment of cap and trade policy in the U.S. This policy is based on the recently proposed Waxman-Markey bill. The analysis traces the effect of the carbon price on sectoral prices, and the resulting impacts on sectoral outputs and employment. It focuses particularly on the trade effects. Four scenarios are run, based on differing responses of China's policy makers to the U.S. carbon price. This paper discusses the implementation of these scenarios and reviews the results, including the U.S. trade impacts in the different cases. This paper focuses on effects of the legislation from the U.S. perspective, but we also discuss some of the policy issues and choices from the Chinese perspective.

## **Application of Factor Decomposition Techniques to Vertical Specialisation Measurements**

Topic: Decomposition Analysis

Author: Bo Meng

Co-Authors: Norihiko Yamano

The increasing importance of vertical specialisation (VS) trade has been considered a representative feature of rapid economic globalisation and regional integration. In order to measure a country's degree of participation in global production chains, many Input-Output based VS indicators have been developed. However, most of them focus on showing the overall magnitude of

a country's VS trade, rather than explaining the roles that specific sectors or products play in VS trade and what factors make the VS change over time. Changes in vertical specialisation indicators are, in fact, determined by mixed and complex factors such as import substitution ratios, types of exported goods and domestic production networks. In this paper, decomposition techniques are applied to VS measurement based on the OECD Input-Output database. The decomposition results not only help us understand the structure of VS at detailed sector and product levels, but also show us the contributions of trade dependency, industrial structures of foreign trade and domestic production system to a country's vertical specialisation trade.

## Direct and indirect productivity gains from offshoring

Topic: Analyzing productivity

Author: Bernhard Michel

The shift abroad of economic activities is a major issue for empirical research on the threats and opportunities of an ever more integrated global economy. This is nowadays mainly referred to as offshoring. Since the pioneering work of Feenstra and Hanson (1996), it has become common practice to measure the offshoring intensity at the industry-level through the share of imported intermediates in total output. To compute this offshoring intensity for both materials and business services for 63 manufacturing and 35 service industries we have used a series of constant price supply-and-use tables (SUT) for Belgium for the years 1995-2004 that are all consistent with the 2007 vintage of the national accounts. It turns out that the offshoring intensity for materials is well above that for business services, but the growth rates of the latter are higher. Moreover, using detailed trade data we split the offshoring intensities according to the country of origin of the imports and find that offshoring to Central and Eastern European countries is growing fastest.

For Belgium, Michel and Rycx (2009) show that there is little or no impact of either materials or business services offshoring on overall employment. This finding raises the question whether there are any productivity gains arising from offshoring at the industry-level. This question is particularly relevant for a small open economy like Belgium where economic activities are rather footloose. On theoretical grounds there is not much doubt regarding the productivity gains from offshoring. Nonetheless, the findings in the empirical literature so far have not produced clear cut conclusions. Moreover, the issue has not yet been looked at for service industries.

Following the standard approach in the empirical literature, we measure the magnitude of productivity gains from offshoring by introducing offshoring as a technology shifter in a Cobb-Douglas production function at the industry-level and estimate its impact on total factor productivity (TFP) growth and on labour productivity growth. We include several offshoring intensities: for materials and business services and for high-wage and low-wage countries. Regarding the other variables in the productivity equation, we use a capital stock calculated with detailed investment data by industry and product, which allows for a split into ICT and non-ICT capital, and labour input data by skill level. The estimations are done separately for the manufacturing and the service sector. The results show that materials offshoring has a significant positive impact on total factor productivity in the manufacturing industries but not in the service industries, whereas business services offshoring has a significant positive impact only in service industries. Both these results are driven by offshoring to OECD countries. However, we also find that materials offshoring to Asia has a significant positive impact on total factor productivity. As further steps in the estimation procedure, we will be lagging the offshoring intensities to see whether the productivity gains from offshoring materialise with some delay. Finally, we will also introduce a measure of offshoring in downstream and upstream industries so as to determine whether there is

an indirect or spillover effect of offshoring on productivity.

## **Oil exploitation regulation framework and effects in the sector and its relation to the whole economy: the case of Brazil's 1997 change**

Topic: Drivers of CO2 emissions

Author: Everlan Elias Montibeler

The world lives a context of energetic pre-crisis, and Brazil has discovered new big reserves of the “black gold”, which led to changing the regulation framework of its exploitation in the country. This paper focuses on the last change in that framework, in 1997, and tries to evaluate its effects in the production and its links to the rest of the Brazilian economy. Using data derived from the I-O matrix in the supply side, and Balance of Payments data, we try to see if there were meaningful changes in the period 1998-2008 from the period 1990-1997 in terms of the oil sector linkage to the rest of the economy, technological modernization, its relation to employment and average earnings, and its impacts in the external insertion of the country (exports and dividends balance).

## **Developing a Bilateral Input-Output Table in the Case of Thailand and Vietnam: Methodology and Applications**

Topic: Regional IO: examples from SE Asia

Author: Kim Kwang Moon

This paper attempts to measure and analyze the interdependent economic relations between the countries of Thailand and Vietnam, made possible by constructing a bilateral input-output (I-O) table linking the said two countries. It is an inter-regional type of I-O models that provides a compact and comprehensive accounting framework to quantify the economic inter-relationships among and between industries located in the study regions. Similar to a single-region (national) IO table, an Inter-Regional IO (IRIO) table can be used to estimate the magnitude of an external “shock” on major macroeconomic indicators such as output, value-added, income and employment. However, unlike its single-region counterpart, an IRIO table is able to capture and assess the inter-regional spillover and feedback effects arising from an exogenous change in demand for the output of any one of the study regions. In other words, constructing an IRIO table will not only allow us to estimate the stimulus to production outside the study region benefiting from, say, an increase in foreign demand for its output, but also the resultant impact on its output arising from the production stimulus it causes in the other study regions.

This study is deemed to be a prototype of what AREES needs to support its ongoing efforts to develop an integrated database for its proposed research project, entitled: “Impact Analysis of Cross Border Infrastructure Investment in the Indochina Region: An Input-Output (I-O) Approach”. The paper is structured as follows: Section II outlines the accounting framework used to develop the IRIO table. The methods and data used to construct the 2000 Thailand-Vietnam IRIO table are described in Section III before we discuss the salient findings of the study in Section IV. Finally, Section V concludes.

## **Sectoral Energy Intensity In Malaysia**

Topic: Analysis of specific sectors: country case studies

Author: Narges Moradkhani

This paper computes the sectoral energy intensity of Malaysian economy. In this paper, we apply input-output technique to investigate sectoral energy intensities. We use the IO table of Malaysia for the year 2000 and 2005 as a references point and applied the close input-output model. More detail kinds of energy are evaluated such as crude oil, natural gas, coal& coal, petrol, diesel, fuel oil, LPG, electricity and gas. The results show that most energy intensive non-energy sectors in terms of total energy belong to primary and basic industries. In general, sectors that are upstream in production chains have higher energy intensities than the downstream sectors. In other words, sectors are at the beginning of the production chain such as Iron & Steel, Lime & plaster, Metal Ore, clay products, China, glass & pottery, Transport, Rubber products, Yarn & clothes, etc. have higher energy intensities than those are mostly downstream processing industries such as Motor vehicle, Household machinery, Radio, TV equipment, Agriculture, Tobacco, etc. This is an outcome of the fact that while production in most upstream sectors is energy and material intensive. Industries in downstream sectors probably required less energy and more labor and capital intensive.

Key words: input-output technique, energy intensity, energy intensive

## **The Global Carbon Footprint of Consumption: Findings from the Eora Model**

Topic: Organized session: Presenting Eora: A Balanced World MRIO

Author: Daniel Moran

Co-Authors: Arne Geschke, Keiichiro Kanemoto, Manfred Lenzen

We present a carbon footprint of the global economy and illuminate the major flow patterns of embodied CO<sub>2</sub> in international trade. The findings are from the Eora model, a multi-region input output model covering over 160 countries at high sectoral detail. This work attempts to provide the most accurate national-level CO<sub>2</sub> footprint of consumption (that is, CO<sub>2</sub> emissions inclusive of all upstream emissions) yet calculated. We also present findings on embodied Ecological Footprint in international trade. We show visualizations that illustrate where a country's Footprint falls around the planet.

## **Economic Impact of Adopting Healthy Diet in Canada**

Topic: Health IO

Author: Kakali Mukhopadhyay

Co-Authors: PAUL J. THOMASSIN

The WHO recognizes obesity as a global health issue with one billion adults worldwide identified as overweight and an additional 300 million as obese. Obesity has come to be recognized as both a Canadian "epidemic" and a global "pandemic". These facts indicate that the costs of chronic diseases such as obesity are increasing at a rapid rate and have negative implications for the well-being of the Canadian economy. Lifestyle plays an important role in determining the prevalence of chronic diseases. Among several initiatives, the provision of healthy diet is recommended as one of the important measures to address the problem of chronic diseases.

The paper estimates the macro economic impact of healthy diet guidelines announced by the Public



Health Canada using Input-output framework. The study calculates a gap between actual and recommended consumption of Healthy diet in Canada for 2003. Results show that Canadian diet is influenced by more meat and less vegetables, fruits, milk and whole grains than the required one. The paper attempts to implement a number of strategies combining different food items in household consumption expenditure. An increase in GDP and employment is observed, if Canadian diet comprises more Vegetables and fruits, while more than double reduction in employment and GDP if consumption of meat is reduced. The combined strategy will generate more job as well as GDP. Finally the paper suggests some policy options.

## Resource Intensity in India

Topic: Neural networks, critical supply paths and resources

Author: Kakali Mukhopadhyay

Co-Authors: Debesh Chakraborty

Resources are the basis for the development of any country. India, one of the rapidly developing countries in the world, is endowed with huge resources of fuel and non-fuel minerals. India is the major producers and exporters of iron ore in the world. Demand for minerals is expected to grow very fast, due to increasing levels of consumption, infrastructure development, and growth of the economy. One of the most challenging issues in India's resource sector is the lack of assessment of India's mineral resources. In recent decades, mining industry has been facing environmental issues like pollution and depletion of resources, and so on.

In this background, the study will estimate resource intensity of fuel and non fuel sectors of the Indian economy during 1993-94 to 2006-7 using input-output techniques. It will measure the extent of dependence on the resources. As the role of the information sector has increased significantly in recent period in India, the paper will study the link between Information sector and the resources. It further calculates the productivity of resources, labour and capital during the study period. The GHG emissions from resources will also be estimated. Finally the study will contribute to the biggest challenge of long term sustainability of resource sectors. Result shows that the accelerated growth of the Indian economy influences the utilization of resources and so also the GHG emissions.

## Economy Wide Impact of the Trade Integration between Japan and India: A GTAP Analysis

Topic: Indian Trade

Author: Kakali Mukhopadhyay

Co-Authors: Biswanath Bhattacharyay

Recently India and Japan signed Economic Partnership agreement covering trade, investment, and Intellectual property rights on 25th October 2010. The EPA will eliminate tariff on goods that account for 94% of their two way trade over ten years. This is a strategic move between two countries which will boost bilateral trade and investment. Indian exports which were subject to rigid standards will find it easier to enter Japanese markets. On the other hand, reduction of tariffs would help Japanese exports to exploit the growing Indian market. Overall, India-Japan Comprehensive Economic Partnership Agreement(CEPA) is a major step for harmonious economic rise of Asia.

In this background, the study evaluates the economy wide impact of the proposed CEPA between India and Japan at 2020. The study has used a widely recognized global CGE model. Result shows a marginal increase in output growth for India and Japan in 2020 after tariff reduction compared to BAU. A marginal export growth is expected for both the countries compared to BAU 2020. A fair

amount of trade creation within these two countries is expected to occur. India would likely to increase its export to Japan by 18.25%, while for Japan it will be only 4.65% by 2020. The proposed FTA will also improve the welfare of both the countries at 2020. On the whole, it reflects that compared to Japan, India is expected to gain more, if CEPA materializes by 2020.

### **Module MRIO: Session 1**

Topic: Multi-Regional Input-Output Analysis

Author: Joy Murray

Co-Authors: Arne Geschke, Keiichiro Kanemoto, Daniel Moran

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### **Module MRIO: Session 2**

Topic: Multi-Regional input-Output Analysis

Author: Joy Murray

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### **Module MRIO: Session 3**

Topic: Multi-Regional Input-Output Analysis

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### **Module MRIO: Session 4**

Topic: Multi-Regional Input-Output Analysis

Author: Joy Murray

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### **Comparison of Natural Prices and Market Prices: Case of Japan for 1951-2000**

Topic: Prices and inflation

Author: Akiko NAKAJIMA

&#12288;Natural prices are defined as prices that are relative to total labour requirements to produce the respective commodity or output of that respective sector. According to this definition, natural prices equals to market prices at two conditions, i.e., when profit rates are zero for all sectors or when organic composition of capital is same in all sectors. Both of these conditions are not

realistic to emerge.

David Ricardo thought that market prices fluctuate around natural prices and eventually market prices converge towards natural prices. If market prices are higher than natural prices in a sector, then productive factors shift to that sector and supply will increase. Given the same level of demand, as supply exceeds demand, price starts to fall until the level of natural prices. Vice versa. Karl Marx thought that profit rates eventually fall towards zero, and in this case, market prices will become equal to natural prices. This is criticized by Shumpeter as new innovative activity will emerge and stop profit rates to fall. Another criticism is given by Okishio, who showed that capital output ratio (capital coefficient) do not have tendency to increase to infinity.

There are three sets of labour statistics counting total labour engaged in production in various sectors, namely, Employment table published as a supplement table of input output tables, RIETE (Research Institute affiliated to the Ministry of Economics, Trade and Industry) data, and data obtainable from Nihon Toukei Nenkan (Japan Statistics Almanac published by the Statistics Office of Japan affiliated to the Prime Minister's Office). The Employment table counts family labour as well as part-time labour, while the last statistics measure core labour for agricultural sector. The levels of natural prices are very sensitive to the labour data, on the definition of direct labour.

In this presentation, capital cost which is taken as depreciation cost of capital are proportioned to the original sector producing that capital goods. For this treatment, capital formation table attached to the input output tables are used. Results with this careful treatment of capital cost (depreciation cost), basic findings do not much differ from my first paper presented at the Turkey meeting.

Japanese GDP is about 500 trillion yen in year 2000. Gross domestic investment which includes fixed capital formation (both public and private) and changes of stocks is 130.3 trillion yen. Public gross fixed capital formation is 35.8 trillion yen. Private sector gross fixed investment is 94.2 trillion yen. On the other hand, depreciation allowance of all private sectors amounts to 93.4 trillion yen. According to these numbers, we understand that new investment is only 0.8 trillion yen. Depreciation allowances are tax free. Anyway I hope reader of this abstract will understand the size of depreciation allowance in Japanese economy.

Brief findings may be summarized as follow.

(1) Generally and especially for industries such as metal processing, machinery, manufactured and old (traditional) service sectors, market prices do have tendency to move towards natural prices. Japanese economy is facing zero interest rates these years. This must be the reason behind such tendency.

(2) When profit rates are increasing, market prices do have tendency to diverge from natural prices. New industries have tendency to diverge from natural prices, this is especially apparent for new service sector such as communication and business services.

(3) Times of high economic growth are times when average profit rates are high, according to simple macro general equilibrium. Periods of high economic growth (1970s for the case of Japan) are periods that market prices diverge from natural prices. This is verified by taking variance of the difference of market price from natural price.

## **A positive observation of long-term knowledge industries change in France and Japan.**

Topic: Analyses of specific economic sectors

Author: Yukinori Nakano

None of the economy cannot avoid taking the risk to adapt global institutional changes or technological innovations.

France, having recognised technology gap in 1970s, constructed European Single Market (ESM) and engaged into it strongly, while Japan concentrated her effort to improve the productivity in

private sector and entered in global competitive market under GATT/OECD institutions in 1960s.

We observed series of IO tables published by INSEE, France, from 1959 to 2008 with 40 branches, and by Soumusho, Japan, from 1960 to 2005 with more than 104 branches, to see if the following hypothesis works;

"A long-term meso-economic performance depends on the institutional change rather than private R&D expenditure."

Positive observation of "Skyline Charts", "IO induction analysis" and "long-term input coefficients changes" shows us that the ESM gave chance to France to expand her agriculture, commerce and some types of the knowledge industries, such as type B(\*) and C(\*), while Japan enjoyed GATT's free trade scheme and concentrated her capacity into the knowledge industry type A(\*) with well trained engineers and intensive input of knowledge services.

After 1989, although Japan seemed neither to well adapt to the post cold-war order nor to prepare the rise of the new industrialized economies, France seemed to continue the trade development with stronger linkage of EU member states.

Two cases show us that the hypothesis would be accepted and Japan shall prepare any institution to get profit from the continuous high risk investment for R&D and to mitigate private activities into the service trade, namely by reinforcing the knowledge industry type B or C.

(\*) Reference of three types of knowledge industry: NAKANO Yukinori, 2007, Comparison of several types of knowledge industries between Japan and Europe, the 16th conference of IIOA, Istanbul.

## **Application of a Global Link Input-Output Model to Material Flow Analysis: A Case of Scarcity Metal**

Topic: IO and MFA

Author: Keisuke Nansai

Co-Authors: Shigemi Kagawa, Yasushi Kondo, Sangwon Suh

Establishing a low carbon society, that is, decoupling green house gas emission from economic growth is one of the important challenges for Japanese economy. Toward the decoupling, it is essential that new low carbon technologies and products will be rapidly developed and widely introduced into the Japanese economy. More consumption of some scarcity metals is sometimes necessary to spreading the new technologies like an electric vehicle, a fuel cell and a solar panel. Considering this reality, the scarcity metals needed for the new technologies will be further forced to be dependent on supply from foreign countries.

In order to achieve the decoupling in Japan with depending on foreign resources, it should be started to structurally understand the relationship between natural resources consumption in the world and Japanese product supply chain. An environmentally extended multiregional input-output (MRIO) model enables quantification of global resources consumption of Japan through international trade. However, due to the complete accounting framework of MRIO, the development of an MRIO model that includes all countries and defines detailed sector classifications generally is extremely labour intensive and expensive.

With this in mind, we applied a global link input-output (GLIO) model (Nansai et al., 2009) to estimate global requirement of a scarcity metal for Japanese economy. The model was designed to reduce the labour required for data compilation by employing a simple accounting framework that differs from that of conventional MRIO models. The accounting framework of GLIO enables the definition of about 800 intermediate sectors of the Japanese economy to be focused in this study, the inclusion of more than 200 nations and regions. As empirical studies, global scarcity metal

networks (neodymium, cobalt and platinum) with regard to the Japanese economy were visually identified. Key global network were also found by analyzing the structural characteristic of each network.

## **The Role of Intermediate Goods and Financial Frictions on Economic Development**

Topic: Prices and inflation

Author: Julian Neira

Per capita income in the richest countries of the world exceeds that in the poorest countries by more than a factor of 50. Income per capita differences are mainly accounted for by low total factor productivity (TFP) in poor countries (Klenow and Rodriguez-Clare, 1997; Hall and Jones, 1999). Jones (2010) has shown that intermediate goods (whose share of final goods production can be measured precisely) serve as an amplification mechanism for reasonable distortions to generate TFP differences of a sufficient magnitude to resemble the data. This paper develops a joint model of financial frictions and intermediate goods and quantifies the impact of financial frictions on TFP when intermediate goods are explicitly taken into account.

Agents in the model choose each period to work for a wage (determined endogenously) or operate their industry-specific technology. Financial frictions arise because lenders cannot observe the ability of entrepreneurs that request loans and entrepreneurs can misreport their entrepreneurial ability. Lenders can observe entrepreneurial output and punish agents that misreported by taking their collateral. The amount of collateral put up for a loan is limited by weak contract enforceability. The lower productivity in each sector (due to bad loans being made and potential good loans never materializing) amplifies throughout the economy through the intermediate goods share of final output (i.e. lower productivity in one sector affects all the other sectors that purchase inputs from it, and these in turn affect other sectors in the economy).

Using data from the latest OECD input-output tables, the model is calibrated to match key joint facts of intermediate goods sector, final goods sector, and financial constraints. Then employing a widely-used index of financial sector development (level of contract enforceability), the external debt to GDP ratio, the model is asked to predict the level of TFP and income per-capita differences across countries for a given level of financial development.

The model's equilibrium makes several qualitative predictions about developing countries that match some well-documented facts (Buera et. al., 2008). Specifically, the model predicts that poor countries are characterized by large differences in output per worker across industries, high employment in sectors with low labor productivity, inflated intermediate goods prices relative to final goods, and the use of inefficient technologies. Finally, the model provides a compelling reason why reform, and therefore growth miracles, are rare: entrepreneurs in developing countries extract economic rents in equilibrium, and these rents dissipate as the financial sector develops.

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### **Supply-Use Tables: Simultaneously Balancing at Current and Constant Prices. A new Procedure.**

Topic: SUTs: issues and applications  
Author: Vittorio Nicolardi

Owing to the considerable complexity of obtaining balanced accounting systems simultaneously at both constant and current prices, most countries publish national accounting data at current prices and only for a small number of aggregates at constant prices. The main complexity in balancing accounting systems simultaneously at both current and constant prices is the nonlinearity of the systems that inevitably occurs. In literature, some attempt to solve the problem was mainly based on the transformation of variables and definition of suitable matrices of variances and covariances. In this paper, a suitable method is proposed to balance an extremely large set of National Accounts simultaneously at current and constant prices through the definition of a new procedure based on the predictor-corrector method. The distinctive features of the proposed balancing method are its flexibility, which is very high compared to the other methods in literature, and its capability to allow the control of the consistency of the system of deflators. An application to the Italian 2006 Supply-Use tables has been worked out, and it has yielded good outcomes.

### **Application of conjoined input-output models for investment project evaluation: the economic efficiency approach**

Topic: Productivity and efficiency and economic growth  
Author: Tatyana Sergeevna Novikova

This paper aims at extending the framework of financial analysis to a microeconomic level of investment project in order to better fit the multilevel input-output interregional results of project implementation. Such approach is necessary for the innovative and infrastructural projects which are characterized by the gap between financial and economic efficiency and the appropriate mechanism of realization on the principles of the public-private partnership. As a tool of the evaluation of the efficiency, a modeling system is used. It consists of multi-period input-output simulation model of investment project and modified input-output inter-regional model of economic interactions which is expanded by inclusion of a technological vector of the investment project. These methods are applied in experimental calculations to the updated small-sized version of input-output inter-regional model conjoined with simulation model of four conditional projects and a complex of eight real innovative projects of the Siberian Branch of the Russian Academy of Science.

Keywords: input-output modelling, investment project, economic efficiency

## **Long-run Effects of a Disaster: Structural Analysis**

Topic: Risks and disasters

Author: Yasuhide Okuyama

Okuyama (2010) found that the long-run effects of the Kobe Earthquake, occurred in 1995, appear to be significant, lasting for several years in an increasing manner, based on the time-series analysis of regional economic data, such as GRP. It also suggested that a large part of the economic effects be resulted from structural changes of the Kobe economy caused by the damages of and reconstruction activities after the earthquake. In order to investigate further the long-run effects, this paper aims to analyze the extent and structure of the disaster effects, based on the input-output framework. The structural changes are measured based on time-series of Kobe regional input-output tables for regional structural change and of the MITI's interregional input-output tables for changes in interregional linkages.

## **Interregional trade, supply chains and regional income disparity**

Topic: Trade and supply chains

Author: Jan Oosterhaven

Co-Authors: Erik Dietzenbacher, Jiansuo Pei

Regional income disparity is caused by broad ranges of factors. Much research concentrates on studying convergence or divergence of single regions or nations within the context of the growth theory of closed economies. Recently, the perspective of different production functions for different regions is added. This study extends this contribution by developing a multi-regional model, based on China's 2002 updated interregional input-output table. The main findings show that interregional trade and regional income disparities are partly explained by a region's position in the global supply chain. In China, typically, the South Coast region and East Coast region locate in the top tier of the hierarchy, and have high income per capita levels. On the opposite side, Central, Northwest, and Southwest China locate in the bottom tier of the hierarchy, and end up with low income per head levels. Moreover, by means of a scenario analysis, the multi-regional model shows that regional disparity will persist, but to a lesser extent due to Regional Development Programs.

## **Identifying critical supply-chain paths that drive the change in CO2 emission in Japan**

Topic: Neural networks, critical supply paths and resources

Author: Yuko Oshita

Co-Authors: Shigemi Kagawa, Keisuke Nansai, Sangwon Suh

To address the problem of global warming, reducing total emission by managing life cycle CO2 emissions associated with industrial productions has garnered considerable attention. One reason for focusing on life cycle CO2 emissions is because, by requiring downstream and upstream industries (firms) to be directly responsible for both direct and indirect CO2 emissions associated with the supply of raw materials and components, emission reduction can be achieved.

Using the 1990-1995-2000 linked Japanese environmental input-output table at the four-digit commodity classification level, we estimated the effects of structural changes on pollution emissions associated with individual production chains and extracted key production chains with high pollution emissions from the entire economy by using the structural path decomposition technique proposed

by Wood and Lenzen (2009). We also compare the results of the case study of Japan with those of Australia.

From the results, we found the production chain that had the largest impact was the path from electricity to household demand. The impact of this production chain accounts for 32% of the total impact (absolute value) relative to the top 60 production chains. However, the change in the commodity composition of final demand and the change in per capita final demand amount, which had a positive contribution to total CO<sub>2</sub> emissions, and the change in direct CO<sub>2</sub> emissions intensity, which had a negative contribution, offset each other and reduced the overall impact. Moreover, because the volume of CO<sub>2</sub> emissions increased as a result of the change in the direct CO<sub>2</sub> emissions intensities of the services sector and the agricultural sector, as well as the change in the input structure from the electricity sector of the services sector, the managed cultivation, energy intensification of the service sector, and progress toward the energy dependence of services was more apparent.

## **Comments on Brazilian structural change during 2000-2008**

Topic: Structural change

Author: Paulo de Tarso Gaeta Paixao

Improvements on the production of national accounts data in Brazil favor the Brazilian economy structural analysis by input-output techniques. The quarterly publication of national accounts involving twelve production sectors allows the working out of tabulations at constant prices ever since 1992. Besides, updated supply and use tables have been provided in both 12 sectors x 12 products and 56 sectors x 110 products, with deflators, allowing the calculation of past supply and use tables at constant prices. Taking advantage of these developments, two aggregation versions were selected for analyzing structural change for the 2000-2008 period, one showing the services sector in greater detail, and the other giving more room to industry sectors, both covering a total of 12 sectors. These two aggregation alternatives paved the way to identifying both major industrial and services structural trends. Simulations over 2000-2008 show a slight decreasing of intermediate consumption participation in total national production required to meet the final demand requirements of 2008, suggesting a loss of intermediate transactions specialization during the period. This trend is more pronounced for the Brazilian "Transformation Industry", which aggregates all industries with the exception of Mining, Electricity and Water Utilities, and Construction. Along with the analysis of value added, imports, exports and indirect taxes, always in the same period, these trends reinforce the views that a deindustrialization process have happened in the Country during the recent past.

## **Diversification of Farm and Non-Farm Sectors and Structural Transformation of Rural Economy**

Topic: Economic growth, diversification and integration

Author: Dipti Prakas Pal

Co-Authors: MAUSUMI DATTA BISWAS

The structure of the rural economy in every country has been changing along with the overall economy. The farm and non-farm sectors- the two components of the rural economy – have been changing in structure through diversification of activities on the one hand and through increasing employment and income generation on the other. Whether the two sectors are complementary or substitutable in the context of overall economic development is an issue attracting the interest of the



researchers. Whether diversification of the sectoral activities is conducive to bring about the desired transformation of the economy in general and rural economy in particular is an issue to be examined. How diversification of activities is changing with inter-sector linkages is also an issue to be examined.

The paper discusses these issues in the context of transformation of the rural economy in general and India's rural economy in particular in the framework of Input-Output analysis.

## **Energy intensity and structural change : I-O analysis based on hybrid units**

Topic: Analyzing the role of energy

Author: Pran Krishna Pal

Co-Authors: Dipti Prakas Pal, Pal Swati

Energy is demanded as intermediate use by different producing sectors and as final use by different institutions, private and public. Its demand thus depends on the levels of gross output produced by different sectors and on the amounts of final demand. Through technological change in production energy use changes, which is accounted for by the concept of energy intensity. Total energy demand hence changes as energy intensity, gross output and final demand change. This paper discusses in the framework of structural decomposition the natural extent of changes in energy use in India during 1993-2006. In the analysis both value and hybrid units are used.

## **A multiregional structural analysis of a dualistic economy: the italian regions over a decade (1995-2006)**

Topic: Country case studies

Author: Renato Paniccia'

Co-Authors: Luca Cherubini

Two stylized facts have mainly characterized the Italian economic growth: the dualism between the two main macroregions of the country (North-Centre and South) and the different kind of industrial economic growth experienced across the most developed North-Central regions. While the North-West part of the country, which led the Italian take-off early in the last century, based its economic growth on the medium/large size enterprises; the North-Eastern and Central (NEC) regions mostly grew during the 60s and 70s following the economic district model based on small size firms. These different growth patterns imply a different set of structural parameters and so different responses to economic policies and exogenous shocks. By using a multiregional I-O model would be possible to catch this differential behaviour. Despite the strong and persistent dualism and different regional growth patterns, Input-Output modelling at regional and multiregional level has not found fertile ground in Italy, as in some other EU countries both at academic and institutional level, with the only exception of some particular period of time (for instance 50s' and 80's) and some research institutes.

This paper aims at partially filling this analytical gap by assessing the possible structural changes occurred in a decade (1995-2006), in the Italian regional economic system in terms of both technological and interregional/foreign trade patterns. The paper will be divided into three sections. In the first one a brief description of the methodology of construction of the multiregional model will be provided with a particular focus on the estimate of multiregional trade. Section two will be presented a structural analysis of the Italian multiregional system over the period 1995-2006. In the last section two simulations will be performed in order to test the behaviour of the regional systems in response to significant shocks.

## Constructing a Flexible National Interstate Economic Model (FlexNIEMO)

Topic: Interregional analysis

Author: JIYOUNG PARK

Co-Authors: Peter Gordon, James Elliott Moore, Harry Ward Richardson

As many have noted, a key limitation of IO models is that the coefficients in the models are fixed, and the models ignore substitution opportunities that should be prompted by market signals. Gordon et al (2009) suggested an approach to constructing new IO coefficients that captures substitution effects actually experienced in the labor sector. This new approach builds on both the demand- and supply- driven models. Their flexible approach relaxed the assumption of fixed coefficients in IO models by applying the RAS method to adjust coefficient matrices to account for empirical changes in value added and final demand. They demonstrated their approach via an example consisting of a two-by-two matrix of intersectoral flows. However, a more important implication of this approach is that it can be applied to extend the classic IO model, making the standard model a useful tool for studying economic resiliency. The coefficients in the resulting IO model can be adjusted across time periods to account for substitution-driven adjustments resulting from exogenous events such a natural disaster or a terrorist attack. This study suggests an approach for constructing such a resilient MRIO model that reflects substitution effects, based on the National Interstate Economic Model (NIEMO), an operational state-level MRIO model of the U.S. While many procedures have been developed over the years to update and/or regionalize coefficients of IO coefficients the flexiable NIEMO (FlexNIEMO) approach extends similar procedures to a MRIO model.

## The Supply-Driven Input-Output Model: A Reinterpretation and Extension

Topic: Modelling resource dependency

Author: JIYOUNG PARK

Most previous input-output applications have focused on constructing various demand-driven IO models because of their widely accepted usefulness in regional science. After Ghosh's suggestion of the supply-driven IO model, a debate over its plausibility ensued. Much of this was resolved with Dietzenbacher's (1997) suggestion of its interpretation as a price model, one that similar to Leontief's price model; the Leontief model estimates relative price changes whereas the Ghosh model can estimate absolute price changes. However, in static market equilibrium, producers will not change the current technical relationships that are based on historical sales during the immediate period after an exogenous event. This addresses the fact that Ghosh's supply-driven model is in terms of monetarily expressed quantities and hence applicable when using the supply-side IO in the circumstance of static market equilibrium with abnormal economic cessations. To suggest a new interpretation for the supply-driven IO model, a four-quadrant space of economic situations is introduced, along 'price vs. price-quantity' and 'increase-decrease' axes. Furthermore, even in the case that normal market equilibrium is not maintained, instead of the direct use of supply-side quantity models, Ghosh's case can be translated to a price-type supply-driven model, and play a role in estimating economic impacts. To address this switching process, exogenous price elasticities of demand are combined with the supply-driven model, adjusting quantity responses to price impacts. This logic will underlie the theoretical background necessary to utilize the supply-side model, and hence it highlights the power and the usefulness of linear models by clarifying the applicability of the supply model. This approach can also simplify the development of non-linear IO models.

## Technical Change Adjusted for Production of Bad Outputs in Input-Output Models

Topic: Productivity and efficiency and economic growth

Author: Carl Pasurka

tenRaa (1995) developed a model that calculated macroeconomic technical inefficiency using a single input-output table. Böhm and Luptá#269;ik (2006) extended this framework to calculate technical inefficiency in the presence of a constraint on emissions of air pollutants (i.e., bad outputs). In their model, inefficiency is determined by the extent to which it is possible to proportionally contract primary input (i.e., capital and labor) use while maintaining the original final demand vector or proportionally expanding the final demand vector with the original level of primary inputs.

Recently there have been efforts to allow sectors to have access to more than one production process. Prieto and Zofío (2007) incorporated input-output tables into an activity analysis model that calculates technical efficiency. This can be viewed as a network data envelopment analysis (DEA) model that calculated technical efficiency. They operationalized their model with input-output tables from a set of OECD countries. In addition, Zofío and Prieto (2001) proposed an extension of their model to calculate technical change, which requires input-output tables from more than one year.

The models specified by Prieto and Zofío can be viewed as depicting an unregulated technology in which bad output production is ignored. In other words, producers are allowed to freely dispose of the undesirable byproducts of their production activity. However, in order to model the consequences of pollution abatement it is necessary to specify the regulated production technology.

We propose to augment the models specified by Prieto and Zofío by modeling bad outputs produced by an economy. Once we introduce bad outputs into the specification of the production technology (i.e., the regulated production technology), we will calculate adjusted measures of technical efficiency and technical change in which an economy is credited for the proportional expansion of marketed good outputs and contraction of bad outputs. A time series of input-output tables from Denmark linked to sector production of air pollutants enables us to conduct an analysis for 1990-2007.

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## Deficit of Resource, Tension of Need and Utility of Wealth

Topic: Modelling resource dependency

Author: Nickolay Alexandrovitch Pecherskykh

Directly from input-output model tension of need or utility of wealth do not express, only deficit of resources: .

Tension of needs corresponds to other type of deficit (  $\delta$ ), which:

depends on input and output not only, but else on stock of resources: ;

is essentially temporal, as input and output corresponds through the time pass. January stock of seeds being not enough for May sowing campaign will enforce farmer to be of “care and resolution” already in January;

is essentially of probability, of chance.

$\delta$  appears at a moment  $t$ , if at the moment stock of a resource  $r_i$  has been consumed in total:  $r_i(t)=0$ .

Few measures of  $\delta$  may be introduced.

(1) Chance of “  $\delta$  appears” at some moment enough remote in time.

(2) Chance of “  $\delta$  appears” through some period, long enough.

(3) Average waiting time of first moment appearing  $\delta$ ;

(4) Probability of appearing  $\delta$  through unlimited period of time, weighted with decreasing value, for instance  $e^{-t}$ .

These measures are coherent in sense by order. All the measures depends on  $I$ ,  $O$  (production program), and  $R$ . Stock of resources decreases, chances (1) and (2) and probability (4) increase, time (3) shortens. Marginal impact every species of resource into  $\delta$  differs. is to be treated as  $r_i$ 's “marginal utility” for decreasing deficit. So  $\delta$  may be regarded as tension of needs. Every alteration of production program (by MRS) may be valued as “decreasing  $\delta$ ,” (useful), harmful, or neutral.

## Balancing Factor Endowment and Composition of Indian Exports

Topic: Indian Trade

Author: Shri Prakash

Co-Authors: Amit Sharma

The Heckscher-Ohlin theory of international trade envisages that a country specialises in the production and export of such goods as conform to its factor endowment. While it may import goods for the production of which it does not conform to its factor endowment. Among others, an assumption of the theory is that the factor endowment does not change, and therefore, the pattern and composition of its export and import trade remains stable. It is thus obvious that the theory relates to the static framework of analysis. Classical and neo classical theories also assumed that such factors of production as land, labour and capital are immobile between countries but mobile within countries. Goods are however, assumed to be totally mobile both within and between countries. Economic growth leads to the transformation of not only the pattern and structure of production but it also transforms factor endowment. It also brings about drastic changes in the quantum, pattern and structure of international trade of an economy. Even if the pattern of trade and factor endowment were consistent with each other, these will diverge with each other as a consequence of growth if factor endowment do not change with growth. Indian economy is no exception to this. The rapid growth of the economy has transformed production structure as well as trade. Leontief paradox inspired economists to examine the validity factor endowment theory with country data. Bharadwaj (1953), Bharadwaj and Bhagwati (1969) found no evidence to support

Leontief-paradox for Indian economy. Prasad extended the theme to include natural resources also as a factor in addition to labour and capital. Prakash (1976) also did not find India's factor endowment and trade to differ from each other.

Technological base of production and supply of labour per unit of capital have also change in the course of development. In 1951, saving rate was around 3 to 3.5% of GDP, which has increased to slightly more than 32.5% (economic survey) of GDP in 2009. This has raised the capital base of production. Besides, less than 5% of total population have had an access to education and .01% of the people had an access to higher education in 1951. Consequently, Indian workforce was largely dominated by illiterate and uneducated workers. Thus, the human capital base of the economy was also low. But in 2008-09, more than 20% population had an access to higher education, including professional and technical education. This has transformed the human capital base of the country. Long term growth at an average annual rate of 3.5% of GDP was also dominated by agriculture and related activities which accounted for 59% of GDP and absorbed more than 80% work force. Agriculture continued to dominate growth of Indian economy till seventies rapid industrialisation notwithstanding. If growth of agriculture accelerated, entire economy was buoyant and vibrant. In agriculture also, growth of output of food grains dominated growth of the economy, while food prices dominated prices (Prakash, S. and Rajan, P., 1977, Prakash, S. 1987).

Eighties, nineties and first decade of the millennium witnessed rapid industrialisation and tertiarisation of Indian economy. Technological upgradation of production has also taken place. Higher, technical and professional education also expanded extremely. Nearly 20% of senior secondary graduates go for higher education. As a consequence of economic growth and educational development, there is economy wide substitution of educated/literate (studied upto primary) for uneducated/illiterate, secondary and above for below secondary/matriculation, graduate for under graduate, and technical and professional for general education graduate manpower in Indian economy (Sharma, Amit, 2010).

In 2009, tertiary sector accounts for 59% of GDP, while agriculture and allied activities produced around 20% of GDP, and employed 55% of the total workforce. Manufacturing activities accounted for remaining 21% of GDP.

Besides, education, including higher professional and technical education, has grown exponentially during last 60 years. The New Economic Policy of liberalisation and globalisation has converted the semi closed Indian economy in to an open economy. Thus, structure of production, capital base and human capital have grown concurrently.

India has emerged as an important destination for foreign investment, including, FDI, though, foreign investment still accounts for about 0.5% of total investment, it is large in absolute terms. . The absolute and relative share of trade in GDP, an indicator of openness of an economy has also increased several times from 1951 to 2009-10. As a consequence of growth and changes accompanying it a radical transformation in factor endowment has taken place.

Conventional natural resources, especially minerals, have been used more extensively both for exports in order to earn foreign exchange and also to feed the growth of minerals

## **The Experience of Compiling Chinese Non-competitive Input-output Tables**

Topic: Foundations of the Supply-Use model

Author: Shuchang Qi

Co-Authors: Jie CHEN

This paper introduces the background of China compiling non-competitive input-output table. Then focus on the data source and methods in compiling 2002 and 2007 non-competitive IO table. The last part are the issues on compiling non-competitive IO table.

## **An approach for the compilation of China 2005 Supply and Use Tables**

Topic: Foundations of the Supply-Use model

Author: Shuchang Qi

Co-Authors: Hong JIN, xianxin ZENG

Under the instruction of ADB experts and RETA 6483 project consultants, NBS staff on National Accounts systematic compiled tentative 2005 SUT (56 commodities by 37 industries) by using current data sources. The paper described the study of supply and use theories of 1993 and 2008 SNA, the gap of boundaries, indicators and methodologies of national accounts between China and SNA, and how to apply theories into practice. Enlightened by the compilation, it is initially ascertained by NBS that study of supply-use accounts will keep on being carried out. With other auxiliary materials, NBS will attempt to directly compile China's 2008 Supply and Use Table, and also give feasible suggestions on consummating Chinese survey systems.

## **PPP's for SDR's? Towards a coherent accounting measure of global inflation**

Topic: Prices and inflation

Author: Utz Peter Reich

If it is a lesson learnt from the current financial-economic crisis that global markets and global money require global regulation then it is also true that global regulation requires global economic data. Purchasing power parities (PPP's) are well suited to meet this need, because they are being established at regular time intervals, and their scope is world-wide, in principle. Their use has so far been restricted to the real economy, providing international volume comparisons for products, at the elementary level of aggregation, for national industries, at a higher level, and finally for domestic product and national income, at the level of countries as a whole. At this highest level of aggregation the bridge from the real to the financial economy is reached, because the general price level, which serves as the measure of national inflation is equal (*grosso modo*) to the inverse of the purchasing power of the national currency. The paper develops this track.

The recently aired political proposal to replace the US-dollar in its role as a universal means of payment by some more diversified system such as the Special Drawing Rights (SDR's) employed by the IMF warrants an equally universe measure of monetary dynamics. Such a measure – so the claim of the paper – may be based on the existing system of PPP's, adding to it an appropriate rule of normalisation which places the measure of world inflation within a world accounting framework in a coherent way. The paper explains this rule in theory, and by means of a small black-board example, for purpose of illustration. The rule proposed says a measure of universal inflation must be invariant to the real exchange rates existing between actual national currencies, assuming that a

unit of product incorporates one, and the same, value independent of where it is produced.

## **A consolidated European Union and euro area supply-use system and input-output tables**

Topic: Organized session: National and Consolidated Supply-Use and Input-Output Tables

Author: Isabelle Rémond-Tiedrez

Co-Authors: Joerg Beutel, Maaïke Corinne Bouwmeester, Jan Oosterhaven, José Manuel Rueda-Cantuche

The paper will present the methods and data related to the first dissemination of consolidated European Supply and Use tables, Input-Output tables: EU27 and Euro Area tables. The project has been conducted by Eurostat and the Joint Research Centre's IPTS of the European Commission. The tables produced are supply tables at basic prices with a transformation to purchasers' prices; use tables at basic prices (broken down into uses of domestic production and imports) and symmetric input-output tables. The supply and use tables at basic prices refer at least to the years 2000 to 2006. As a regular annual process 2007 consolidated tables should be available as well at the time of the presentation. The process is based on primary data source transmitted by Member States through the official ESA95 and on additional data provided by the National Statistical Institutes (NSI), e.g. valuation matrices and use tables at basic prices. The project leads to a regular compilation of such tables by Eurostat.

## **Extending the Waste Input Output Model to behavioural change: the case of municipal food waste in South Australia**

Topic: IO and MFA

Author: Christian John Reynolds

Co-Authors: John Boland

Australian households are throwing out more than \$5 billion worth of food each year, with over 40% of household food wasted. The creation, transport and disposal of this non consumed food constitutes a needless waste of resources and energy. Public education campaigns are run by government agencies in an attempt to reduce this wastage. These campaigns often lack the formal quantitative verification required to provide economic and environmental impact.

This paper explores the extent to which the Waste Input-Output model (WI/O) can be extended to provide the solution to this lack of quantification. Enabling an economic and environmental assessment of the effectiveness of waste education to take place. These modifications primarily include adapting the waste allocation matrix to include influences from psychological behavioural change models to gauge the reallocation of waste due to household behaviour change.

Informing the creation of this behavioural change based extension of the WI/O model is the case study of a 2010 South Australian local council program to provide a new food waste education and collection trial to further enhance municipal food waste collection.

Keywords: Municipal food waste, consumer behaviour change, Waste Input Output

## Industry-specific price indexes for R&D

Topic: Organized session: The Measurement of Intangible Capital

Author: Carol A Robbins

Co-Authors: Olympia Belay, Matthew Donahoe, Jennifer Lee

The heterogeneous nature of research and development activity poses a challenge for the development of aggregate price and quantity statistics for research and development as a type of intangible investment. Approaches that focus on either inputs to the R&D process or outputs of the R&D process obscure the what is intended to be measured—the unobserved output of the R&D process itself.

In this paper we first develop a set of industry-specific price indexes for R&D activity using the input price method suggested by Griliches (1984), and implemented by Mansfield et al (1987), and Jankowski (1990). For industry-specific inputs and prices, we combine intermediate input data and commodity level price indexes from BEA's industry accounts, wage and occupation data from the Bureau of Labor Statistics, and R&D expenditure data from the National Science Foundation (NSF).

We compare alternative adjustments for unobserved productivity change in the conduct of R&D using both a broad measure of business sector multifactor productivity and an alternative measure to capture productivity change in R&D's main input—labor. For the latter, we use the change in the Bureau of Labor Statistics labor productivity index for two knowledge-intensive service industries that BLS currently has indexes for, architectural services and engineering services.

We create price indexes for scientific R&D services, computer services, semiconductor manufacturing, pharmaceutical manufacturing, and transportation equipment manufacturing for the period from 1997-2007. Using these R&D price indexes, we calculate the impact of capitalizing R&D expenditures on real GDP for these industries, as measured by value added, and compare these results to other measures.

## Estimating the Local Economic Impact of U.S. University Activity Using a Bill of Goods Approach

Topic: Organized US-BEA Session: The Measurement of New Economic Dynamics

Author: Carol A Robbins

Co-Authors: Zoe Ambargis

In this paper we collect budget data from U.S. universities on actual expenditures as well as the local share of these expenditures to calibrate and regionalize custom economic impact multipliers. We compare these economic impacts to those obtained using an “off-the-shelf” multiplier for universities from BEA's Regional Input-Output Modeling System (RIMS II). We find that results are very sensitive to initial assumptions about the study region and the scope of university economic activity. We provide recommendations to improve the usefulness and reliability of multiplier-based estimates of the economic impact of universities wages and salaries and other expenditures.



## Measuring Central Place Architectures in Multi-Regional Input-Output Systems

Topic: Structural analysis

Author: Hank Robison

Co-Authors: Jonathan Crapuchettes

While multi-regional input-output (MRIO) and central place theory (CPT) are both constructed on the basis of trade across distinct regions in space, there is little mixing of the two methodologies in the professional literature. This separation may be ending. The rapid advance of computer technologies in the last several years means that fully-detailed MRIO models that were little more than theoretical ideals just a decade or two ago are now readily available and even likely soon to become commonplace.

In this paper we cast the most basic elements of CPT in MRIO terms and derive a simple algebraic expression for measuring the presence and extent of central place hierarchies. We turn next to a large-scale and just recently available MRIO data set covering all 3,000+ counties of the United States and empirically test our central place measure in the setting of three spatially diverse regions.

We follow our empirical explorations with a discussion of our central place-MRIO measure, and the importance of the CPT-MRIO connection in defining appropriate regions, and in addressing notable issues of regional policy.

## The Globalisation Effects on the Trade Flows: Czech Experience

Topic: Globalization, trade and spill-overs

Author: Marek Rojicek

The Czech Republic is a small open economy, which is vitally dependent on its export performance. In the period after EU accession the intensity of international cooperation grew rapidly in all the Central European countries, which is mostly the result of the huge FDI inflow at the beginning of the decade. In this context one significant problem for the Czech Republic and some other countries of the region appeared: the valuation of the trade flows based on the cross-border measuring overestimates the country's trade balance in comparison with its value added created. This is the case of trade declared by non-resident units, which is more and more common within the European Union. This phenomenon is even enhanced by the strategic geographical location of the Czech Republic, which is important factor why a lot of this "quasi-transit" trade is being operated. The overvaluation of the trade balance is divided into exports (which are over-valuated) and imports (which are under-valuated). It is concentrated in several commodity groups, among them especially computers and electric equipment are significant. The revision of the foreign trade data, which aim is to follow more consistently the ownership approach, significantly changes the picture of the Czech economy, specifically the role of external demand to the economic growth. It will have also impact on the structure of the input-output tables, especially the division of the domestic and foreign part of the supply and use matrices.

## Does bias really matter in input-output analysis? An almost definite answer

Topic: Organized session: WIOD 4: Methodological Contributions

Author: José Manuel Rueda-Cantucho

Co-Authors: Antonio F. Amores, Esteban Fernandez-Vazquez

Pioneering works on stochastic input-output analysis usually assumed stochastics on the technical

coefficients and proved that under certain circumstances the Leontief inverse is biased (e.g. Simonovits, 1975). More recently, stochastics was alternatively imposed on the intermediate transactions of an input-output table rather than on its technical coefficients (e.g. Dietzenbacher, 2006). The findings of the latter experiments turned out that the bias tends to be rather small and needs a large sample size to get significant relevance. This paper however shifts the attention to supply and use tables, which really constitute the basic units of the elements of an input-output table and therefore, of the technical coefficients. By means of the same kind of experiment as in Dietzenbacher (2006), we prove that the bias might be small indeed but its consequences over the output multipliers (column sums of the Leontief inverse) might not be so tiny but to the contrary, rather large. The Leontief inverse estimations of the output multipliers are confronted with the unbiased and consistent econometric estimations of the output multipliers as in ten Raa and Rueda-Cantucho (2007). A similar application on carbon dioxide emission multipliers is also tested in order to quantify the estimated bias of a different kind of multiplier. The results suggest that the use of supply-use tables and stochastics in the determination of multiplier impact estimates should be increasingly applied in all kind of forthcoming scientific studies that currently (ab)use of the Leontief inverse. We would say therefore that bias does matter in input-output analysis and this paper provides an almost definite solution to circumvent this so far everlasting problem.

## **Greenhouse gas emissions in Mexico, relative cost estimations and policy implications**

Topic: Analyzing greenhouse gas emissions in Mexico and Brazil

Author: Pablo Ruiz-Napoles

This study is an assessment of the impact of greenhouse gas emissions on prices and quantities of production of the various industries that make up the 2003 input-output matrix of the Mexican economy. These emissions are seen as negative externalities associated to each industry's productive activity. The study includes the calculation of gas emissions by industry, the estimation of the relative costs of these gas emissions and the identification of "key sectors". For the purpose of calculating relative costs we make use of the so called Ghosh matrix, that is to say we study the GHG emissions' effects on prices.

The essential conclusion is that the key sectors of the Mexican economy are those of energy power production and others closely related to it; all these sectors are also the most polluting ones. In order to reduce gas emissions, it is required to strongly supervise their activities and find ways to produce a technology change so as to make them more efficient, meanwhile new clean technologies are set in operation to develop energetic products substitutes.

## **Analyzing impacts of growth in production sectors on poverty across ethnic groups in Malaysia: using an extended multiplier decomposition technique**

Topic: Using SAMs

Author: Mohd Yusof Saari

Structures of production, sectoral outputs, remunerations of factors of production and the ownership of the factors by households are the structural features that determine the generation of income and, in its turn poverty alleviation. This is why policies on poverty alleviation have been frequently analyzed by examining their impacts, starting with the expansion of outputs. The objective of this paper is to examine the impacts of growth in production on poverty alleviation across ethnic groups in Malaysia. The analyses use a social accounting matrix (SAM) multiplier decomposition technique.

For the purpose of studying poverty, we propose two extensions for the SAM multiplier analysis. First, the public account is treated as an endogenous component in the multiplier modeling. As a result of this theoretical extension, the extent to which public expenditures and taxation have implications on the poor households can be quantified. Second, we decompose the poverty alleviation effects into the effects that are determined by initial, by direct and by indirect output effects. The initial output effect indicates how a one-unit increase in final demand for a sector leads to an immediate increase in the output of this sector by one unit. The direct output effects capture how this change in the output has first-order effects on output from the sector itself and from other sectors. The indirect output effects measure how the first-order effects give rise to second and higher-order effects because the first-order increases in output are produced themselves and require further inputs and so on. Using this decomposition approach, we are able to examine the extent to which interdependencies among the production sectors affect poverty alleviation. Another interesting aspect about this study is that the three separated output effects are incorporated in the 'microscopic detail' multiplier decomposition of Pyatt and Round (2006). For policy purposes, this framework could provide useful information in identifying the specific production linkage paths in which an output injection is transmitted to households. For the empirical analysis, we run a SAM model for Malaysia for 2000.

## Evaluating Economic Effects of the 2004 Tsunami on International Trade

Topic: Risks and disasters

Author: Sebnem Sahin

Co-Authors: Yasuhide Okuyama

This study aims to estimate the regional and global regional economic impacts of the 2004 Indian Ocean Tsunami within the GTAP (Global Trade Analysis Project) Global Computable General Equilibrium (CGE) model (<https://www.gtap.agecon.purdue.edu/models/current.asp>). The global CGE framework is selected to represent the relationship among the Tsunami affected countries (Indonesia, India, Sri Lanka, Maldives, and Thailand) and their major partners (Japan and US) in details.

Fewer studies exist regarding the disaster's impact on international trade. On the basis of the damage/loss information from various sources and of the previous modeling studies (Okuyama, 2010), this study will fill the gap by estimating the higher-order effect of the Tsunami, specifically in terms of international trade.

In addition to economic impact assessment at the sectoral/national/multi-national levels, the multi-country the GTAP-CGE framework for the Tsunami affected countries will also be used for policy recommendations. The simulation will analyze the case where the major economic partners of the Tsunami affected countries (US and Japan) commit to post-disaster international aid for recovery. The CGE model will be used to keep track of the feedback mechanisms between the international donor countries and Tsunami affected economies. Assuming that the aid helps the Tsunami affected countries to quickly rebuild the traditional trade links with US and Japan, the CGE model will be used to determine the optimal level of aid which would allow the donor countries to compensate for their economic losses from disrupted commercial links. Based on these results, further scenarios will be developed.

The CGE analysis will be conducted in a comparative static framework. The GTAP model is calibrated on 2004 data and includes 57 sectors. A detailed sensitivity analysis will complement the scenario analysis.

## **VAT reduction as anticiclic policy and macroeconomic effects: the case of Brazil in the current crisis**

Topic: Modelling monetary policies

Author: Rodrigo Emmanuel Santana Borges

The economic crisis of 2008-2009 will be known as the day when the creator knelt before its creation (Syll, 2010). Amid such economic mess created by economists (and engineers so-called such) themselves, there seems to be a single economic orientation: every man for himself and save yourself if you can. In the midst of this major disruption in the global economy, the Brazilian government decided, in a set of economic measures, to promote a partial and time-limited VAT reduction as its main countercyclical policy.

This paper proposes to measure which were the direct and indirect effects of lowering the taxes for a limited time on production, employment generation and income. It intends to check also whether the reduction in the IPI - a tax that is one of the VATs in Brazil was indeed the most efficient choice among the other value added taxes in Brazil.

In order to accomplish such objectives, a simple final demand model for the GDP is adopted, and the latest national accounts input-output data is taken as basis to infer the multipliers for the variables chosen and to estimate hypothetical impacts of reduction in other taxes instead of IPI reduction.

Currently, it is a consensus that the counter-cyclical economic policy adopted in Brazil had a positive result and fulfilled the expected goals.

## **An input-output framework for assessing hurricane impact on regional workforce productivity**

Topic: Modelling disasters

Author: Joost Reyes Santos

This research develops a workforce recovery model based on input-output analysis to estimate sector inoperability and economic losses. Based on our simulated hurricane scenarios, service sectors in Virginia suffer the largest workforce productivity impact—accounting for nearly 40% of the total economic losses. Sensitivity analysis of inoperability and loss reduction objectives can provide insights on identification and prioritization of critical workforce sectors to expedite disaster recovery.

## **Using the SNA and SAMs for a better (socio-)economic modelling**

Topic: Using SAMs

Author: Susana Santos

A SAM (Social Accounting Matrix) approach can be an important aid for the modelling of economic policy and a valuable support in the decision-making process, since it provides a description of the measurable part of a society's activity.

Richard Stone made the first and most fundamental contribution to the System of National Accounts (SNA), implemented by the United Nations. Benefiting from successive improved versions since 1953, this system has defined the rules for using the above-mentioned measurement tool. In turn,

statistical offices have considered these rules and adapted them to their specific realities, thus defining their own systems, which they have then used as guidelines for measuring the activity of their countries or groups of countries. With these successive improvements, as embodied in the SNA's latest version from 2008, the description of the activity of a society, its specific characteristics and the problems that it faces have become more realistic. Therefore, the use of the SNA in a SAM-based approach will certainly contribute towards a better modelling of economic policy.

Numerical and algebraic versions of the SAM will be examined, with special attention being paid to the former and to the method of its construction from the SNA. Its basic structure and its consistency within the whole system will be studied, as well as any possible disaggregations, extensions, aggregates, balances and budgets that can be calculated. Other aspects beyond that basic structure and the non-measured part will also be examined.

Applications of the SAM will be made to a European country (Portugal) and an African country (Mozambique) in order to study how countries adopt and adapt the SNA (or not) to their specific requirements.

## **Module SAM: Session 1**

Topic: Construction of Social Accounting Matrices

Author: Susana Santos

Int School of IOA

## **Module SAM: Session 2**

Topic: Construction of Social Accounting Matrices

Author: Susana Santos

Int School of IOA

## **Module SAM: Session 3**

Topic: Construction of Social Accounting Matrices

Author: Susana Santos

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## **Module SAM: Session 4**

Topic: Construction of Social Accounting Matrices

Author: Susana Santos

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## Regional differentiation of technological coefficients in Russia

Topic: Country case studies

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### Regional differentiation of technological coefficients in Russia

The paper focuses on concept that countries with large territories and diverse natural and climatic conditions need constructing regional IOTs. At that, regional tables should be compiled basing on data of one-time-only survey of production cost structure but not on averaged country technological coefficients.

This question is especially urgent in condition of forthcoming one-time-only survey in Russia in 2011 and subsequent constructing of IOTs. However, none of the 83 subjects of the Federation is going to have IOT constructed, and the author points out that it is crucial mistake for the spatial analysis and planning.

In fact, analysis of regional difference of technological coefficients requires availability of regional tables. However, regional IOTs haven't been constructed in Russia for 25 years yet. Luckily, separate kinds of unit costs (electric energy, refined petroleum products, gas, transportation services) are measured in every region of Russia. The author has carried out interregional comparative analysis of their required input per one unit of industry output. Certainly, technological coefficients and unit costs aren't the same. However, there are quite many products produced mainly by single industry, and in this case regional variation of unit costs reflects regional differentiation of technological coefficients.

Regional variation of unit costs has been studied at different aggregation levels of industries and regions. Factors of regional differentiation of unit costs are studied as well. Comparative analysis of regional and average Russian technological coefficients was carried out in previous research (the 18th IOT conference, A. Sayapova).

The sufficiently detailed study has revealed high level of regional differentiation of unit costs. That proves necessity of constructing regional tables with the use of one-time-only survey data.

## Structural change, trade and the environment: an application to WIOD data

Topic: Organized session: WIOD 3: Environmental Applications

Author: Michael Schymura

Structural change has been identified to have a significant impact on environmental issues just because of its impact on international trade patterns. The present paper provides insights into the driving forces of structural change and its close relationship to international trade. In a further step, the paper connects these economic forces with environmental issues based on recent econometric approaches in the literature. We especially address possible arising endogeneity problems with regard to the effects of trade on the environment, trade on income and income on environmental regulation. In addition to these guidelines by the literature, an econometric panel data approach using WIOD data is offered and employed to shed some light on the impact of structural change and international trade on environmental pressure. Our main findings are, that trade is not per se bad for

the environment and that the effect of changing trade patterns depend on the comparative advantage of a country in "dirty" or "clean" production.

## **Jobless growth with imported inputs: The Turkish case**

Topic: Modelling jobs and data issues

Author: Umit Senesen

Co-Authors: Gulay Gunluk-Senesen, Zeynep Yilmaz

The Turkish economy in the 2000's is characterized by positive growth rates and persistent high rates of unemployment. This paper attempts to gain insight into the concurrence of these two phenomena by taking the role of intermediate imports into account, an aspect which received relatively less attention in the jobless growth literature. Considering the upward trend of intermediate input penetration in the Turkish production sectors, we hypothesize that the same GDP growth rates are feasible with less employment generation. Several hypothetical scenarios (e.g. substitution of 1 %, 5 % of domestic intermediate input use of all the sectors, of major exporting sectors, of highly import dependent sectors, etc.) are calibrated with the input-output data of TURKSTAT for 2002 and estimated employment data for 31 sectors to see the extent of (possibly negative) effects on employment. The methodology provides decomposition of employment generation of policy sectors with respect to origin sectors along with decomposition of import dependency.

Preliminary findings show that the shift from domestic intermediate goods to imported ones in food products, wood products, tobacco, wearing apparel, textiles and agriculture generate the highest job losses in the economy. These industries have sizeable negative effects on employment in agriculture, textiles, leather products, wood products, utilities and metals. In general, adverse affects on employment of a 5 % shift are greater than fivefold of that of a 1 % one, hinting for scale dependency of adverse substitution and calling for further elaboration.

## **Foreign Trade and Inter-Province Trade of China**

Topic: Interregional analysis

Author: zhang shaojun

Co-Authors: Shantong Li

Economic growth and regional disparity in China must consider the micro-base of intra-product specialization. Firstly, this paper measures the foreign trade and inter-province trade of some province based on input-output table of 1987-1992, 1992-1997, 1997-2002 and 2007. Then having used the simultaneous equation model, we demonstrates a test on the industry data of some provinces and find there isn't a positive relation between foreign trade and inter-province trade. A sound interaction between foreign trade and inter-province trade is a new way for China to develop economy and reduce the area disparity.

## **Changing levels and pattern of rainfall on climatic factors and their effect on output**

Topic: Analysis of specific sectors: country case studies

Author: Shalini Singh Sharma

Quantum, time and space pattern of rainfall influences climatic factors which, in their turn, affect

agriculture, forestry and animal husbandry sectors directly. Change in output of these sectors, in their turn, affect output of several other sectors, drawing intermediate inputs from these sectors. Final consumption expenditure on selected goods is also affected since change in output changes purchasing power in the hands of consumers. This also exercises influence on output of several sectors through backward, forward and residentiary linkages and income of those sectors associated with such sectors.

The proposed study shall examine the inter-relations of rainfall with output of selected sectors. These effects will be fed into IO model as supply side allocation constraints of intermediate inputs for different sectors of the economy. IO model may be combined with LP model for this purpose. The models shall be applied to Indian data collected from various published sources.

## **The economy and environment- An integrated approach for Canada**

Topic: Water IO: country case studies

Author: Yusuf M. Siddiqi

This paper presents a hybrid framework integrating the national accounts data with environmental statistics. It shows economic accounts in monetary units and the environmental accounts in physical units. It presents environmental indicators that are consistent with national accounts aggregates. The framework also identifies the SNA monetary transactions related to environment like environment taxes, property income, environmental protection expenditure (current and capital), and expenditure on natural resources.

This framework has been designed to serve analytical tools that would relate the impact of production and consumption activities on environmental variables that are of great concern to the public and policy makers.

## **The Factor Content of Bilateral Trade between India & Sri Lanka**

Topic: Globalization, trade and spill-overs

Author: Chandrima Sikdar

Co-Authors: Debesh Chakraborty

India and Sri Lanka accounts for the largest bilateral trade flow in the SAARC region. Following India's liberalization in early nineties this bilateral trade grew by 10% per annum during 1993-99. Thereafter following India-Sri Lanka FTA the trade flows grew by over 27% from 2000 to 2006. India is now Sri Lanka's largest importer and among the top five destinations for Sri Lankan exports. Given the growing importance of this bilateral trade, the present paper attempts to study the factor contents of India-Sri Lanka bilateral trade.

The paper aims to examine whether the factor intensity of the bilateral trade have been in conformity with the pattern of comparative advantages of the respective countries as are determined from their factor endowments. Using the input-output transaction tables for Sri Lanka (year 2000) and India (year 1998-99) the paper tests empirically the Heckscher-Ohlin theory for India- Sri Lanka's bilateral trade and reports if Leontief paradox is witnessed or not. Results show that exports from India to Sri Lanka are capital intensive while imports from Sri Lanka are labour intensive. Thus, the results provide evidence to support Leontief paradox in case of India which the paper seeks to explain. The current paper also included land as a third factor of production in case of agricultural products. Researchers across the world have shown interest on similar work involving developed and



developing countries. But there has not been much work involving two developing countries. The paper seeks to contribute to this gap and comes up with results that have important implications both for academic and policy-making community.

## **Retrospective Measures of GDP Using Input-output Tables for Former Czechoslovakia**

Topic: Issues in input-output economics

Author: Jaroslav Sixta

Co-Authors: Jakub Fischer

The paper focuses on the development of the Czech economy during socialist era, 1970 – 1989. The paper is a part of the project aimed at the transformation of data from balances of national economy based on MPS (material product system) to national accounts. There are several data sources that were digitized from old printed official documents and one of them is input-output table for 1973 for former Czechoslovakia. The main task is to transform data for the Czech Republic but input-output tables can be found for Czechoslovakia only. Therefore, these input-output tables will serve as an auxiliary tool when describing the Czech economy using other data sources, as well. For transformation of data, current simplified system of supply and used tables will be used for the description of the economy and volume indices estimates.

## **Supply and Use Tables at Basic Prices for the Czech Republic**

Topic: Organized session: National and Consolidated Supply-Use and Input-Output Tables

Author: Jaroslav Sixta

Supply and use tables are mainly prepared by official statistical institutions. Although supply and use tables represent a quality check and a tool for deflation, they are sometimes on the edge of interests. Supply and use tables should be compiled within the process of compilation of national accounts but many times they are compiled ex-post. On the first sight, the use table valued at purchaser's prices offers only commodity to industry flows. But the key importance is in valuation at basic prices. When analysing the use table and its development at basic prices, many statistical errors should be found. The paper describes the techniques used in the Czech Republic. The description of the annual system of supply and use tables is provided. Special emphasis is put on VAT matrix, trade and transport margins, other taxes and other subsidies on products and use of imported products.

## **Mapping flows of embodied emissions through the global production system – a quantitative investigation using a global multi-regional input-output model**

Topic: Drivers of CO2 emissions

Author: Andrew Skelton

Co-Authors: Dabo Guan

Global, environmentally extended, multi-regional input-output (MRIO) models have recently been used to investigate embodied emissions associated with finished goods (the consumption perspective) and internationally traded goods. Results have been presented as national and industry sector carbon footprints, accounting for both direct and indirect emissions occurring anywhere within

the global production system. In contrast, conventional emission inventories account for only direct emissions associated with an entity under investigation (the production perspective). Several studies have explored linkages between regions and industry sectors in order to explain discrepancies between production and consumption perspectives by using Structural Path Analysis (SPA). However, the complexity of the global MRIO framework means that it is impossible to exhaustively quote SPA results.

This paper presents a methodological approach that builds on SPA to exhaustively map flows of embodied emissions through the global production system, linking the production and consumption perspectives. The approach allows us to draw Sankey-type diagrams that visually unravel the cumulative flows of embodied emissions that run from the depths of the production system to the point of consumption of finished goods, picking up additional direct production emissions along the way as intermediate goods are processed. These diagrams are designed to ease the communication of results to policy-makers, industry actors and the general public.

To illustrate the approach, we report results at the global industry sector level, using an empirical MRIO framework derived from the GTAP Version 7 database for the year 2004, which disaggregates global economic activity into 113 regions and 57 industry sectors. Using the resultant Sankey-type diagrams we explore the interlinkages between global industry sectors and discuss the relative weight of direct and indirect emissions associated with each industry sector through the sequential layers of the global production system. Finally we acknowledge the limitations of the approach and suggest possible future applications.

## **Environmental progressive tax reform through a dynamic general equilibrium analysis**

Topic: Evaluating environmental policies

Author: Claudio Socci

Co-Authors: Maurizio Ciaschini, Rosita Pretaroli, Francesca Severini

The challenge of climate change needs to be tackled with environmental policy instruments carefully designed in order to achieve environmental benefits and to avoid negative economic effects. An environmental tax reform that is designed to reduce greenhouse gas (GHG) emissions can generate additional benefits when tax revenue is recycled in the economy in order to finance the reduction of pre-existing taxes. These further benefits, known as blue second (or third) dividend, integrate the first green dividend that represents the environmental target. In particular, a green tax on commodities output, that is applied with a progressive structure according polluting capacity of each production process, can generate a double/triple dividend when tax revenue is recycled by means of a reduction of income tax or value added taxes. Such tax reform should be tested through a dynamic general equilibrium analysis in order to quantify its effects over time period both on emission level, disposable income and unemployment rate. International environmental agreements in fact, set clear temporal objectives for each country about the reduction of GHG. Thus environmental policies that aim to restore the correct level of emission without neglecting GDP growth should be tested over time. In this respect, the paper develops a dynamic general equilibrium model based on the SAM framework that allows to quantify in the long time both the economic and the environmental effects that the environmental tax reform can generate.

## **Convenient policy for Health care expenditure in a multisectoral extended model**

Topic: Health IO

Author: Claudio Socci

Co-Authors: Maurizio Ciaschini, Rosita Pretaroli

As well as a policy variable that has the potential to affect economic development, a reform of health care expenditure involves the change of GDP because of its role played inside the processes of generation and distribution of income. In this paper an effort is made to verify, through the Macro Multipliers approach, the possibility to design a convenient policy for the health care expenses. Such a policy permits to rule the incidence of health's expenses with respect to total output and without neglecting the effects that it originates on the main macroeconomics variables like as GDP. The empirical analysis is built on an SAM framework developed for the United States economic system. The convenient policy differs from selective policy for health sector. The first one implies a complex redistribution of the resources in order to achieve the best result in terms of reduction of the ratio between health expenditure and GDP but without depressing total industrial output and income generation.

## **Artistic Originals as a Capital Asset**

Topic: Organized session: The Measurement of Intangible Capital

Author: Rachel Harris Soloveichik

In 2002, I estimate that US artists, studios, and publishers produced artistic originals with a nominal value of \$65.1 billion, 0.62% of total GDP. Television programs accounted for more than half of total production, with the remainder split almost evenly between theatrical movies, books, original music and miscellaneous artwork. I have not yet completed my research for television programs and miscellaneous artwork, so those numbers could change significantly in the final paper.

The cost of producing this \$65.1 billion in original artwork could be treated either as a current expense or it could be treated as a capital investment. If production of artistic originals is treated as a current expense, then production costs are treated the same as advertising costs, manufacturing costs and shipping costs. None of these costs are included in private investment or capital stock. At the current time, BEA treats artistic production as a current expense.

On the other hand, production of artistic originals could also be treated as a capital investment. Under that treatment, the production costs of artistic originals is added to GDP as part of private investment and added to the pre-existing capital stock of artistic originals to get the total capital stock of artwork. This capital stock of copyrighted artwork then returns a flow of value to its owner, and that flow is counted in GDP as part of capital services. Finally, the total capital stock of copyrighted artwork is depreciated, which is known as consumption of fixed capital (CFC). In this paper, I will calculate GDP and CFC when production of artistic originals is an investment activity.

## **Economic and environmental impacts of shifts in regional diets: a global MRIO scenario analysis**

Topic: Organized session: EXIOPOL

Author: Nathaniel Springer

Co-Authors: Faye Duchin

This paper examines the impacts of future regional changes in population and diets, as constrained by the availability of land and water, on the international division of labor in agricultural products and on their relative prices. The study applies an input-output model of the world economy with an explicit representation of both resource requirements and the constraints imposed by resource endowments. The database includes three categories of land (non-irrigated cropland, irrigated cropland, and pastureland), two of water (rainwater and irrigation water), as well as phosphate rock ore for fertilizer production. A baseline scenario, and a projected baseline for 2050, are compared against two experimental scenarios for 2050 incorporating assumptions about diet change. The first scenario increases meat consumption and caloric intake in developing regions to levels at which the FAO estimates that undernourishment is eliminated. The second scenario decreases meat consumption and caloric intake in developed regions to the levels assumed for developing regions in the previous scenario. Developing regions are defined as regions in which daily caloric intake is below 3000 cal person<sup>-1</sup>. Comparisons among the baseline and the two experimental scenarios provide estimates of the extent to which more moderate diets in the developed regions can offset the increased demand originating in developing countries. These estimates can give policymakers and indication of the degree to which these changing dietary patterns can reduce stresses on resource inputs to agriculture. Resulting changes under alternative scenarios in the international agricultural division of labor and in agricultural prices, based on minimizing costs subject to resource constraints and resulting scarcity rents, highlight the regions of the world where agriculture will be most affected by global population growth and changing dietary patterns.

## **Estimation of Russian constant-price input-output tables according to NACE and CPA**

Topic: National accounts

Author: Elena Alekseevna Staritsyna

Co-Authors: Eduard Filaretovich Baranov, Igor Alexandrovich Kim

Construction of annual input-output (IO) tables for Russian economy for the period of 1995-2003 was based on a classification used during the Soviet times. The transition of Russian statistics to the classifications harmonized with NACE and CPA resulted in a gap in construction of IO tables. It is expected that the first table for Russian economy for 2011 consistent with NACE and CPA harmonization will not appear before 2014. Construction of time series of consistent IO tables will require several more years. Filling the gaps in the time series of IO tables is possible due to availability of aggregated IO data for 2004-2006 that distinguish between 15 activities and products. These published tables are available from the Federal State Statistics Service of the Russian Federation. This paper focuses on building harmonized IO tables in constant prices. Special attention is paid to the estimation of deflators for domestic and imported products, transportation and trade margins, and net taxes on products.

## **On Rents in Input-Output Modeling**

Topic: Organized Session: Rents and Physical Resource Constraints in Input-Output Models

Author: Albert Steenge

This paper proposes a new approach at dealing with the concept of rents in input-output modeling. Backgrounds are given in the first part of the paper. A central point will be the presence of rents concepts which have originated in an analytical context significantly different from modern IO analysis. This results in the occurrence of several useful concepts which did not yet find a proper place in the standard IO frameworks.

We concentrate on a number of problems. One major problem concerns the determination of market prices in the presence of homogeneity issues, such as those related to differences in access to and quality of natural resources, where also property rights play a role. We present a number of models that illustrate the issues at hand. Implications for the familiar fixed-coefficients assumption are discussed.

## **On the Factor Content of Bilateral Trade**

Topic: Organized session: WIOD 2: Empirics of International Trade

Author: Robert Stehrer

Co-Authors: Neil Foster

In this paper we derive testable restrictions relating the factor content of bilateral trade to bilateral differences in technology and endowments. As an extension over previous research which is surveyed in the paper we allow for trade in intermediates, and in particular allow for differing intermediate input requirements across countries, which may arise due to aggregation. These restrictions are tested using the recently compiled WIOD dataset that allows us to track the supply and use of intermediate goods across countries and industries over time.

## **Decomposing trade in value added**

Topic: Organized session: WIOD 1: Introduction

Author: Robert Stehrer

Co-Authors: Neil Foster, Gaaitzen de Vries

We decompose (net) trade flows in value added and its components like capital and labour and the respective subcomponents. The approach distinguishes between direct, indirect and re-imports with a similar distinction for exports. Trade flows will be differentiated by types of products like intermediate and final goods. Further, we relate this approach to the existing methods applied in the literature on trade in value added and vertical specialisation. Empirically we present selected results of an application of the proposed decomposition method based on the recently compiled World Input-Output Database (WIOD) covering 40 countries and 35 industries over the period 1995-2006.

## **Imported Inputs and Industry Contributions to Economic Growth: An Assessment of Alternative Approaches**

Topic: Organized US-BEA Session: The Measurement of New Economic Dynamics

Author: Erich H. Strassner

Co-Authors: Jennifer Lee

Over the past decade imports have become an increasingly important source of supply for both U.S. consumers and producers, partly due to changes in the relative prices of imported and domestic goods. This aspect of globalization has affected the size and structure of the U.S. economy, especially the manufacturing sector, but it has also complicated the task of measuring economic growth and industry performance. Statistical agencies use different, but complementary, methods to measure gross domestic product (GDP), and limitations in the measurement of imports have somewhat different implications for these various approaches. For this paper, we use data from the BEA's Annual Industry Accounts and from BEA's surveys of multinational companies (MNCs) to determine how growth in imported intermediate inputs has affected growth in real value added by industry (real GDP growth), and to assess the impact of alternative assumptions about the use of imports and the behavior of import prices. The balanced I-O use tables of BEA's Annual Industry Accounts provide the product detail needed to aggregate estimates of intermediate inputs into cost categories, and the MNC data provides an alternative view of import shares. In preliminary findings, we show that over the period 1999-2006, import shares of materials for manufacturing based on the MNC data are consistently higher than those constructed for the industry accounts using standard assumptions and data sources; however, the pattern of growth between the two series is similar.

## **SUT in developing countries: compromising in statistical units**

Topic: SUTs: issues and applications

Author: Bernd Struck

Co-Authors: Asif Bajwa, Arif Cheema

In contrast to IO-tables Supply and Use tables (SUT) are meant for empirical application, bringing together various data of different kind, periodicity and origin. In most developed countries SUT are just an interim step to achieve an input-output framework based on the concept of homogeneous production units. The statistical unit for SUT recommended in the SNA is the establishment. Yet, even OECD countries have to compromise in this regard as in a lot of cells the data stem from enterprise based surveys or from estimates.

In compiling SUT the developing countries are far from being in a comfortable situation to choose among statistical sources with different concepts of statistical units. In most developing countries the statistical system is meager and gaps in the data base are many. There is a vicious circle: Because of poor data the trust in the statistical agencies is limited. Suspicion of the statistical agencies tampering with the figures is common. Therefore, their courage and their propensity to estimate are low. Especially National Accounts figures often lack the necessary estimation adjustment for data gaps and for poor response. Consequently, trust in the figures deteriorates further.

Moreover, developed and developing countries differ in the structure of dimensions of the economic variables. While developed countries have a huge variety of products they usually make their output commensurable by collecting the data not only in quantities but also in value terms. In developing countries the diversity of production is limited and still most of the products are homogeneous as they are or stem from agricultural products. Hence, in a lot of branches output data in volume or quantity dimension prevail while prices and values have to be estimated.

Nevertheless, for the developing countries SUT are an excellent tool to encourage and to support

estimates and to convince users from their necessity and their rationale. SUT also are a very useful tool to educate in understanding the inner consistency of the macro-economic framework called System of National Accounts.

However, for most developing countries the recommendation of the SNA to apply the establishment as the basic kind of unit for SUT is too challenging. One reason is that especially in agricultural production statistical measurement of output is product oriented. The predominantly small scale structure of agriculture does not even allow for collecting data via the units. And even if so: in the industrial classification almost all of them would fall under class "mixed farming" as in subsistence agriculture there is no specialization worth to be elaborated by means of SUT.

At the end of the day the mix of statistical units used for SUT is wider than for OECD-countries. It includes a lot of data accruing from a pure functional approach with no reference to whatsoever statistical unit at all. In practice, the interlocking of functional (products) and institutional concept (establishments and enterprises) creates a lot of problems but the explanatory and didactical beauty of SUT is worth coping with them.

During the next years things may improve. For branches outside agriculture there are tools now which support the application of establishments as the appropriate statistical units. One is the upcoming of statistical business registers in developing countries. The other is the introduction of Geographical Information Systems (GIS) into the toolbox of official statistics, the latter one being strengthened by Population Censuses carried out these years in a lot of countries as per recommendation of UN. GIS supports the idea of allocating data to local units / establishments as by its very nature its digital regional reference is spot-oriented. Linking GIS with business register information will be an attractive approach for developing countries. Consequently, the national data bases will tend towards the establishment to be the favorite kind of statistical unit.

The presentation will refer to experiences made in the context of strengthening Pakistan's national statistical system and in elaborating its SUT.

## **The structure of life-cycle environmental impact of the U.S. economy**

Topic:

Author: Sangwon Suh

Environmental impacts associated with the U.S. economy pose significant global implications. This paper integrates hybrid, multi-regional input-output and Life Cycle Impact Assessment (LCIA) approaches to quantify the environmental impact of the U.S. economy. An integrated system is constructed using various data sources that embrace about 2,600 environmental pressures, over 400 industrial commodities for the U.S, 123 industrial commodities for China, 8 final demand categories, over 4,000 process Life Cycle Inventories and over 1,200 environmental impact characterization factors, which, altogether represent one of the most comprehensive frameworks for analyzing environmental impacts. The structure of the hybrid input-output framework is analyzed, and the generality of the hybrid frameworks proposed Suh (2004) over Konijn et al (1997) is shown. The composition and structure of the environmental impacts are analyzed using contribution analyses and environ analysis by Patten (1982). Particularly, environ analysis result is used to visualize the network structure of the life-cycle environmental impact of the U.S. economy. The results show that private household consumption and investment is responsible for about 66% of the total environmental impacts induced by the U.S. economy, half of which is caused by the consumption expenditures for the provision of 'Mobility', 'Food' and 'Shelter'. Major industrial activities that generate direct environmental impacts were 'Natural gas, Electricity and Utility', 'Mining, Drilling and Refining' and 'Agriculture, Forestry and Fishery'. Overall, it is shown that provision of energy, transportation, food and materials are the major conduits of environmental impacts in the U.S. economy. The contribution of environmental impacts by imports to the U.S. is

estimated to be responsible for about 28% of the total impact created by the U.S. economy, while the results associated with imports are relatively more uncertain. The current study demonstrates a novel combination of various tools and techniques that are developed in the fields of natural science, engineering, ecosystem science and input-output economics in addressing major environmental policy imperatives. The results are expected to inform the U.S. EPA in prioritizing major areas of effort needed to reduce the environmental impact of the U.S. economy.

## **The Modeling of Health Risk Factors in Russia with Using Input-Output and Econometric Approaches**

Topic: Risks and disasters

Author: Tatyana Olegovna Tagaeva

Co-Authors: Vadim Manavirovich Gilmundinov

The Modeling of Health Risk Factors in Russia with Using Input-Output and Econometric Approaches \*)

V. Gilmundinov, T. Tagaeva

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The paper analyzes particular reasons, or risk factors, that cause the deterioration of public health. In recent years, socio-economic instability in Russia have had a significant adverse effect on the health condition of the population. The number of yearly registered sick people increased by 75% during 1990 – 2008 years. Specialists single out the following risk factors that have had a negative influence on health of the Russians: economic, psychological, cultural, medical and environmental. The result of our investigations is a midterm forecast of Russian ecologo-economic development in the period of overcoming of World Financial crisis's consequences with using Input-Output (I-O) approach. The purpose of such investigations is to explore the moving forces and trends of social development, development dynamics of the branches of national economy, economic structural changes and conditions of competitiveness in the industries taking into consideration not only production characteristics, but estimates of industry pollution pressure. For these purposes we use a Dynamic I-O Model of Russia with a block of environmental protection, which has been created in the Intersectoral Research Department of the Institute of Economy and Industrial Organization (IEIE SB RAS) in Novosibirsk (Russia). The block considers two environmental protection activities: atmospheric air cleaning and sewage treatment. This model apparatus allows to forecast the level of pollution formation in the sphere of production depending on the economic development of Russia using coefficients of atmosphere and water-polluting substances formation per unit of industry's output. The difference between formation and pollution trapping gives us the volumes of waste water disposals and volumes of emissions.

In order to explain the dynamics of sickness rate of the Russian population we carried out a multi-factor analysis of indices that characterize the health condition of the Russian population depending on above-mentioned health risk factors. Having studied the most interesting regression equations received during the econometric analysis and having received estimates of economic and ecologic indices for the forecasting period, we evaluated the effect of the risk factors on the health of the population of Russia. The proposed approach combines the application of the advantages of intersectoral modeling methods and econometric methods for the purpose of analyzing and forecasting ecological-economic processes.



## Contribution of transport to economic growth and productivity in New Zealand

Topic: Economic growth, diversification and integration

Author: Tantri Tantirigama

Co-Authors: Joanne Leung

In response to the recent economic recession, governments worldwide have been using infrastructure as a means to accelerate the rate of economic growth. The key question is: how much do transport and transport infrastructure contribute to the growth of the economy? While there are many economic analyses on the economic benefits from specific infrastructure investment projects, these analyses seldom look at the overall effects from a national perspective. The purpose of this paper is to gain a better understanding of the economic impacts of transport and transport infrastructure in New Zealand using: (a) input-output approaches; and (b) a time series analysis.

The first part of the paper utilises the input-output tables for 1996, 2003 and 2007 to estimate the multi-factor productivity (MFP) for the transport industry at a disaggregated level, using both a gross output-based MFP measure and a value-added-based MFP measure. Our analysis found that the transport industry as a whole displayed productivity gains over the periods from 1996 to 2003 and to 2007. 'Water and air transport' sub-group shows the highest productivity gains from 2003 to 2007. Efficient use of labour inputs has been a major driver for the estimated improvements for the transport industry as a whole and for its industry sub-groups.

The second part of the paper attempts to separately identify the relative contribution from productive road infrastructure capital stock to economic growth. The econometric analysis is carried out using data from 1972 to 2009. Our analysis found that increase in net productive road infrastructure capital stock can enhance New Zealand Gross Domestic Product.

Key words: Transport and economic growth, multi-factor productivity, Economic impacts of road infrastructure

(The views expressed in this paper are those of the authors and do not necessarily reflect the views of the New Zealand Ministry of Transport.)

## A semiGRAS method for benchmarking and temporal disaggregation

Topic: Important issues in IO theory and practice

Author: Umed Temurshoev

We argue that the variants of Denton (1971) procedure, adapted by many national statistical institutes for benchmarking and temporal disaggregation (B/TD), do not satisfy the principles of (i) data stability and (ii) movement and sign preservation. The same applies to the growth rate preservation method of Causey and Trager (1981) which is usually found to be performing quite well either (see e.g., Chen 2007). A semiGRAS method proposed in this paper does satisfy these two principles, hence improves upon the Denton and Causey-Trager methods in estimating disaggregated series in the national accounts. We show these findings both analytically and empirically.

## **Firm Efficiency, Industry Performance and the Economy: Three-Way Decomposition with an Application to Andalusia**

Topic: Structural analysis

Author: Thijs ten Raa

Co-Authors: Antonio F. Amores

An economy may perform better because the firms become more efficient, the industries are better organized, or the allocation between industries is improved. In this paper we extend the literature on the measurement of industry efficiency (a decomposition in firm contributions and an organizational effect) to a third level, namely that of the economy. The huge task of interrelating the performance of an economy to industrial firm data is accomplished for Andalusia.

## **The Solow Residual, Domar Aggregation, and Inefficiency: A Synthesis of TFP Measures**

Topic: Productivity and efficiency and economic growth

Author: Thijs ten Raa

Co-Authors: Victoria Shestalocva

We consolidate and interrelate the four main approaches to the measurement and decomposition of total factor productivity growth, namely Solow's residual analysis, the index number approach, Data Envelopment Analysis, and Domar aggregation. Two new results link the general technology TFP growth measure to the industry Solow residuals and inefficiency.

## **Compilation of symmetric input-output tables with a minimum of assumptions.**

Topic: Foundations of the Supply-Use model

Author: Bent Thage

When input-output statistics are compiled in practice it is essential to consider the desired properties of the symmetric input-output table (SIOT) already at the stage where the supply and use tables (SUT) are planned. By making appropriate choices of classifications and structure of the SUT it is possible to construct a set of basic data which is relevant and useful both in compiling the current national accounts and deriving the SIOT with a minimum of efforts and data manipulation.

In this paper it is illustrated with data from the Danish input-output tables that it is possible to derive an industry-by-industry input-output table from the SUT as if it were almost directly observed, i.e. only to a very limited degree based on assumptions. The following procedures are shown to be essential: (1) For industries: specific redefinitions, primarily to deal with important cases of secondary production of products belonging in other major industrial groups (sections of the ISIC Rev.4) and vertically integrated enterprises that should be partitioned into establishments according to the stages of production if they span several sections of the ISIC; and (2) For products: The most detailed product classification possible. For products with a single user or a single producer no assumptions are necessary. The cases of more than one user can be dealt with in several ways, and eventually by applying the assumption of fixed product sales structures.

## Making Room for China: a Global Value Chain Approach

Topic: Organized session: WIOD 1: Introduction

Author: Marcel Timmer

Co-Authors: Bart Los

Emerging economies increasingly take part in global production chains, from textiles to chemicals, cars and in particular electrical equipment. This has pervasive consequences for the distribution of wages and profits within and across countries. So far, global value chain analysis has mainly been based on case-studies of products. While this provided deeper insight into the mechanisms at work, it misses out on the broader implications for redistribution of value added around the world, for example between low- and high-skilled workers. In this paper we rely on a new database that combines national input-output tables, international trade statistics and data on employment, wages, skill premia and profits at the industry-level to analyse global value chains at the industry level. This World Input-Output Database database (WIOD) contains 41 countries, 34 industries and 58 products. It allows one to track the direct and indirect contributions of labour and capital worldwide to final output of a particular industry. We provide new evidence on the changes in global value chains for various manufacturing industries since 1995. In particular, we will focus on the increasing part of global value added captures by China. A decomposition will be made providing novel insights into the contributions of changes in wages and employment of various types of workers, profit rates and productivity in each country to these global shifts.

## Offshoring and productivity in Spanish industry

Topic:

Author: Maria A. Tobarra-Gomez

Co-Authors: Maria Angeles Cadarso, Nuria Gomez, Luis A. Lopez

The objective of this paper is to analyse the impact of offshoring on productivity for the Spanish manufacturing sector between 1994 and 2005. Offshoring can be defined in different ways but it usually implies the international fragmentation of production. The effects from this process on wages or employment have been studied in a number of recent papers. The analysis of its impact on productivity has been so far more limited. Most of the literature has found a positive effect from outsourcing (buying inputs from external, domestic or foreign, providers) or offshoring (buying foreign inputs).

Girma & Görg (2004) finds a positive effect of outsourcing on productivity for chemicals and engineering in the UK, using both labour and total factor productivity (TFP), and defining outsourcing as cost of services. In electronics, however, outsourcing is negatively related to labour and TFP. These results are not unusual, as the review by Olsen (2006) shows that the effect from offshore outsourcing on productivity does not follow a clear pattern and it depends on industry and firm characteristics. Siegel & Griliches (1991) found a negative, although not significant, relation between productivity and imported materials in the short run. Egger & Egger (2001b) also showed a negative effect in the short run from offshore outsourcing on productivity for workers with low qualification, but a positive impact in the long run. From a different approach, Amiti & Wei (2004b), using a measure of broad outsourcing (Feenstra & Hanson, 1999), found a not clear effect on labour productivity from material outsourcing in contrast with services outsourcing.

For the Spanish case, there is only a study by Fariñas & Martín-Marcos (2006), although they focus on the impact from total imports on productivity, rather than imports of intermediate goods and services. They concluded, in agreement with previous studies by Antràs & Helpman (2004), that importing firms are more productive than non-importing firms.

In our paper we will calculate different outsourcing measures (narrow, broad and difference, following Feenstra & Hanson) usually employed in recent literature, as well as an additional measure: offshoring of capital goods, defined as imported inputs of Machinery and mechanical equipment, and Electronic, electric and optical equipment. We will use data from input-output tables, manufacturing firms survey (INE) and capital services survey (IVIE), and follow Griliches' approach and Girma & Görg by estimating an equation where labour productivity depends on capital services per worked hour, intermediate inputs per worked hour, and an offshoring measure, by fixed effects panel data techniques. According to our results, offshoring of capital inputs appears to have a negative impact on production and labour productivity.

## **A Regional WIO Analysis of the Effect of Non-residents' Consumption: A Comparison between Tokyo and Kyoto**

Topic: IO and MFA

Author: Makiko Tsukui

Co-Authors: Takumi Ichikawa, Shigemi Kagawa, Yasushi Kondo, Masaru Kagatsume

As metropolises are attractive areas for consumers, not only by their residents but also by non-residents such as commuters and visitors from other regions. In this study, using the regional waste input-output analysis, we investigated the impact of the final demands of a metropolis which are especially induced by the consumption of non-residents. Non-residents' consumption induced the industrial outputs, waste emissions, CO<sub>2</sub> emissions and landfill consumptions not only in the metropolis itself but also in the other regions. The extent of the effect of the landfill consumption to other regions was not negligible. As case studies, we estimated the effect of Tokyo and Kyoto respectively which are both major metropolises in Japan and in which non-residents' consumption is great. However, the characteristics of these two metropolises are different. On the one hand, Tokyo is the capital of Japan and many commuters from surrounding regions stay there in the day time. On the other hand, Kyoto is one of the most popular sightseeing places in Japan. We used the 2000 interregional waste input-output table for Tokyo and the 2000 regional waste input-output table for Kyoto respectively in each case study to estimate the impact of the non-residents' consumption activities in a metropolis. By comparing the results of these two regions, we could show the differences in the characteristics of these two metropolises.

## **Overall review of the EXIOPOL project and approach towards harmonisation of SUT and environmental extensions**

Topic: Organized session: EXIOPOL

Author: Arnold Tukker

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

The EE I-O work in project also forces scientists that worked on rather separate fields such as IO

analysis (IOA) Material Flow Analysis (MFA) and Life cycle assessment of products (LCA), to organise their approaches and data in a unified framework. Where in theory such unified frameworks have been developed (e.g. SEEA, UN et al, 2003), EXIOPOL is probably one of the first projects that integrates data on such a broad scale. In this paper we want to discuss the architecture of the project, and how all data harmonization and transformation steps have been performed. This paper discusses the architecture of the proposed database, and our experiences and proposed solutions for problems related to integrating data and indicators systems that have been set up using different conventions (FEEM&TNO, 2006; Tukker et al., 2009). In short steps included:

1. Harmonizing and detailing SUT
  - a. Constructing Use tables in basic prices via reversed engineering
  - b. Detailing SUT with auxiliary data from FAO and a European AgriSAMS for agriculture, the EIA database for energy carriers and electricity, various resource databases for resources, etc.
2. Harmonizing and estimating extensions
  - a. Allocating available resource extraction data (e.g. FAOSTAT, Aquastat) to sectors
  - b. Estimating emissions on the basis of activity data and TNOs TEAM model
3. Linking the country SUT via trade
  - a. Splitting of Import Use tables and allocating imports to countries of exports using UN COMTRADE trade shares
  - b. Confronting the resulting implicit exports with exports in the SUT, adjusting differences and rebalancing via RUGs GRAS procedure
4. Importing all data in EXIOBASE developed by CML, a specially constructed database system with extensive reporting on errors and inconsistencies allowing for iterative improvement of the database.

Note: this paper is part of the EXIOPOL special session in which also papers of Heijungs/Koning en Bouwmeester/Oosterhaven will be presented, and for which a session proposal has been submitted to the scientific chair. Please put these papers in the same session.

## **Creating consolidated EU27 Supply-Use and Input-Output Tables, adding environmental extensions (air emissions), and conducting Leontieftype modelling to approximate carbon and other 'footprints' of EU27 consumption for EUROSTAT**

Topic: Organized session: Estimation of the Carbon Footprint for the EU27

Author: Arnold Tukker

In two projects conducted with DG JRC IPTS on the one hand, and a consortium of TNO, CML, RU Groningen and NTNU on the other hand, EUROSTAT has produced for the first time integrated environmentally extended input output tables (EE IOTs) for the EU27, based on the official ESA95 SUT as well as NAMEAs that EU member states transmit to Eurostat. The initial data set forms a time series between 2000 and 2006. In later stages of the project, data for 2007 and 1995 to 1999 will be added. This paper gives an overview of the overall approach to the project, where other papers in the session will cover specific aspects such as creating country SUT in basic prices and analyses based on the data set. Overall, the project took the following steps:

- For each EU member state, SUT in basic prices had to be estimated with the available SUT (in basic/purchaser prices) and auxiliary data. This work has been performed by IPTS.
- The SUT for the individual Member states had to be aggregated to an EU27 SUT. This work was performed by EUROSTAT with support of IPTS and RUG. The main sub-steps included
  - o For each country, separating the Use table in an Import Use and Domestic Use part;
  - o Further separating the Import use tables in an Intra-EU import Use table and an Extra-EU import

Use table.

- o Aggregating all domestic use, intra-EU import use, and extra EU import use tables;
- o Confronting and rebalancing the intra-EU import use with the intra EU export supply totals (which in theory should be identical apart from valuation differences, but in practice are not so, due to the fact that these data is reported by different countries and hence may be subject to statistical errors)
- o Moving differences to the rest of world; neglecting the (now identical) intra- EU import use and intra EU export supply, and creating an aggregated EU SUT by aggregating the individual country Domestic SUT and Extra EU Import Use and Export supply tables.
- To the EU27 SUT, environmental extensions had to be added, and the SUT had to be transformed into an IOT (performed by NTNU)
- On the combined EE IOT, basic modelling was necessary to generate analytical results (most notably creating a Leontief inverse (performed by NTNU))
- Finally the results obtained had to be interpreted (performed by CML and TNO)

## **Russian Input-Output Survey for Compilation Benchmark Input-Output Tables for 2011**

Topic: On the compilation of national accounts

Author: Natalia Ustinova

Topic: Development of Input-Output Benchmark Accounts and Statistics.

As an integral part of the system of national accounts, benchmark Input-Output Tables play significant role both for producers and users of statistical data. They effectively ensure the consistency among GDP estimates by production, income and expenditure approaches at a detailed level of industries and products and improve the overall quality of the national accounts. Based on the data sources data of the highest quality available, these tables provide not only an accurate and comprehensive picture of the economy on the detailed level of industries and products, but also an efficient tool for macro-economic analysis and forecasting in the fields of production, demand, prices, and so on.

The last benchmark IOTs for Russia were compiled for 1995. Afterwards only annual Supply and Use Tables were compiled by Rosstat due to a number of reasons.

In March 2009 the government of the Russian Federation took a decision providing the legal and financial basis for organization of a special input-output survey for compilation benchmark IOTs for 2011.

The objective of this paper is to describe the spadework carried out by Rosstat for compilation of the benchmark IOTs for 2011 and distinguishing features of these tables. This paper focuses on the problem of the choice of the number of economic activities and products and their classifications for the benchmark IOTs for 2011, on the methodological issues of the special input-output survey, such as statistical units, survey methods, coverage, survey contents and many other aspects of the survey design.

Keywords: benchmark Input-Output Tables, product and industry classifications, input-output survey, statistical units, survey methods.

## The homogenisation of detailed employment data

Topic: Modelling jobs and data issues

Author: Bart Maria Jan Van den Cruyce

The paper discusses the homogenisation of detailed employment data by (heterogeneous) industry using commodity or industry technology. The exercise is based on the Belgian Make tables and employment data for the years 2000 and 2005. When employment is detailed by gender and education level, applying commodity technology leads to most plausible results and there is hardly a negatives problem. Both methods lead to a fairly similar and stable ranking of industries with respect to the use of high skilled labour and output per head.

If a distinction between employees and self-employed is introduced, a negatives problem arises in the group of self-employed when using product technology, while industry technology yields implausible results. To solve this problem, we propose to treat self employed and employees with equal education level and gender as perfect substitutes. Therefore, when replacing negative results for self-employed with appropriate positive ones or zero's, the results for employees are obtained by taking the difference between the homogenised series for all worker and that for self-employed. This method leaves the commodity technology results for all workers unchanged and yields plausible employment figures and plausible wages per head for employees.

Proposed session: "Development of Input-Output Benchmark Accounts and Statistics"

Other possible session: "Mathematical treatments of Input-Output Relationships"

## Supply, use and input output tables in the Netherlands

Topic: Organized session: National and Consolidated Supply-Use and Input-Output Tables

Author: Piet Verbiest

In the Netherlands the questionnaires for the compilation of business statistics provide data output at basic prices and intermediate at purchasers prices. In order to have a balancing process as closely linked to the source data as possible, the set up of the supply use system is likewise. The (detailed entries of the) supply table is values at basic prices while the use table is valued at purchasers prices (excluding value added tax). The gap between these valuations is bridged in the supply table by adding a number of columns containing taxes and subsidies on products and trade and transport margins.

In order to compile input output tables at basic prices, the valuation of the use table has to be transformed from purchasers prices to basic prices. Therefore valuation matrices (layers) with the same dimensions as the use table are derived for every column of the valuation bridge of the supply table.

In a final step the transformation to an input-output table at basic prices made, mainly using the assumption of a fixed product sales structure.

The paper will describe the practice of the compilation process from source statistics to supply, use and input output tables. Special attention will be paid to the necessary assumptions to be made in this process.

## **A Life Cycle Assessment of printed matter using EE-IO data: Opportunities and limitations of a combined approach**

Topic: LCA application

Author: An Vercalsteren

Co-Authors: Evelien Dils, Theo Geerken

In Belgium the Federal Public Planning Agency responsible for product policy is exploring the possibilities to introduce a carbon/environmental labelling initiative for consumer products. In that context VITO is studying the environmental impact of printed matter (newspaper and periodical) using life cycle assessment.

An ISO-conform LCA study will be performed, using specific data (from private partners in the life cycle chain) as well as generic data from publicly available LCA datasources. In Flanders EE-IO tables with high resolution (117x 117) have recently been developed. Since the sectors for "printed matter" have a strong base in Flanders and as such are well-defined in the Flemish IO-tables, the potential for using EE-IO data as input for the LCA study can be explored. Part of the project is to compare the results from and efforts for performing an ISO-conform LCA versus a combined IO-LCA. For the case of printed matter this will provide insights to the offset between accuracy of results and efforts needed for data inventory.

The presentation will briefly describe the approach of the study on printed matter and will compare results of both methods (ISO conform versus combined). We will highlight opportunities and limitations of the combined IO-LCA approach as identified during this study.

## **The Challenges of introducing new standards and classifications into the Australian Input Output Tables**

Topic: On the compilation of national accounts

Author: Branko Vitas

The implementation of new standards and classifications by any statistical organisation raises significant challenges. The release of the 2006-07 Australian Input Output (IO) in December 2010 was the first set of IO tables released by the Australian Bureau of Statistics (ABS) to incorporate changes to the System of National Accounts (SNA08) and the new Australia New Zealand Standard Industry Classification (ANZSIC06) into the IO tables.

The implementation of SNA08 and ANZSIC06 has had significant impacts on the economic statistics produced by the ABS and particularly the production of the National Accounts data, including Supply Use (SU) and IO tables. The changes introduced through the SNA08 and ANZSIC06 necessitated a review of the existing IO Product and Industry classifications, resulting in the creation of new products and industries in those classifications.

This paper discusses the challenges faced by the ABS in implementing the new standards and classifications into the IO tables. It also outlines the strategies adopted by the ABS with respect to data collection, statistical methodology and IO table compilation. The paper also discusses some of the issues faced by users of IO tables, such as the prospect of working with new metadata.



## **High Speed Rail and Regional Economic Development in Australia: A Multi-regional Input-Output Approach**

Topic: Country case studies

Author: Jian Wang

Estimating the economic impacts of HSR on regional development is a largely unsolved issue. This paper will provide an overview of the basic issue, the contributions of empirical literature, the modelling approaches used until now, a multi-regional framework and how it might be applied in the Australian context.

Many cost-benefit studies of individual transport projects concentrate on narrow measures of economic benefits. Another type of research, focusing on economic productivity, defines benefits more broadly but is also limited by functional aggregation constraints. This research introduces a unified approach to estimate and evaluate the economic impacts from development of HSR networks within the regional context in Australia, based on our review of the existing literature of alternative methodologies available. The proposed multi-regional framework focuses on the inter-industry relationship in conjunction with regional commodity flows and the assessment of changes on a transportation network. The analytical methods employed are twofold: a multi-regional input-output (IO) model and a transportation accessibility evaluation index. By using this analytical framework, the economic impacts from developing an Australian HSR system can be estimated and evaluated on hypothetical scenarios relating to any future HSR project.

## **Regional carbon footprint and interregional transfer of carbon emission in China**

Topic: Carbon footprinting and trade

Author: YAN WANG

Co-Authors: Minjun Shi

Carbon footprint is the total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide. Carbon footprint of a region can be calculated as sum of CO<sub>2</sub> emissions that are induced by final demands in the region. Due to the embodied CO<sub>2</sub> emission may be transferred across regions through interregional commodity trade, carbon footprint of a region is affected by regional industrial structure and interregional commodity trade. This paper aims to measure carbon footprint of each province and CO<sub>2</sub> emission transfer across provinces through interregional commodity trade in China, based on China interregional input-output model 2002. The results show that there is significant difference of carbon footprint across provinces in China. Carbon footprint per capita in Shanghai is over than 12 tons, which is equivalent to the level of European countries. However in most of provinces carbon footprint per capita is less than 4 tons. More than 1/3 of provinces have a carbon footprint per capita less than 2 tons, where is almost inland areas with a GDP per capita less than 10 thousands CNY, the average level of China in 2002. A significant correlation between carbon footprint and GDP can be observed (correlation coefficient is 0.785). In most of developed coastal provinces, carbon footprint is higher than real CO<sub>2</sub> emission of that province, except Shandong, Liaoning and Zhejiang. In developing inland regions, real CO<sub>2</sub> emission is higher than carbon footprint in the provinces with rich mineral resources, but real CO<sub>2</sub> emission is less than carbon footprint in the provinces of the middle part. It indicates that livings of developed coastal provinces depended on support of carbon emission from inland provinces. On the other hand, geographical transfers of embodied carbon emission are concomitant with commodity flow across provinces. The inland

provinces get commodities for livings or capital use from the provinces with large production capacity. It resulted in CO<sub>2</sub> emission transferred from developed coastal provinces to developing inland provinces.

## **Price effects of VAT reform in China: With a focus on “refund rate of export tax” and “tax credit of investment goods”**

Topic: Modelling monetary policies

Author: Takatoshi WATANABE

Co-Authors: Kiyoshi Fujikawa, Mitsuru Shimoda, Ye Zuoyi

The introduction of a VAT type indirect tax is advanced in developing countries in order to stabilize the tax revenue. China is not an exception. Value Added Tax (VAT) was experimentally introduced in China as a replacement of the previous indirect tax (industry and commerce tax) in the national tax reform given in 1984. Chinese government reformed the tax system in large in 1994 while the VAT was also reformed for full-fledged introduction after a decade of experimental period.

The current VAT rate is 17% and the VAT revenue as of 2007 amounts to 1.56 trillion RMB (approximately 205 billion USD), which accounts for about 32% of the total tax revenue of 4.95 trillion RMB (approximately 650 billion USD). Now VAT is the largest source of the government revenue in China.

According to the principle Border Tax Adjustment (BTA), all of the VAT included in exports (export tax) should be refunded to exporters, export tax in China, however, is not necessarily refunded to the exporters. In other words, Chinese government has been used the refund rate of the export tax as a policy instrument to adjust domestic industry structure. This policy is criticized since this could distort the relative price structure in China and the frequent change of the refund rate makes it difficult for exporters to estimate the production cost.

The VAT system in China used to have another problem. The VAT system did not have tax credit system for investment goods. It is said that this has disturbed investment activities in the private sector. In response to such criticism, Chinese government implemented a tax reform again on January 1st, 2009 where the tax credit system was enlarged to cover investment goods.

This research has two proposes: (1) to give a theoretical model to calculate the price change by industry and tax revenue of VAT in the framework of input-output analysis, and (2) to implement simulation analyses regarding the regime change on “refund rate of export tax” and “tax credit of investment goods” based on this theoretical model.

## **Global shifts of green house gas emissions and requirements for water and bio-productive land**

Topic: Modelling global water issues

Author: Jan Weinzettel

Co-Authors: Kjartan Steen-Olsen

In order to avoid shifts in environmental burden among regions and different environmental issues, a set of three footprint indicators was proposed. Carbon footprint is intended for an evaluation of human contribution to climate change in the form of green house gas emissions, water footprint is intended to evaluate human requirements for fresh water, and ecological footprint is intended for tracking human need for bio-productive land. For the first time, these three indicators were calculated altogether within a joint framework of a multi-regional input output model (GTAP 7).

The ecological and water footprints are based on linking economic sectors with consumption of primary products and direct requirements on land and water. Greenhouse gas emissions are taken directly from the GTAP 7 database. The conversion of primary crops into ecological footprint is based on the methodology proposed by global footprint network. Greenhouse gas emissions are converted into CO<sub>2</sub> equivalents using global warming potentials for 100 years published by the intergovernmental panel for climate change.

In our contribution we will briefly introduce the method which we have developed and used. Then we will discuss effects of international trade for shifting the environmental burden expressed by these indicators. We will show the main global virtual flows of water, bio-productive land, and green house gas emissions.

## **The Least Eigenvalue of the Input Coefficients Matrix**

Topic: Important issues in IO theory and practice

Author: Daju Xu

It is well known that the input coefficients matrix, called direct consumption coefficients matrix in China, plays an important role in Input-Output Analysis. The matrix with nonnegative entries has  $n$  eigenvalues, and the first two eigenvalues have been studied and been given their economic meanings in some articles published in the journal *Economic Systems Research*. In details, the dominant Frobenius eigenvalue determines the turnpike growth rate, and the subdominant eigenvalue determines the speed of a convergence. But few articles are given to research the economic meaning of the least eigenvalue in terms of absolute magnitude. In this paper, we discuss it based on linear system theory and finally give its economic meaning in some dynamic models. In an empirical analysis for China between 1987 and 2007, results are calculated for the least eigenvalues in modulus of the direct consumption coefficients matrices.

## **Does the rest of the world matter? A sensitivity analysis with the WIOD tables**

Topic: Organized session: WIOD 4: Methodological Contributions

Author: Yan Xu

Co-Authors: Erik Dietzenbacher

The intercountry input-output (IO) tables in the WIOD database include 40 countries. Although these countries represent approximately 85% of world GDP, a substantial number of countries in the world are not included. This implies that there is still a considerable rest of the world (RoW) for which we have only very limited information. The central question in this study is: what is the role of the RoW? That is, does it matter very much that we only have limited information for the RoW? In a sensitivity analysis, we mimic the actual situation by assuming that the world consists of just the 40 WIOD countries. We omit one country (or a group of countries) from this world IO table, which then plays the role of RoW. Four types of cases are discussed: a full neglect of the RoW; using information on the imports from the RoW; adding a very crude estimate of the RoW's production structure; and adding the RoW's true production structure. In all cases, we calculate the consumer responsibility for global CO<sub>2</sub> emissions of the remaining countries and compare it with the true outcome as obtained from the world IO table. We find that serious biases may occur when the true emission coefficients are estimated by average emission coefficients, and when the true technical coefficients matrix of the omitted country (i.e. the one that mimics the RoW) is estimated by the average matrix. In general, omitting a "large" country from the world may affect the estimation of the consumer

responsibility in its “small” neighbors or trading partners.

Keywords: limited information, Wold Input-Output Database, intercountry input-output table

## **Rent and Profit**

Topic: Important issues in IO theory and practice

Author: Takashi Yagi

The aim of this paper is to consider I-O system with land and fixed capital. When land and natural resources are taken into account, the distributive variables become three; the wage, the rate of profit, and rent. In models with land, extensive and intensive use of land will be considered. But in this paper, we assume land of uniform quality. We will consider that the I-O table is given exogenously. In addition, the uniform wage rate and the uniform rate of profit are prevailing in an economy. Under these assumption, we will derive a virtual relation between rent and the rate of profit by incorporating the Sraffian price system into I-O table. The Sraffian standard system enables us to eliminate the wage rate from our consideration and to obtain a very simple relation between rent and the rate of profit. We will examine the properties of distribution and cost of production in a model with land. Our model with land of uniform quality yielding rent will be applied to the imported scarce natural resources.

## **Measuring global fragmentation/openness indicators using harmonized international input-output database**

Topic: Organized session: WIOD 2: Empirics of International Trade

Author: Norihiko Yamano

Co-Authors: Bo Meng

The global trade network is increasingly fragmented, resulting in higher dependence on supplies of goods and services from neighbouring countries. The internationally harmonized Input-Output tables and Bilateral Trade Databases in final goods and intermediates of major countries allow us to examine the recent evolution of international trade network at sectoral level. Using our multinational globalization indicators, this paper highlights the similarity and dissimilarity of evolution patterns of regional integration in Europe and Asia-Pacific regions.

## **The Modelling of Computable General Equilibrium Integrated Multi-Household Model and Its Application for China**

Topic: Country case studies

Author: Binjian Yan

Co-Authors: Jin Fan, Geoffrey J.D. Hewings, Yingheng Zhou

This paper tries to build a CGE-IMH model for china to analyze the issues like macro policy on micro behaviors. We first compile a detailed social accounting matrix with 18036 households based on the macro data from national account of China and the household data from Chinese Household Income Project in 2002, then modify the standard CGE model constructed by Lofgren(2002) with increasing more households and estimated parameters, and take the agribusiness development policy effect on income distribution as example to illustrate the powerful ability of CGE-IMH model of

China. We show that the CGE-IMH model is a useful tool for policymakers.

## **Study on the Relationship between Economic Growth and Structural Change of Agribusiness**

Topic: Various approaches to structural analysis

Author: Binjian Yan

Co-Authors: Jin Fan, Yingheng Zhou

this paper analyzes the relationship between economic growth and structural change of agribusiness. Under the concept guided by Davis and Goldberg(1957), we first build a comprehensive framework of agribusiness system. We then measure the value added of four sectors—agri-input sector, agri-producing sector, agri-processing sector, agri-distributing sector—in agribusiness system based on the method modified on Furtuoso and Guilhoto(2001) to characterize the facts of structural change in agribusiness both in national level based on OECD IO Tables(2010 edition) and in province level based on Chinese provincial IO tables in 1997 and 2002. The two main features of structural change in agribusiness are: (1) the share of value added of agribusiness system in national economy is decreasing with the growth of economy; (2) the share of agri-processing and agri-distributing sectors are increasing with the growth of economy. In the third part, we build a theoretical model based on Kongsamut, Rebelo&#21644;Xie(2001) to explain the above facts from the demand side of the economy. Our findings are useful for understanding the structural change in agribusiness both in empirical and theoretical aspects.

## **Application of Input-Output Technique for Assessing Water consumption of Manufacturing Industries in Iran**

Topic: Water IO: country case studies

Author: Mohammadgholi Yousefi

Application of Input-Output Technique for Assessing Water Consumption of Manufacturing Industries in Iran

Mohammadgholi Yousefi , Zahra Zakeri , Mojtaba Esfandyari Kaloukan

A Nation future growth and development depends upon more efficient and more productive use of its water resources. This is more important for a water scarce country such as Iran .In this paper through input output technique we try to estimate water consumption pattern of Iran manufacturing industries .Input output technique is an ideal way to present the relationship between economic sectors and water consumption .It also allows us to distinguish the direct and indirect water use .Through understanding of the relevance of various industrial sector within Iranian economy, we can better equip water authorities to make sound policy decisions in the event of emergency .To do this we try to aggregate 99 sector input output of Iran in to 29 sectors emphasizing more on manufacturing for which we have taken into account 23 branches based on ISIC Classification, in addition to sectors such as agriculture, Construction ,Mines, services, electricity, Gas and water, into account. In our study, we follow Cella and Dietzenbacher using Extraction Methods and discuss the results.

## **An Economic Analysis of the Philippine Tourism Industry**

Topic: Analyses of specific economic sectors

Author: Krista Danielle Sy Yu

The archipelagic nature of the Philippines, as well as its colonial heritage, offers a wealth of scenic views that invite both locals and foreigners to participate in tourism-related activities. According to the Department of Tourism (2010), the industry is one of the three largest industries in the country.

This study aims to measure the economic impact of tourism to the Philippine economy through the use of input-output analysis. This will aid policy makers in improving the country's tourism industry through identifying the key sectors that are interrelated to tourism.

## **Analyzing industrial structure change in the Input-Output Economic System based on Q-analysis: an Application to Chinese's Economy from 1992 to 2005**

Topic: Structural change

Author: Jianqin Yuan

Co-Authors: Xu Jian

The topological principles of the well-known Atkin Q-analysis are applied to the analysis of interconnectedness of sectors in input-output systems. This paper presents an attempt to integrate important coefficients(IC) and Q-analysis to find the changes of key sectors and analyze structural chains of highest dimension as the most significant input-output industrial clusters. Important coefficients analysis presents a transition from quantitative matrices to binary incidence matrices based on the maximum information content. While depending on above binary incidence matrices, structural Q-analysis provides a set of structural sectors which reflect the incidence relation of sectors and structural chains of highest dimension, and also provides a new way for visualizing economic complexity through the process of structural economic complication. Using a set of annual 19-sectors input-output tables, the application to Chinese's economic structure analysis in the period of 1992 to 2005 revealed an increasing pulling function of other service industry to other sectors. Secondly, the key structural chains mainly composed of chemical industry&#12289;non-mental mineral product industry and metal smelting&#12289; steel wire products industry both in the forward and backward linkages; besides that, a much more stable economic structure in the perspective of forward linkages than that in the perspective of backward linkages. However, it is also revealed that construction industry and real estate finance insurance industry didn't play an important role in the industrial clusters as key sectors of economic system in the input-output models.

## **A Study of the Relationship Between Cultural Industry and Economic Growth in Guangdong Province**

Topic: Analyses of specific economic sectors

Author: Jianwen Yuan

In recent years, for speeding up the transformation of economic growth mode and upgrading the industrial structure changes in the economic and social development, study of the relation cultural industries and economic growth becomes more and more important in Guangdong Province. Using the input-output analysis method for researching the relation between the culture consumption and

economic growth in Guangdong Province, we know that the cultural industries have made great contribution to economic growth and the culture industry help promoting other industries obviously, but the potential of the cultural industries pushing forward related industries is still not fully tapped. There are two reasons for it. On the one hand, the relationship between the cultural industries and other industries is so close that it has a large ripple effect for other industries. On the other hand, the industry of Guangdong Province is mainly labor-intensive without little capital-intensive and technology-intensive. Therefore, trying our best to develop the cultural industry, making use of the cultural industry to promote economic growth and optimizing industrial structure can ensure the development of economic faster and better.

## **European Integration and National Labor Markets - On the Factor Content of Intra-European Trade Flows**

Topic: Economic growth, diversification and integration

Author: Goetz Zeddies

In recent decades, the international division of labor expanded rapidly in course of globalization. Since 1980, world production grew about 270% in real terms. In contrast, world trade in goods and services more than quintupled in this period. In this context, highly-developed countries did increasingly specialize on (human-)capital-intensively manufactured goods and sourced labor-intensively manufactured products and particularly parts and components from low-wage countries. Hence, especially the opening up of Eastern Europe and the international integration of the Newly Industrializing East Asian Economies is considered as the main reason for increasing unemployment of the lower-qualified in high-wage countries, since international trade should favor the high-skilled in those countries. The present paper addresses this question by analyzing the factor content of total as well as of bilateral, intra-European trade flows of selected EU Member States, where the focus is on two input factors: 'high-skilled' workers on the one hand and 'lower-qualified' labor on the other. By analyzing bilateral trade flows, differences in factor inputs, production technologies and thus product differentiation are considered. Since (human-)capital-abundant countries should, according to the neoclassical Heckscher-Ohlin-model of trade, specialize on and export (human-)capital-intensively manufactured goods and, in reverse, import more labor-intensively manufactured products, exports of these countries should embody more high-skilled factor services than imports. Hence, factor content of trade allows inferring on countries' factor demand patterns resulting from international trade. Thereby, labor market adjustment effects induced by European Integration can be identified for single EU Member States. As the analyses show, the results do largely depend on whether product differentiation is allowed for or not. Whereas adjustment effects emanating from bilateral trade between the Western European countries seem to be quite low even in case of product differentiation, the opposite is the case for East-West trade.

## **Structure Decomposition Analysis of China's Energy Intensity Change from 1987 to 2007**

Topic: Analyzing the role of energy

Author: Haiyan Zhang

Co-Authors: Michael L Lahr

China has relied on energy to stimulate its booming economy. Its share of world energy consumed rose to 14.2% in 2005 from 7.9% in 1978. Somewhat surprisingly, its rate of economic growth rate

was about half that of its rate of energy consumption through 2000. This trend appears to have changed since 2001 as energy consumption rose about 1.3 times more rapidly than did GDP through 2005. Through heavy governmental influence, energy intensity subsequently reduced through 2007, but just marginally. This paper uses the structure decomposition approach to understand key drivers behind China's energy intensity from 1987 to 2007. Using recently released Chinese economic input-output data; we decompose energy intensity into five determinants: energy efficiency, changes in production structure, changes in input use, changes in consumption volume, and changes in consumption structure. In the analysis, we compare results from both multiplicative and additive approaches. This paper provides insights into how changes in China's economic structure, technology, urbanization and lifestyle changes affect energy intensity.

## **Economic Structural Change and the Development of Service in China**

Topic: Structural analysis

Author: Hongxia Zhang

Based on the Chinese input-output tables in 1997, 2002, and 2007, and the input-output tables of US and Japan, the features and problems of service development in China are analyzed in this paper, by using Miyazawa partitioned matrix multiplier and labor flowing matrix. The main results show that, in recent years, the pulling effects of final demands on service somehow decrease, and the effects of manufacture on service drop down as well. Yet at the same time, some business service sectors, including finance and insurance, leasing & business service, synthetic technical services, and scientific research, have an obvious growth. Moreover, the relations of these business service sectors and manufacture sectors including chemical products, Manufacture of Electrical Machinery and Equipment, Manufacture of Communication Equipment, Computers and Other Electronic Equipment, Production and Supply of Electric Power and Heat Power, are strengthened. These changes may indicate the promotion of modern service in China, as well as the deepening connection of economy and finance. From the view of employment, generally, the total employment multipliers of most service sectors are much higher than manufacture sectors, and keep increasing. It shows that the potential of service sectors to solve employment problem is large. Moreover, the total labor connections of business service sectors and other sectors, especially manufactures and construction, tend to be strengthened, indicating the developing of service outsourcing in China.

Key words: service; input-output technique; Miyazawa partitioned matrix multiplier labor flowing matrix

## **Analysis on virtual water cycle of economy in Zhangye City using regional input-output model**

Topic: Applications of water IO

Author: Ma Zhong

Virtual water is the water embedded in goods and services products and used in the whole production chain. As one of the pilot cities to establish a water-saving society, Zhangye City needs a demand oriented water management approach, especially in structural and social way. From the demand of Socio-economic system for water resources perspective, in this paper, getting rid of the effects of imported goods to account for virtual water flows within economy and outsider the area, we compile and use regional water input-output model in Zhangye. By means of local water consumption, total local water demand calculated the virtual water transfer between



industries and regional outflows and inflows. Furthermore, transfer matrix was constructed to illustrate the inter-industry virtual water flows. The results show that the cultivation and other agricultural water is the largest virtual net transfer and export sector, a lot of water actual transfer to manufacturing and livestock and export; most of virtual water livestock products received from cultivation were exported to outside. From the perspective of the input-output analysis, the author wishes to proposal a new reference for water demand management in Zhangye City.

## **The Economic and Environmental Effects of Border Adjustment Measures: A Multi-Region CGE Analysis for Japan**

Topic: CGE applications

Author: Xin Zhou

Co-Authors: Satoshi Kojima, Takashi Yano

Border adjustment as a measure to tackle carbon leakage and to level the playing field for international trade is one of the hot issues in domestic policy-making to mitigate GHG emissions. Recently, the Government of Japan revealed a plan to implement carbon tax from 2011. This plan will increase domestic production costs inevitably and put Japanese industries at a disadvantageous position in terms of their international competitiveness.

There have been many economic analyses applying either general equilibrium analysis or partial equilibrium analysis to assess the economic and environmental impacts of border adjustment measures (BAM), however few of them address the emissions embodied in imports subject to adjustment at the border or take account of the nationally appropriate mitigation actions (NAMA) to be implemented in developing countries. The implementation of NAMAs in developing countries in terms of either absolute mitigation or carbon intensity reduction will shorten the gap in the production costs between Japanese carbon-intensive industries and corresponding industries in developing countries. This will in turn influence the environmental and economic benefits of a BAM which is originally expected to correct such a cost differential.

In this paper, we assess domestic and international impacts of the BAMs together with a carbon tax policy to be implemented in Japan by using a recursive dynamic global computable general equilibrium model. We put particular emphasis on the emissions embodied in international trade and NAMAs in developing countries, in particular in China.

## **Can Consumer Responsibility Help Address Carbon Leakage Concerns? An Economic Analysis of Participation vs. Non-Participation in a Mitigation Regime**

Topic: Consumer responsibility and households' carbon emissions

Author: Xin Zhou

Co-Authors: Hiroaki Shirakawa

Competitiveness and carbon leakage concerns are at the center of policy debates for implementing carbon pricing policy to achieve the mitigation targets in Annex B countries. Recently Japan announced a plan to implement a carbon tax system from 2011 and one of the major concerns is industrial competitiveness. More policy attentions have been given to border adjustment measures to address these concerns. Accounting for emissions embodied in imports subjecting to adjustment at the border is one of the technical and practical challenges. Together with the problems related to current national inventory based on producer responsibility, it is rational to consider consumption-based national inventory to account for emissions embodied in international trade. In this paper, we examine the impacts of a change in the national emissions accounting principle from

producer responsibility to consumer responsibility on national welfare, international trade, competitiveness and carbon leakage. We conduct an economic analysis for Japan and China by applying linear programming to a two-region input-output model.

Preliminary results indicate that without full participation of large emitters in a global mitigation regime, the international competitiveness and national welfare of Japan will be affected negatively. A change from producer responsibility to consumer responsibility may have potential impacts on international trade and may function as an effective measure to reduce carbon leakage.

## **The Effects of Aggregation: A case of carbon footprint accounting by using Multi-Region Input-Output models**

Topic: Embodied CO<sub>2</sub> emissions in trade

Author: Xin Zhou

Co-Authors: Hiroaki Shirakawa, Manfred Lenzen

Aggregation uncertainty in input-output analysis has been recognized as one of the critical barriers impeding the acceptance of input-output analysis as a practical tool in the standardisation process of carbon footprinting. It is particularly important when using multi-region input-output models to account for emissions embodied in international trade. In this paper, we examine the effects of sectoral aggregation in multi-region input-output models on carbon footprint accounting by a Monte Carlo-type of sensitivity analysis. By using the ten-region and 76-sector Asian International Input-Output Table, we calculated the errors of random aggregation of sectors against the 76-sector carbon footprints of each region. The error ratios can be as high as more than 2.5 times (in particular for Indonesia) and converge to the range of -10% to 10% for most regions when the number of simulations is as large as 100,000. We also conducted statistical analysis on the relations between error ratios and the characteristics of aggregated sectors, including the carbon intensity, output share in national economy, degree of differences in technical coefficients among sectors to be aggregated, etc.

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