出國報告（出國類別：其他）

赴韓國首爾參加2016年第24屆國際投入產出研討會出國報告

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派赴國家：韓國
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摘 要

核能研究所目前正積極執行「第二期國家能源型計畫」，包含「我國能源風險評估系統化研究能力之建立(1/3)」與「先進能源技術策略規劃與電力供給中長期影響分析(I)」。本次派「能源經濟及策略研究中心」助理研發師秦安易、助理研發師楊皓荃，赴韓國首爾參加 7 月 4 日由 The International Input-Output Association (IIOA) 舉辦的「第 6 屆 International School of Input-Output (IO) Analysis」訓練學程，並於 7 月 5 日至 9 日參加「第 24 屆 International Input-Output Conference 」研討會，研討會討論內容包含環境與能源經濟分析、多國投入產出模型分析、能源使用與環境影響評估及風險管理等議題，而秦員與楊員亦於研討會中分別發表一篇研究論文，並與許多能源模型與政策評估經驗豐富之學者、研究人員交流，有助於核研所能源政策評估與模型規劃能力的提升。經本次參與研討會發現目前於探討氣候變遷對國家能源政策、環境使用等影響評估以整合多國 (區域) 以及能源工程模型結合總體經濟模型為研究趨勢，而核研所能源經濟及策略研究中心亦是符合此能源模型建置之發展方向。相關建議如下：(1) 參考國外能源經濟模型研究經驗，可將本所現與 MIT 合作建置考量國際貿易互動關係的多國 CGE 總體經濟模型 (EPPA Taiwan) 與 TIMES 模型做軟連結，求得我國的詳細能源使用情形評估結果，使兩者模型的研究產出具有考量我國新能源產業發展與能源使用互動關係的優點；(2) 能源經濟評估議題牽涉範圍廣泛且模型運維不易，因此建議核研所應努力精進 TIMES 與 GEMEET 等模型，並對於模型研究人員做適當的分工，且利用 GitHub 等線上協作平台，確保各版本模型的重要參數與設定一致，以維護核研所的研究品質，得到較為全面且詳細的研究結果。

關鍵字：國際投入產出學會、投入產出分析、能源經濟分析

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一、目　的

核能研究所目前正積極執行「我國能源風險評估系統化研究能力之建立 (1/3)」及「先進能源技術策略規劃與電力供給中長期影響分析 (1/3)」兩項政策研究計畫，本次派遣秦安易助理研發師、楊皓荃助理研發師除參加「6th Edition of the International School of Input-Output (IO) Analysis」了解國際能源模型最新發展趨勢，亦於「第 24 屆國際投入產出研討會」發表會議論文「Assessment of CO_2 Emissions Change in Eastern Asia: A Multi-Regional Structural Decomposition Approach」與「Applying Multi-Regional Input-Output Analysis to Evaluate the Impact of Indirect Energy Consumption on Energy Security」兩篇，並與國外能源經濟研究專家討論交流，分享核研所近期研究成果，藉以掌握相關能源經濟與政策最新資訊，可作為執行政策研究計畫之參考。

二、過　程

本次出國行程共計 7 日，於 105 年 7 月 3 日自桃園前往韓國首爾，7 月 4 日參加「第 6 屆 International School of Input-Output (IO) Analysis」訓練課程，了解國際能源模型最新發展趨勢；7 月 5 日~7 月 8 日則參加第 24 屆國際投入產出研討會，並發表兩篇論文，並於會中與國際能源經濟專家 (如表 1) 討論，獲得許多寶貴建議；7 月 9 日則從韓國首爾返回桃園，結束這次出國公差行程，茲將出國公差行程表整理如表 2。

表 1、出國公差交流人員名單

姓名	單位、職稱
Hector Pollitt	Director and head of International Modelling at Cambridge Econometrics (CE).
Michael L. Lahr	Director of Rutgers Economic Advisory Service (R/ECON™).
Tharinya Supasa	Ph.D. candidate of Graduate Institute of Energy Engineering at National Central University.
Klaus Hubacek	Professor of Geographical Sciences at University of Maryland.
Anne Owen	Research Associate of School of Earth and Environment at University of Leeds
Anjali Tandon	Associate Fellow at National Council of Applied Economic Research.

表 2、出國公差行程表

項次	日期	行程		工作重點
		出發	抵達	
1	105 年 07 月 03 日	台灣	韓國仁川	搭機前往韓國首爾，準備參加 IIOA 國際研討會
2	105 年 07 月 04 日	首爾		參加 E3ME 模型訓練課程
3	105 年 07 月 05 日	首爾		參加第 24 屆投入產出國際研討會
4	105 年 07 月 06 日	首爾		參加第 24 屆投入產出國際研討會
5	105 年 07 月 07 日	首爾		參加第 24 屆投入產出國際研討會
6	105 年 07 月 08 日	首爾		參加第 24 屆投入產出國際研討會
7	105 年 07 月 09 日	韓國仁川	台灣	抵達台灣

註：「24th International Input-Output Conference & 6th Edition of the International School of I-O Analysis」會議資訊：

https://www.iioa.org/conferences/24th/download/program/24th-conference-program_WEB.pdf

三、心　得

第 24 屆 IIOA 國際研討會於 105 年 7 月 4 日至 7 月 8 日在韓國首爾延世大學舉行，出席者多為世界各地鑽研於投入產出分析模型 (Input-Output Analysis) 之研究員、學者，除了 7 月 4 日為 ISIOA 訓練課程外，7 月 5 日至 7 月 8 日共四天的會議期間內約有 270 篇的論文發表。

IIOA 年會為一年一度的國際學術盛事，因投入產出分析模型應用甚廣，本次會議不僅侷限於傳統經濟模型分析，除了探討能源、環境及經貿等多元議題外，亦包含多種經濟模型分析方法之應用，如：可計算一般均衡分析模型、計量投入產出模型、跨國投入產出模型、財務分析模型、全球價值鏈、結構分解法、環境及能源投入產出模型等研究主題。

投入產出分析模型多用於政策模擬分析，核研所目前於此模型之應用已具相當之能力，而本所近年積極建置的單國動態 CGE 模型 (GEMEET Model)，其經濟理論亦建立在投入產出模型之基礎上，因此，參與本次會議除可汲取當前國際間投入產出模型應用之方法、增加本所於此模型應用上之深度與廣度外，亦可參考各國學者之研究情境設定 (如能源經濟方面目前大多以各國達成國家自定預期貢獻 (Intended Nationally Determined Contributions, INDCs) 的能源供需變化或碳價等研究為主)，對未來本所進行能源經濟議題之模擬分析上具相當之助益。

(一) 6th Edition of the International School of I-O Analysis 訓練課程心得

秦員與楊員參與本次 IIOA 年會之重點之一為「6th Edition of the International School of I-O Analysis」訓練課程，此訓練課程共分成五大研究主題，受訓學員依據自身的研究背景與研究興趣而被分發至特定主題訓練課程，此五大研究主題概述如下：

(1) E3ME Global Macro-Econometric Model：E3ME 模型 (Energy-Environment-Economy Macro-Econometric model) 是由英國劍橋大學計量經濟研究中心 (Cambridge Econometrics, CE) 與歐盟委員會 (European Commission, EC) 共同開發與

建置的總體計量投入產出模型，此模型主要用於政策評估、經濟預測與學術研究等。本堂訓練課程除了介紹 E3ME 模型之架構外，並以 Soocheol Lee 與 Hector Pollitt 等人於 2015 年發表的 「Low-carbon, Sustainable Future in East Asia: Improving energy systems, taxation and policy cooperation」 一書中的研究為例，解說使用 E3ME 模型進行的東亞國家課徵碳稅的經濟研究，以及使用此模型進行貿易協定影響評估之結果。

(2) Construction of OECD Inter-country Input-Output (ICIO) Database：本堂訓練課程聚焦於由 OECD 發展之跨國投入產出資料庫 (OECD Inter-country Input-Output Database，以下簡稱 OECD ICIO)，首先介紹資料庫的特色(如該資料庫提供的多國投入產出表有較其他資料庫詳細的最終需求用途分類)與發展歷程，而後講授跨國投入產出表之格式、編制方法與過程，以及如何平衡跨國投入產出表的做法。此外，講者亦展示了數個先前研究成果，包含附加價值貿易指標、隱含於國外最終需求之勞動量與技術類別 (高技術、中技術與低技術)、貿易隱含之二氧化碳排放量等研究，以供學員更能透徹了解 OECD ICIO 資料庫的應用方法與範疇。

(3) Dynamic IO analysis：按照分析時期的不同，投入產出模型可分為靜態模型 (Static IO Analysis) 與動態模型 (Dynamic IO Analysis) 兩大類。靜態模型分析與研究某一特定時期 (年份)的再生產過程與產業關聯效果，其內生變量的時間跨度僅為一期；動態模型則分析與研究若干時期的再生產過程，社會的生產過程是一個不斷變化和發展的連動過程，各個時期或各年度

的生產過程之間均存在著密切的關連性,因此動態投入產出分析模型之重點在於資本存量係數矩陣，透過投資、資本的累積以及存貨變動以具體探討累積生產、擴大再生產的關係。本課程亦提供數個研究成果供學員參考。

(4) Structural Decomposition Analysis：結構分析法 (Structural Decomposition Analysis, SDA) 多用於探討二氧化碳排放量以及能源使用量之變化趨勢,利用結構分析法將此變化趨勢拆解出數個影響因子,並據以分析各種影響效果對二氧化碳排放或能源使用量變化之貢獻,此研究方法常見於近年的學術期刊中。資料選擇的部分則多採用世界投入產出資料庫 (World Input-Output Database, WIOD),本課程除講授 SDA 之概念、方法及相關文獻回顧外，亦利用勞動人口變化趨勢、全球二氧化碳排放趨勢等作為範例，講授拆解之觀念與步驟。

(5) Environmental Impacts of Consumption-based Policies：環境衝擊評估與消費面觀點分析多應用於碳足跡與能源足跡的計算、消費面觀點會計帳與碳排放社會責任分擔等領域,此方法可量化環境衝擊之影響,以及各種因消費而產生的碳足跡與能源足跡,以利於衡量各種隱含於最終消費中的能源使用或碳排放，並觀察一段時間內消費結構改變可帶來的正面影響。本課程除了介紹環境衝擊評估方法外,另將聚焦於多區域投入產出分析模型 (Multi-Regional Input-Output Analysis, MRIO) 之介紹與應用，包含 MRIO 表的格式與編制、環境與能源相關係數之計算以及建構 MRIO 分析模型之方法與步驟。

圖 1、E3ME 總體計量經濟模型訓練實況

本次秦員與楊員皆由 IIOA 學會分派參與 E3ME 模型訓練課程。透過本次參加 E3ME 總體計量經濟模型的訓練課程，瞭解英國劍橋計量經濟學會開發模型之建置經驗，而課程中講師引用「Low-carbon, Sustainable Future in East Asia: Improving energy systems, taxation and policy cooperation」一書中的研究，並解說應用 E3ME 模型進行中國、日本、南韓及台灣等四個東亞主要國家課徵碳稅的經濟研究及模擬結果，其研究過程與結果可作為核研所未來於國際能源經濟模型的研究參考方向之一。此次訓練課程除可汲取英國 E3ME 模型之建置經驗外，亦可以藉由他國模型建置過程與經歷，精進核研所 GEMEET 模型與 EPPA 模型之基礎。經本次參加模型教育訓練發現，目前國際間於建立能源模型有兩大趨勢：一、以單國、單區域模型開發成熟後，再將模型評估範圍擴張，邁入多國、多區域之

整合評估模型，如 E3ME 總體經濟模型，從英國單國總體計量模型擴展成全球總體計量模型。二、整合多種不同評估面向模型，以增強研究的全面性，如整合總體經濟評估模型與能源技術系統模型。由於能源工程模型對於總體經濟與產業間的互動效果評估能力較為缺乏，而總體經濟評估模型的發電技術分類則較為粗略。因此 E3ME 總體經濟模型亦是採用總體計量模型連結電力系統模型，以充分發揮兩類模型之評估能力，期獲得較完整的能源與經濟評估結果。核研所能源經濟及策略研究中心目前除本身長期建置與維護之 TIMES 能源工程模型外，亦有與中原大學合作開發完成的 GEMEET 一般均衡能源經濟模型 (**G**eneral **E**quilibrium **M**odel for **E**nergy, **E**nvironment, and **T**echnology analysis)，並於今年 (民 105 年) 將兩類模型進行軟連結，互相支援運作，以期提升整體計畫對於能源經濟、政策等議題分析的精緻度與完整性，此外，更與「MIT 全球氣候變遷科學與政策聯合專案研究中心」合作建置符合台灣現況的資料與模型設定的多國 CGE 模型，不但能評估我國各種政策情境下的 3E 效益，更能將分析結果進行國際比較，以觀察我國與各國間的政策影響與產業互動效果，並依此做為區域經貿、能源與減碳政策等國際議題之政策參考依據。本次與會瞭解英國 E3ME 模型整合經驗，有助於核研所於整合模型之建置參考。此外，亦發現由於能源經濟涉及議題甚廣，在全球化、國際化的發展趨勢下使得能源、資源的流動更為頻繁，因此各國大型研究單位 (如：瑞典國家經濟研究所的 CGE 模型 EMEC 及 TIMESSweden、美國 MIT 全球氣候變遷科學與政策聯合專案研究中心的 EPPA 模型等) 紛紛建立跨區域之能源經濟模型，以評估各種國際重大事件對自身國家之詳細影響，而核研所一方面將 TIMES 能源工程模型與 GEMEET 一般均衡能源經濟模型進行軟連結，並與

「MIT 全球氣候變遷科學與政策聯合專案研究中心」的合作建置多國 CGE 模型，不但符合國際趨勢，亦能促進核研所與國際間的學術交流，強化核研所評估國際能源與減碳政策對我國能源供需與經貿影響之能力，以促進整體計畫之施政效益。

(二) 2016 年第 24 屆國際投入產出研討會與會心得

核研所本次會議亦發表兩篇近期研究成果，獲與會專家提供實質建議，可供未來研究主題之擴展。圖 2 為會場發表文章之實況。

圖 2、2016 國際投入產出研討會 會場簡報實況

針對「Assessment of CO_2 Emissions Change in Eastern Asia: A Structural Decomposition Approach」一文，與會專家提出以下數點問題與建議：(1) 資料年份選擇：本文選擇 1999 年、2004 年、2009 年

等三年份之資料，並據以劃分成 1999-2004 年與 2004-2009 年等二段時間區間，但於文中並未針對此資料年份之選擇詳加解釋與說明，建議應可多做著墨，並應避免選擇到數據波動較劇的特定年份。(2) Leontief 結構效果 (L effect) 在過往的研究中，多解釋為產業生產結構與技術改變所致之效果，而產業部門於生產過程中所排放之二氧化碳應會隨著技術進步而逐年減少，故 L 效果對於二氧化碳排放變化量之影響效果應為減效果，然本文之實證結果顯示，台灣 1999-2009 年間之 L 效果對於二氧化碳排放變化量之影響效果為增效果，此一結果於簡報內並未深入探討，建議應多對此做相關事證之整理與闡釋。(3) Michael L. Lahr 教授另提到，本文利用中、日、韓、台等四國之單國 IO 表進行研究，然國際間之貿易互動及其所帶來的影響效果十分值得多作探討，建議本文後續可採用多國投入產出分析模型 (Multi-Regional Input-Output Analysis)，將跨國貿易影響納入考量，以強化本研究之深度及廣度。筆者回覆如下：(1) 因 WIOD 資料庫中，能源與環境統計資料目前更新至 2009 年，又本文欲探討一段時間內二氧化碳排放變化之趨勢，故資料年份選擇以 1999-2004 年與 2004-2009 年作為本研究之研究區間；(2) 翻查產業結構效果之相關文獻發現，在市場擴展與經濟進步的過程中，會出現產業分工深化的現象，意即產業於生產過程更趨於專業化，產品在生產的過程中將轉手更多次、刺激更多的中間投入。相較於日本發展較早，中、台、韓皆為 1990 年代後始蓬勃發展的國家，故分工深化的進程較晚，因此，對中、台、韓三國而言，1999-2004 年間由於出現分工深化的現象、產業生產一產品所需的中間投入增加，故在 L 效果對於二氧化碳排放變化量之影響呈現增效果；(3) 確實如與會專家所述，台灣為一能源淨進口國，應考量跨國貿易對二氧化碳排放變化所造成之影響，後

續本研究可考慮朝此目標努力。

針對「Applying Multi-Regional Input-Output Analysis to Evaluate the Impact of Indirect Energy Consumption on Energy Security」一文，與會專家提出，由於研究主題著重探討能源部門，但世界投入產出資料庫 (WIOD) 對於能源部門的分類較為粗略，僅劃分一個能源部門，因此建議後續相關研究可以採用 Global Trade Analysis Project (GTAP)、EXIOBASE 或 Eora 等對於能源部門刻劃較細緻的多國投入產出資料庫。此外，另有專家想要瞭解本研究以一國生產與消費商品的能源含量來源衡量能源風險指標變化之意涵，因為一般來說，如本文選用的初級能源使用集中度作為能源風險指標時，會採用實際初級能源供給量與來源衡量指標的數值。筆者回應如下，本研究嘗試以進出口商品之能源含量的觀點探討初級能源使用集中度指標之變化情形與意涵，在全球化的時代，國際貿易對於一個國家生產財貨所消耗的能源具有一定程度的影響，因為當一個經濟體生產一最終財時，所耗費的能源不但包括這一經濟體為生產產品這一行為所直接投入的能源消費，還包括生產此一產品時，向其他國家進口或國產製造用於組成產品的必要零組件所產生的間接能源消費。而傳統的分析常聚焦於生產財貨的直接能源消費，往往未考慮到以全球貿易的角度衡量間接能源使用的效果，因此考量間接能源使用影響的能源安全指標能供生產國思考下列問題，為滿足他國需求而產生的能源消費 (進口的能源消費含量) 是否必要 (能否帶來相對應風險之報酬，如 GDP 等)，以及此一需求是否會間接影響到我國的能源安全，相對應地，提供我國財貨使用與消費的進口國家，其初級能源消費組合是否夠分散，使其能穩定供給進口品供我國使用。上述三點為本研究採用商品能源含量衡量能源安全指標之理由與目的。

以下針對 IIOA 會議的專題演講與兩篇值得參考之發表論文，簡述其研究成果與心得：

本次國際投入產出協會特別邀請到英國國家統計局的國際策略與協調處負責人 Sanjiv Mahajan 為大家進行專題演講，講題為「Measuring the Economies of the World - YOU can be part of that journey.」，由於 Sanjiv Mahajan 目前負責編製英國的國際國民所得統計帳、投入產出表及 GDP 等，故其對於國際統計制度相當重視，其認為在現今科技發展迅速、國際貿易頻繁的時代，全球化分工與新興行業的崛起對於統計資料的蒐集工作造成是一種挑戰 (如圖 3)，而國民所得會計帳、投入產出表等相關經濟分析的基礎資料係按照國際統計制度所編製完成，因此他建議國際統計制度應時常更新，較能反映目前現實的情況，使經濟分析專家 (如：投入產出表的使用者) 獲得公正、客觀的資料，獲得較為具體的分析結果，如：利用更新後的投入產出表評估新興產業對於經濟體的影響等。

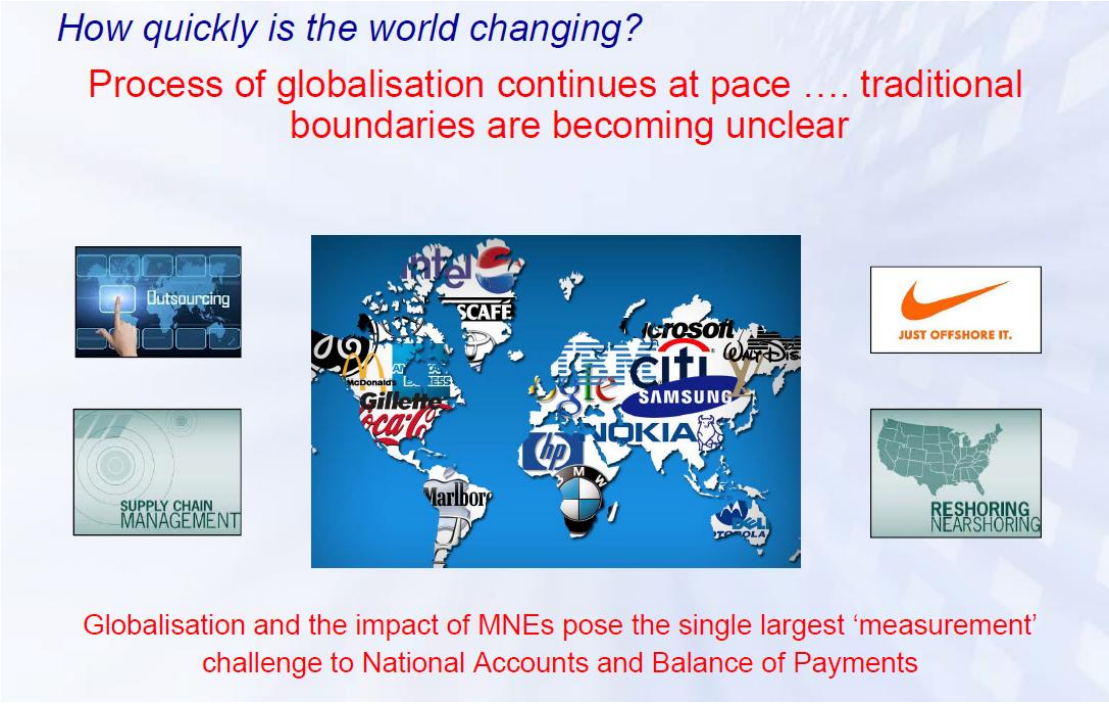

圖 3、全球化分工生產導致傳統定義的國家邊界日趨模糊

1. Towards a better understanding of consumption-based energy accounts: a comparison of MRIO results calculated from different energy extensions.

(by Anne OWEN, John Barrett, Marco Sakai, Lina Isabel Brand Correa.)

Dr. Owen 為英國里茲大學地球與環境學院的研究員，本次發表的主題著重於應用跨國投入產出模型，搭配 Eora、WIOD、GTAP 等跨國資料庫提供的多種能源消費向量 (包含產出、初級能源總供給、最終能源總消費、損耗、能源部門自用等) 與經濟資料計算英國消費者觀點的能源消費量與結構，並藉由投入產出分析將英國的能源消費結構進行重新分配，如：將最終消費者購買最終財 (包含進口品的部分) 的相關能源使用歸屬於最終消費者，此有別於一般 IEA 的國家能源平衡表報告對能源消費的類別定義，該報告透過能源供給追蹤能源消費去向，分別定義為產業、運輸、非能源使用與其他等用途的最終能源消費，此研究亦針對不同來源的跨國投入產出資料庫進行比較，並提供投入產出分析相關研究人員對於資料特性與選擇建議如圖 4，GTAP 的資料格式與特性較適合想建立 CGE 模型的研究者當作基礎資料使用，而 WIOD 資料庫提供的多國投入產出表適合用於多國投入產出分析，因為 WIOD 透過各國的供給使用表建立，對於各國進口的中間財與最終需要，有較為詳細的分配設計 (亦即同一產品進口至其他國家的各個產業都有詳細的金額)。

MRIO	Region detail	Sector detail	Time series	Extensions	Status (as of Jan 2015)
AIIOT	10	76-78	1975, 1985, 1990, 1995, 2000, 2005	Employment matrix (for 2000)	Updated every 5 years
Eora	188	Varies by country, ranging from 26 to 511	1990-2012	Energy, emissions, water and land footprints, employment	Released in 2012 updated annually
EXIOBASE	44	163 industries 200 products	2000, 2007	Over 100 extensions including energy, emissions, water and land footprints, employment	Released in 2012. Latest data (2007) made available in 2015. Will be updated with an annual time series in 2016
GTAP (Open EU)	129	57	1990, 1992, 1995, 1997, 2001, 2004, 2007	Emissions, employment, land use	Released in 1990. Updated every 3 to 4 years
OECD ICIO	57	18	1995, 2000, 2005, 2008, 2009	Economics only	Released in 2012
WIOD	41	35	1995-2011	Emissions, employment, water, land and resource use	Released in 2012. Update status unknown

圖 4、跨國投入產出資料庫之比較

2. Evidence of energy efficiency improvements in Thailand's manufacturing and transport sectors using structural decomposition analysis.

(by Tharinya SUPASA, Shih-mo LIN.)

Tharinya SUPASA 為中央大學能源工程研究所博士生，Shih-mo LIN 則為中原大學國際經營及貿易學系教授。本次 Tharinya 發表之論文主要利用投入產出分析及結構分解法來探討泰國能源與節能政策的效率及成果。由於泰國近年經濟成長快速，對於化石能源之需求亦大幅提高，導致能源過度依賴進口，危及本國之能源安全，因此自 1995 年起泰國政府便針對製造業及大型建築實施節能政策。由於本文重點在於探討運輸部門與製造業，因此本文將總能源消費分成運輸部門能源消費、製造業能源消費及其他部門能源消費等三部分，並分別計算能源消費變化之驅動因子與效果。本文將能源消費變化拆解成

能源效率效果、生產結構效果、最終消費結構效果、人均 GDP 效果、人口變化效果等五個效果，研究結果顯示，1995-2011 年間泰國能源效率明顯提升，運輸部門的能源密集度高於製造業，而製造業相對運輸部門消費更多的能源產品。透過 SDA 法亦可看出能源效率的提升以及能源結構的改變是抑制能源使用量增加的主要原因，故據此推論政府的節能相關政策是有效的。本篇論文著重在 SDA 方法的應用與計算結果呈現，但在泰國政府自 1995 年起所執行之具體節能減碳政策並未多作著墨，稍覺可惜。

利用本次參加研討會之機會，一方面可瞭解各國能源研究組織與投入產出分析領域專家學者之近期研究重點與成果，做為核研所後續研究主題之規劃；另一方面，透過與各國能源研究組織與會人員交流，建立核研所與各國能源研究組織聯繫管道，此將有助於提升核研所於能源經濟領域之知名度，以及拓展核研所能源經濟及策略研究中心之國際關係。

四、建 議 事 項

經本次參與 The International Input-Output Association (IIOA) 舉辦的「第 24 屆 International Input-Output Conference 」研討會可發現，目前於探討氣候變遷對國家能源政策、環境使用等影響評估以整合多國 (區域) 以及能源工程模型結合總體經濟模型為研究趨勢，而核研所能源經濟及策略研究中心亦是符合此能源模型建置之發展方向。藉由參加此次會議獲得與許多能源模型與政策評估經驗豐富之學者、研究人員交流的機會，對於提升核研所能源政策評估與模型規劃能力具有莫大幫助，在此提出未來核研所可持續努力精進的建議方

向：

(一) 參考國外能源經濟模型研究經驗，可將本所未來建置之多國 CGE 總體經濟模型 EPPA Taiwan 與能源工程模型 TIMES 進行軟連結

參與此次研討會可發現，目前國際於能源模型之建置上有兩大趨勢：一是以單國、單區域模型開發成熟後，再擴張模型評估之範疇，邁入多國、多區域之整合模型，如 E3ME 總體經濟模型便是從英國單國總體計量模型擴展至全球總體計量模型；另一趨勢則是整合多種不同評估面向的模型，以增強研究的全面性，如整合總體經濟評估模型與能源技術系統模型。 2015 年 COP21 通過全體締約國各自提交該國自主減排貢獻的巴黎協定 (Paris Agreement) ，並規範全球溫室氣體排放，在各國為了因應氣候變遷而制定各自的低碳發展策略，以達成其未來減碳目標的情勢下，國與國間的經濟、產業發展與能源使用等勢必會相互影響，而本所現與 MIT 合作積極建置的多國 CGE 總體經濟模型 (EPPA_ Taiwan) 能考量國與國、產業與產業經濟活動的互動關係，並對我國的能源與經濟進行細緻的分析與評估，未來若可透過軟連結 TIMES 模型，將可求得我國的詳細能源使用情形評估結果，如此不但能考量我國的新能源產業發展與能源使用的互動關係，並可提出較貼近現實發展情形的產業發展策略與建議。

(二) 能源經濟評估議題牽涉範圍廣泛且模型運維不易，建議應趨向精細化分工

觀察整個研討會，凡涉及氣候變遷、能資源使用與能源政策評估分析等能源經濟相關議題時，由於討論議題的牽涉範圍廣泛，因此各研究單位對此類相關研究議題的分工會較為細緻，藉此加強對於研究主題探討的深度，如英國劍橋大學計量經濟研究中心的 E3ME 總體經濟模型，即探討區域經濟發展的主題時，其模型研究範圍可分類為全球 E3MG 模型、歐盟 E3ME 與英國 E3ME 單國模型等三類，同

時亦能根據探討議題對區域分類要求的精度，將歐盟、英國分為由各個不同的子區域組成；而以議題區分則有能源與環境、勞動市場等不同模型，分工相當精細，由研究中心的成員依據各自專長發展自己的研究，每個人建置的模型皆以 E3ME 為原始架構，但各自發展的特色與應用領域並不相同，因此不但能保持既有模型的特色，還能擴大模型的研究議題，讓該中心在研究氣候變遷與能源政策評估時，得到較為全面且詳細的研究結果，因此建議核研所應努力精進 TIMES 模型與 GEMEET 等模型，並對於模型研究人員做適當的分工，並利用 GitHub 等線上協作平台，使模型開發者能更有效率的掌握其他部門的模型版本與修改紀錄，並能透過 GitHub 共享程式碼，確保各版本模型的重要參數與設定一致，以維護核研所的研究品質，如此將能提升核研所的能源政策評估能力。

五、附　錄

附件一、會議論文摘要與簡報投影片 **(秦安易)**

Assessment of CO_2 Emissions Change in Eastern Asia: A Structural Decomposition Approach

By
An-Yi Chin, Hao-Chuan Yang

Abstract

Due to the unstable political situation in Middle East, and large-scale exploitation of shale gas in United States, fossil fuel prices fluctuate dramatically. Besides, the continuous deterioration of global climate also awakes authorities to seriously concern various ways such as promoting renewable energy, taking several CO_2 emissions reduction policies and improving energy efficiency to mitigate the impacts. So, observing CO_2 emissions trends now become to be an important work. This paper aims to identify the driving forces of change in CO_2 emissions, we use structural decomposition approach (SDA) and World Input-Output Database (WIOD) to uncover the disparities in Eastern Asia and trace the change of embodied CO_2 emissions during 1999 to 2009 by the effects of emission intensity, primary energy intensity, and energy efficiency. This study provides a broad overview of the magnitude and distribution of the drivers for embodied CO_2 emissions across countries, and offers insights for policy makers to formulate a comprehensive and sector-specific energy policy to sustain economic growth.

Key Words: CO_2 Emissions, SDA, Input-Output Analysis

Assessment of CO_2 Emissions Change in Eastern Asia: A Structural Decomposition Approach

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Outline

- **Introduction**
- **Methodology & Data**
- **Empirical Results**
- **Conclusion**

核能研究所 2

Introduction (1/2)

- From Kyoto Protocol, Nationally Appropriate Mitigation Actions (NAMAs) to Nationally Determined Contribution (NDC), controlling CO_2 emissions and **climate change mitigation have become serious issues for policy makers all over the world**.

- **Fossil fuel combustion** is one of the major contributors for the increase of greenhouse gas.

- To analyze how CO_2 emissions have changed over time, we use **structural decomposition approach (SDA)** to identify the driving forces of change in CO_2 emissions for main Eastern Asia countries, including **China, Japan, South Korea and Taiwan**.

Introduction (2/2)

- We decompose changes in CO_2 emissions into
  - (1) the carbon intensity (**CI**) effect
  - (2) the energy mix (**EM**) effect
  - (3) the energy intensity (**EI**) effect
  - (4) Leontief structure (**L**) effect
  - (5) final demand (**F**) effect

- This study provides a broad overview of the magnitude and distribution of the drivers for embodied CO_2 emissions across countries, and offers insights for policy makers to formulate a comprehensive and sector-specific energy policy to sustain economic growth.

Methodology & Data

- $X = (I - A)^{-1}F = LF$
- $\frac{CO_2}{X} \cdot X = CO_2 = \frac{CO_2}{X} \cdot LF$
- $CO_2 = \frac{CO_2}{Fos} \times \frac{Fos}{Ene} \times \frac{Ene}{X} \times L \times F$
- $CO_2{}^n = CI^n \times EM^n \times EI^n \times L^n \times F^n$

$$\Delta CO_2{}^n = \Delta CI^n + \Delta EM^n + \Delta EI^n + \Delta L^n + \Delta F^n$$

Where

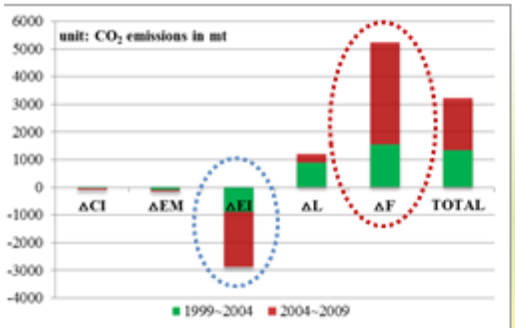
- CI^n : measuring the CO_2 emissions that industries i produced by burning of fossil fuel in nation n;
- EM^n : measuring the changes in fossil fuels combustion compared to total energy consumption in nation n;
- EI^n : measuring the changes in energy requirements per unit of output of industry sectors i in nation n;

Methodology & Data

- This study was based on data retrieved from World Input-Output Database (WIOD), including these countries' **national IO tables**, **tables of energy consumption**, and **tables of CO_2 emissions** for years 1999, 2004 and 2009.
- Since the national IO tables were published in current prices, we need to adjust them into constant-price tables. For this purpose, price indexes from WIOD Socio Economic Accounts are used to deflate the IO tables into constant 1995 prices.

Empirical Results (1/5)

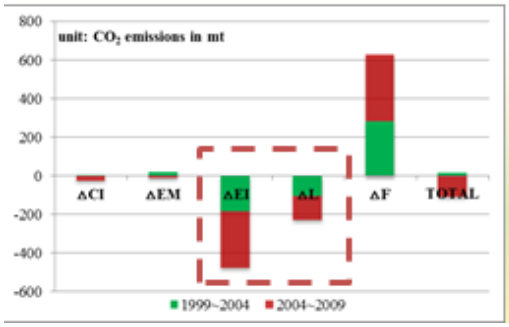
- **China**
  - Between 1999-2004 and 2004-2009, China's total CO_2 emissions increased from 1332.8 mt to 1872.3 mt, about 40.5% increasing.
  - Final demand effect (ΔF) contributed 1541.2 mt CO_2 emissions in 1999-2004 ,and 3690.9 mt in 2004-2009.
  - Energy Intensity effect (ΔEI) contributed -906.8 mt CO_2 emissions in 1999-2004, and -2014.2 mt in 2004-2009.



	ΔCI	ΔEM	ΔEI	ΔL	ΔF	ΔCO_2
1999-2004	-64	-105	-907	867	1541	1333
2004-2009	-60	-76	-2014	331	3691	1872

Empirical Results (2/5)

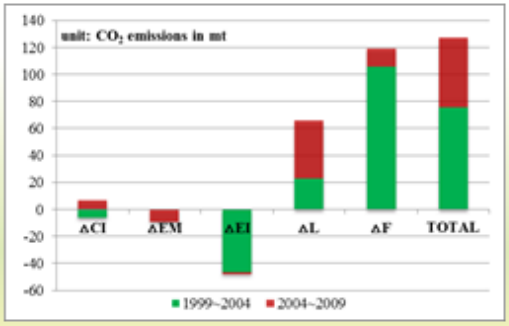
- **Japan**
  - Japan is the only country that the change in CO_2 emissions is negative during 2004 to 2009 (108 mt CO_2 emissions decreasing).
  - Energy Intensity effect (ΔEI) contributed -182.7 mt CO_2 emissions in 1999-2004, and -294.8 mt in 2004-2009.
  - Leontief structure effect (ΔL) contributed -105.8 mt CO_2 emissions in 1999-2004, and -123.7 mt in 2004-2009.



	ΔCI	ΔEM	ΔEI	ΔL	ΔF	ΔCO_2
1999-2004	1	22	-183	-106	283	17
2004-2009	-24	-11	-295	-124	346	-108

Empirical Results (3/5)

- **South Korea**
  - The changes of CO_2 emissions in South Korea were decreasing from 1999-2004 to 2004-2009, and the decreasing rate was around 31%.
  - Final demand effect (ΔF) contributed 105.6 mt CO_2 emissions in 1999-2004 ,and 13.5 mt in 2004-2009.

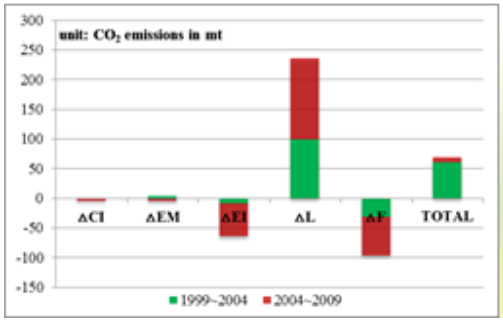


Decline of mining and quarrying sector, electricity, gas and water supply sector, basic metals and fabricated metal sector

	ΔCI	ΔEM	ΔEI	ΔL	ΔF	ΔCO_2
1999-2004	-6	0	-46	23	106	75
2004-2009	7	-9	-2	43	13	52

Empirical Results (4/5)

- **Taiwan**
  - The changes of CO_2 emissions in Taiwan were decreasing from 1999-2004 to 2004-2009, and the decreasing rate was around 84.7%.
  - Energy Intensity effect (ΔEI) contributed -9 mt CO_2 emissions in 1999-2004, and -55.5 mt in 2004-2009.
  - The contributions of final demand effect (ΔF) were negative to CO_2 emissions, -31.9 mt in1999-2004 and -65.0 mt in 2004-2009.



Decline of mining and quarrying sector

	ΔCI	ΔEM	ΔEI	ΔL	ΔF	ΔCO_2
1999-2004	-2	4	-9	99	-32	60
2004-2009	-3	-5	-55	137	-65	9

Empirical Results (5/5)

- **Cross-country comparisons (2004-2009)：L & F**
  - **L(+) & F(+)：**
    - Both intermediates and final demand increased;
    - Deepening processing.
  - **L(-) & F(+)：**
    - Intermediates decreased but final demand increased;
    - Technological progress.
  - **L(+) & F(-)：**
    - Intermediates increased but final demand decreased;
    - Allocation structure change.

	ΔCI	ΔEM	ΔEI	ΔL	ΔF	ΔCO_2
China	-60	-76	-2014	**331**	**3691**	1872
Japan	-24	-11	-295	**-124**	**346**	-108
Korea	7	-9	-2	**43**	**13**	52
Taiwan	-3	-5	-55	**137**	**-65**	9

Conclusion

- **Energy intensity effect** is the main driver of CO_2 reductions for these four Eastern Asia countries.
- The CI effect and EM effect truly improved during this two time period, reflecting **improvement of fossil fuel efficiency** and the **shift of energy consumption structure**.
- The CI, EM and EI effects of Taiwan totally contributed 63 mt CO_2 reductions during 2004-2009, due to
  - rapidly rising of energy price caused the primary energy demand decreased and improvement of energy efficiency, and
  - expanding renewable and gas-fired generation.

Thank You for Your Listening

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附件二、會議論文摘要與簡報投影片 **(楊皓荃)**

Applying Multi-Regional Input-Output Analysis to Evaluate the Impact of Indirect Energy Consumption on Energy Security

By
Hao-Chuan Yang, An-Yi Chin

Abstract

There has been increasing attention being paid to the issue of energy security in recent years. In order to access the energy security situation, many indicators are developed toward to a more complex and multi-dimensional way. However, most indicators involved energy consumption ignores the indirect effect from international trade. Consequently, this paper intends to assess major Eastern Asia countries energy security by combining the Multi-Regional Input-Output analysis and energy security indicator system to consider the indirect energy consumption effect based on the World Input-Output Database. The result shows that the foreign energy embodied in traded goods could affect energy security and serves as an important insight for the government agency in charge of relevant energy policy.

Key Words: Energy Use, Energy Security, Multi-Regional Input-Output Analysis

Applying Multi-Regional Input-Output Analysis to Evaluate the Impact of Indirect Energy Consumption on Energy Security

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Content

- Introduction
- Research Purpose
- Methodology
- Empirical Results
- Conclusion

The Energy Security Issues in Recent Years

- The rapid growth of global energy demand due to the development of emerging markets
  - China has passed the U.S. to become the world's biggest energy consumer in 2010.
  - Other non-OECD Asian countries have rapid economic growth.
- The violence and disasters are getting more frequent
  - Venezuelan strike in 2003, war in Iraq in 2003, hurricanes Katrina and Rita in 2005, Libya collective action in 2011, Paris attacks in 2015 ,etc.

The Measurement of Energy Security

- There have many indicators are applied to trace the long run of energy security performance for a country, or to compare with other countries at specific times.

(Frondel and Schmidt, 2014; Sovacool and Brown, 2010; Löschel, *et al.*, 2010 and Le Coq and Paltseva, 2009.)

The indirect energy consumption are often ignored

- However, these assessment were usually based on accounting of territorial energy consumption data which provided by statistic institutions
- Besides the direct energy inputs within territorial boundary, indirect energy demands or requirements associated with cross-country exchange of goods and services (import product or service) are often ignored (Zhang *et al.*, 2015).

Purpose

- This paper applied a Multi-Regional Input–Output Analysis (MRIOA) of energy uses embodied in final demand and inter-regional trade.
- The impacts of indirect energy use on energy security indicators.
- The differences between production-based and consumption-based energy security indicators are applied for China, Taiwan, Japan and South Korea from 1995 to 2009.

Data

- This analysis was based on data retrieved from the World Input-Output Database (WIOD). The WIOD provided detail WIOT, energy accounts, for 35 economic sectors, and 40 countries from 1995 to 2011,.
- For the analysis the set of WIOD primary energy commodities are aggregated towards a set of six different primary energy carriers as defined Table.

Table. Aggregation of WIOD primary energy carriers

Primary energy sets	WIOD code
Crude oil	CRUDE
Coal	HCOAL, BCOAL, COKE
Nature gas	NATGAS, OTHGAS
Nuclear energy	NUCLEAR
Hydropower	HYDRO
Renewables	WASTE, BIOGASOL, BIODIESEL, BIOGAS, GEOTHERM, SOLAR, WIND, OTHRENEW

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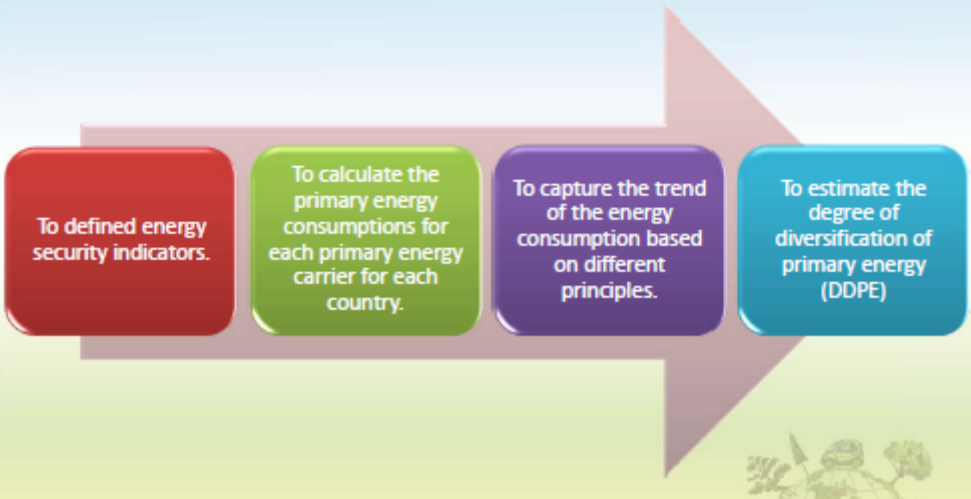
Research Steps



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The Energy Consumption in Different Approaches

$$E_n^{pro} = \sum_{pe}\left[e_{pe,n}(I-A)^{-1}\sum_{s} y_{n,s}\right]$$

Where:

- E_n^{pro} is the total primary energy uses associated with the production of country n
- $e_{pe,n}$ denote the carrier-specific (pe) energy intensities of country n
- $(I-A)^{-1}$ is the Leontief inverse matrix
- $y_{n,s}$ stands for the final demand flow from country n to country s.

$$E_n^{con} = E_n^{pro} + E_n^{im} - E_n^{ex}$$

Where:

- E_n^{con} is the total primary energy uses associated with the consumption of country n
- E_n^{im} representing the energy embodied in import of goods and services
- E_n^{ex} representing the energy embodied in export of goods and services

Degree of Diversification of Primary Energy

$$DDPE_n = \sum_{pe}\left(\frac{E_{pe,n}^{pro}}{E_n^{pro}}\right)^2$$

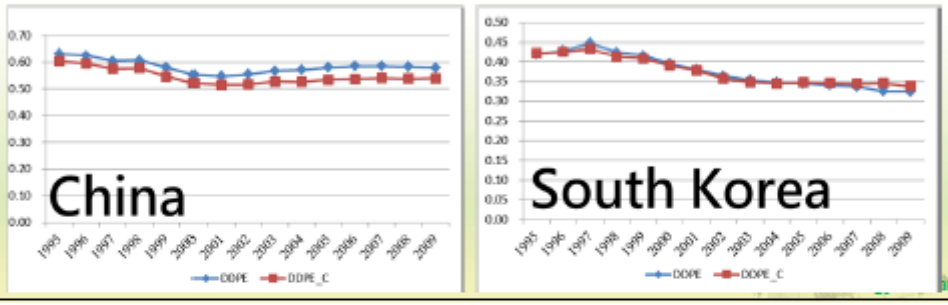
- $DDPE_n$ is calculated as the sum of the squared shares of direct use of primary energy carrier (pe) in total direct use of primary energy associated with the production of country n.
- The larger values of the indicator means the country's primary energy carrier mix towards more concentrated some specific primary energy carriers.

$$DDPE\_C_n = \sum_{pe}\left(\frac{E_{pe,n}^{con}}{E_n^{con}}\right)^2$$

- The $DDPE\_C_n$ is the degree of diversification of primary energy using the consumption-based accounting.

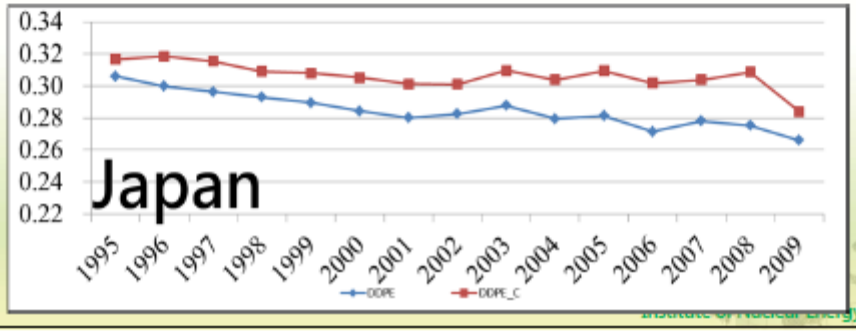
Empirical Results

- China and South Korea have similar results (DDPE and DDPE_C, are approximately equal), but for different reasons.
- This Results shows that the energy embodied in domestic (account for 95% of total energy consumption) of China is more than its energy embodied in trade (whether export or import); but the result of South Korea is cause by their diversification of primary energy mix is same as its trading partners.



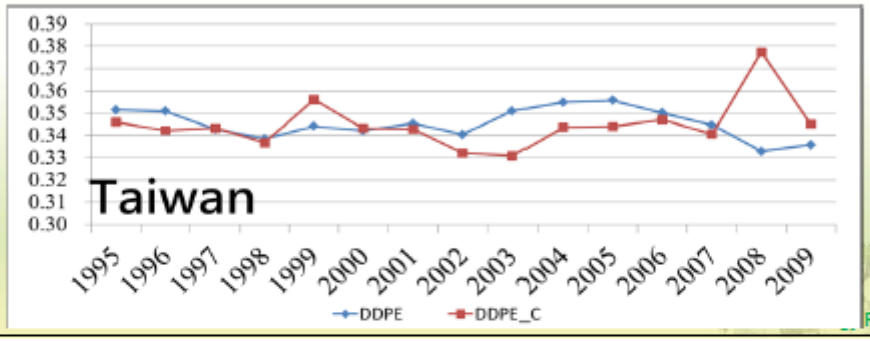
Empirical Results (cont.)

- Our empirical result shows that Japan's DDPE_C was always more than DDPE by around 2%.
- Japan has highly diversification in the production-based primary energy mix. But Japan should prepare alternative importing sources, in case of the impact from energy shock to their original importing sources.



Empirical Results (cont.)

- Taiwan has the most complicated situation in these four countries.
- During periods of energy crisis (2008), the countries which exported commodities to Taiwan would have more impacts when facing energy price fluctuated, and turned to be concentrated on particular energy carriers.



Conclusion

- This paper intends to gain a better understanding of energy security in an economy that relies heavily on imported energy, such as Taiwan.
- The approach adopted in this paper differs from traditional ones which focus on only assessments based on accounting of territorial energy consumption in that, the indirect energy consumption is explicitly taken into account.
- Our result shows that some country is sensitive to the choice of the energy accounting framework. In particular, both Taiwan and Japan are having volatile indictor value, when it used consumption-based energy accounting framework.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Thank you!
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附件三、研討會手冊與議程

24th International Input-Output Conference &
6th Edition of the International School of I-O Analysis,
4-8 July 2016, Seoul, Korea

Conference Program and Abstracts

International Input-Output Association

Korean Association of Economic Systems Research

The Bank of Korea

Korea Institute for Industrial Ecomonics & Trade

College of Commerce and Economics at Yonsei University

Welcome Message

Jinmyon Lee,
Chair of the Local Organizing Committee,
Korea Institute for Industrial Economics & Trade

Dear Conference Participants,

As the Chair of the Local Organizing Committee, I together with committee members warmly welcome you all to the 24th International Input-Output Conference in Seoul.

During the preparation of the conference, the Local Organizing Committee has been very indebted to a number of professors and scholars. In particular, we are most grateful to Prof. Erik Dietzenbacher, the President of the IIOA, and Dr. Satoshi Inomata, the Chair of the Scientific Program Committee, for their continuous advices and encouragement to us for organizing this conference. Also, I would like to express our sincere appreciation to Dr. Christof Paparella, the IIOA Treasurer, and Dr. Oliver Fritz, the IIOA Secretary, for their kind cooperation and administrative arrangements with us.

As the previous IIOA Conferences covered a very wide range of research topics based on the input-output analysis, so will this Seoul Conference. I have no doubt that the 24th IIOA Conference in Seoul will be able to contribute to various communities and countries by providing clues for solving socio-economic and environmental issues at the regional, national, and global levels.

Last but not least, the Committee Members and I would like to take this opportunity to thank all the Local Organizers, in particular the Bank of Korea, for their financial and in-kind assistance for this conference.

We wish you all a very fruitful and pleasant stay in Seoul.

Conference Program

Program Overview

Time	Sun, 03/Jul/2016	Mon, 04/Jul/2016	Tue, 05/Jul/2016	Wed, 06/Jul/2016	Thu, 07/Jul/2016	Fri, 08/Jul/2016
09:00-09:30		The International School of Input-Output Analysis	Opening Ceremony	Flash Session 1	Flash Session 2	Parallel Session 6
09:30-10:00			Keynote Speech 1	Keynote Speech 2	Keynote Speech 3	
10:00-10:30	IIOA Council Meeting (invitation only)		Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:30-11:00			Super-event: Guess Who on What?	IIOA General Assembly	Parallel Session 3	Parallel Session 7
11:00-11:30						
11:30-12:00						
12:00-12:30			Lunch	Lunch	Lunch	Lunch
12:30-13:00						
13:00-13:30						
13:30-14:00			Parallel Session 1	Excursion	Parallel Session 4	Parallel Session 8
14:00-14:30						
14:30-15:00						
15:00-15:30						
15:30-16:00			Coffee Break		Coffee Break	Coffee Break
16:00-16:30			Parallel Session 2		Parallel Session 5	Closing Session
16:30-17:00						
17:00-17:30						
17:30-18:00						
18:00-18:30	Welcome Reception for International School of Input-Output Analysis	Welcome Reception for the IIOA Conference	IIOA Economic Systems Research - Editorial Board Meeting (invitation only)	Conference Dinner	Young Researchers' "Get Together"	
18:30-19:00						
19:00-19:30						
19:30-20:00						
20:00-20:30						
20:30-21:00						
21:00-21:30						
21:30-22:00						

Sun, July 3

10:00 - 18:00 *IIOA Council Meeting (invitation only)*

18:00 - 20:00 *Welcome Reception for International School of Input-Output Analysis*

Monday, July 4

09:00 - 18:00 *The International School of Input-Output Analysis*

09:00-10:30 Session 1

10:30-11:00 Coffee Break

11:00-13:00 Session 2

13:00-14:00 Lunch

14:00-16:00 Session 3

16:00-16:30 Coffee Break

16:30-18:00 Session 4

[Module 1]
E3ME Global Macro-Econometric Model
Lecturers: Hector POLLITT (Cambridge Econometrics), Soocheol LEE (Meijo University)

[Module 2]
Construction of OECD Inter-country Input-Output (ICIO) Database
Lecturers: Norihiko YAMANO, Colin WEBB and Kirsten WIEBE

[Module 3]
Dynamic IO analysis
Lecturer: Bert STEENGE

[Module 4]
Structural Decomposition Analysis
Lecturer: Bart LOS and Erik DIETZENBACHER

[Module 5]
Environmental impacts of consumption-based policies
Lecturers: Richard WOOD

18:00 - 20:00 *Welcome Reception for the IIOA Conference*
Location: Engineering Research Park

Tuesday, July 5

09:00 - 09:30 *Opening Ceremony*
Location: **Auditorium**

- Erik DIETZENBACHER, President, International Input-Output Association, Professor, University of Groningen
- Young Kyung SUH, Deputy Governor, Bank of Korea
- Sang Yul SHIM, President, Korean Association of Economic System Research

Introductory video of Yonsei University
(Chair: Satoshi INOMATA, Institute of Developing Economies, JETRO)

09:30 - 10:30 *Keynote Speech 1*
Location: **Auditorium**

Pol ANTRÀS
Robert G. Ory Professor of Economics, Harvard University
(Chair: Bart LOS, University of Groningen)

10:30 - 11:00 *Coffee Break*

11:00 - 12:30 Super-event: Guess Who on What?

Navigator: Satoshi INOMATA, Institute of Developing Economies, JETRO

*** Some prominent IO researchers will be there for presentations !! ***

- **Location: Venue F: B112**
  Topic: Guess Who on What? ...Lot A

  1. Geographical keyword: The World
     by ... *absolutely secret until the day !!!*
  2. Geographical keyword: Europe
     by ... *absolutely secret until the day !!!*

- **Location: Venue W: 101**
  Topic: Guess Who on What? ...Lot B

  1. Geographical keyword: The U.S.
     by ... *absolutely secret until the day !!!*
  2. Geographical keyword: From Brazil via Congo to Outer Space
     by ... *absolutely secret until the day !!!*

12:30 - 14:00 *Lunch*

Tuesday, July 5

14:00 - 16:00 Parallel Session 1

- **Location: Venue A: B101**
  Topic: 514A Special session: Science for Re-designing Science, Technology and Innovation (SciREX) Policy

  Chair: Masahiro KURODA

  1. The Creation of Policy Options of Science, Technology and Innovation Policy
     by *Masahiro KURODA, YASUSHI HARA, Michael C. HUANG*
  2. Resource Logistics as a Support Tool of Science, Technology and Innovation Policy Decision
     by *Kazuyo MATSUBAE, Tetsuya Nagasaka, Kenichi NAKAJIMA, Keisuke NANSAI*
  3. A General Equilibrium Approach to Nepal Earthquake Recovery Policy with Renewable Energy Implementation
     by *Michael C. HUANG, Damaru Ballabha Paudel*

- **Location: Venue B: B103**
  Topic: 514B Structural Decomposition Analysis

  Chair: Michael L LAHR

  1. Assessment of CO2 Emissions Change in Eastern Asia: A Multi-Regional Structural Decomposition Approach
     by *An-yi CHIN, Hao-chuan YANG*
  2. Changes in the Brazilian Productive Structure and Economic Growth During the Great Recession
     by *Carolina T. BALTAR*
  3. Evidence of energy efficiency improvements in Thailand's manufacturing and transport sectors using structural decomposition analysis
     by *Tharinya SUPASA, Shih-mo LIN*
  4. Structural Decomposition and Shift-Share Analyses: Let the Parallels Converge
     by *Michael L LAHR, Erik DIETZENBACHER*

- **Location: Venue C: B106**
  Topic: 514C CGE/econometric IO Modelling (1)

  Chair: Jae-Un PARK

  1. Unconventional monetary policy expansion: the economic impact through a dynamic CGE model
     by *Francesca SEVERINI, Clio CIASCHINI, Rosita PRETAROLI, Claudio SOCCI*

2. General Equilibrium Analysis of Energy Development Scenarios: the Case of Lithuania
   by *Vidas LEKAVICIUS*
3. Climate policy design to preserve the competitiveness of the French industry with hybrid input-output tables
   by *Gaëlle LE TREUT*
4. Temporal and spatial distribution of global mitigation costs: INDC role and generation equity
   by *Jingyu LIU, Shinichiro FUJIMORI*

• **Location: Venue D: B109**
Topic: 514D Special session: Korean Input-Output Tables: Practical Viewpoints

Chair: Sang Yul SHIM

1. The Valuation of Transactions and the Treatment of Scrap in Korean Input-Output Tables
   by *Moonhee LEE*
2. The Past, the Present and the Future of Korean Input-Output Tables
   by *TaeHyun Kwon*
3. Compilation and Analysis of Korean SME's Input-Output Table
   by *Youngho LEE*
4. The effects of external shocks on the Korean economy : CGE model-based analysis
   by *Hyeok LEE, Yong Kyun KIM*

• **Location: Venue E: B110**
Topic: 514E Enviromental Analysis for Development (1)

Chair: Makiko TSUKUI

1. Brazilian greenhouse gas emission reductions as an optimization problem: when the government chooses policy design
   by *Kenia B. DE SOUZA, Luiz Carlos Santana Ribeiro, Fernando Salgueiro Perobelli*
2. Making 'dirty money' out of exports: Estimating value-added and pollution exports in China
   by *Wencheng ZHANG, Rui WEI*
3. Using the Input-Output Model for Evaluating the Impact of Environmental Restrictions on the Economic Development of the Republic of Buryatia, Russia
   by *Zorikto B. DONDOKOV, Konstantin Pavlovich Dyrkheev*

4. China's virtual SO2 emission transfer embodied in interprovincial trade: a multiregional input-output analysis
   by *Qiaoling LIU*

• **Location: Venue F: B112**
Topic: 514F Environmental IO Modelling (1)

Chair: Manfred LENZEN

1. Environmental impacts of capital formation
   by *Carl-Johan H. SÖDERSTEN, Edgar G. Hertwich, Richard WOOD*
2. Global biodiversity impacts of Dutch industries
   by *Harry C. WILTING, Mark van Oorschot*
3. The trade-offs between carbon and critical metal footprints of Japanese households
   by *Yosuke SHIGETOMI, Keisuke NANSAI, Susumu Tohno*
4. An analysis on Relation between Consumption Based Emissions and Tax
   by *Yoo-kyung YANG, Jong-soo LIM, Yong Gun Kim*

• **Location: Venue W: 101**
Topic: 514W Special session: Global Production Networks: Theory and Empirics (1)

Chair: Bart LOS

1. Characterizing Global and Regional Value Chains
   by *Xinding YU, Zhi Wang, Shang-jin WEI, Kunfu ZHU*
2. Offshoring and the Functional Structure of Labour Demand in Advanced Economies
   by *Gaaitzen DE VRIES*
3. The Impact of Contract Enforcement Costs on Outsourcing and Aggregate Productivity
   by *Johannes BOEHM*
4. The Global Production Line Position of Chinese Firms
   by *Davin CHOR, Kalina Manova, Zhihong YU*

• **Location: Venue X: 110**
Topic: 514X Special session: Economic Implications of Transpacific Partnership Agreement (TPP)

Chair: Kakali MUKHOPADHYAY

1. The Impact of TPP on selected ASEAN Economies
   by *Paramita DASGUPTA, Kakali MUKHOPADHYAY*

2. Economy wide impact of TPP: New Challenges to China
   by *Chandrima SIKDAR, Kakali MUKHOPADHYAY*
3. The Impact of Trans-Pacific Partnership agreement on the Canadian economy
   by *Kakali MUKHOPADHYAY, PAUL J. THOMASSIN*
4. TPP Agreement and its Implication on Pakistan Economy- A CGE Approach
   by *Muhammad Aamir KHAN, Kakali MUKHOPADHYAY, Naseeb ZADA*

• **Location: Venue Y: 113**
Topic: 514Y Energy IO Modelling (1)

Chair: Klaus HUBACEK

1. Tracing and Quantifying Influences of Fossil Fuels in Thailand's Economic Structure Using Multiplier and Structural Path Analysis
   by *Nattapong PUTTANAPONG*
2. Energy Balance in India's International Trade: An Input-Output Based Analysis
   by *Anjali TANDON, Shahid Ahmed*
3. Applying Multi-Regional Input-Output Analysis to Evaluate the Impact of Indirect Energy Consumption on Energy Security
   by *Hao-chuan YANG, An-yi CHIN*
4. Towards a better understanding of consumption-based energy accounts: a comparison of MRIO results calculated from different energy extensions
   by *Anne OWEN, John Barrett, Lina Isabel Brand Correa, Marco Sakai*

• **Location: Venue Z: 115**
Topic: 514Z Special session: Compilation and Application of EXIOBASE 3 – a time series of highly detailed EE MRIOs

Chair: Arnold TUKKER

1. EXIOBASE 3 - Compilation and analysis of an EE MRIO time-series in current and constant prices
   by *Konstantin STADLER, Richard WOOD, Tatyana Bulavskaya, Carl-Johan H. SÖDERSTEN, Arjan de Koning, Arnold Tukker*
2. Decoupling consumption from our environmental pressures and impacts - a global Multi-Regional analysis with EXIOBASE
   by *Richard WOOD, Konstantin STADLER, Arnold Tukker*
3. EXIOBASE 3 - Construction and analysis of the world physical IOT
   by *Stefano MERCIAI, Jannick Schmidt*
4. Potentials for a circular economy – assessment with Exiobase V3
   by *Arnold Tukker, Arjan de Koning, Jannick Schmidt, Konstantin STADLER, Richard WOOD*

Tuesday, July 5

16:00 - 16:30 *Coffee Break*

16:30 - 18:30 Parallel Session 2

- **Location: Venue A: B101**
  Topic: 516A Financial Analysis

  Chair: Jiyoung KIM

  1. Carbon Tax Policy under Renminbi Appreciation: a Financial CGE Model Analysis
     by *Jingyu LIU*
  2. Convergence of Demand Pull into Cost Push Inflation in Indian Economy
     by *Shri PRAKASH, Sudhi Sharma*
  3. Cost-push Inflation in Turkey: An Input-Output Analysis
     by *K. Ali AKKEMIK*

- **Location: Venue B: B103**
  Topic: 516B Special session: The Use of Open, Semi-Closed and Closed IO Models; Theory and Application

  Chair: Albert E. STEENGE

  1. The evolution of income inequality in Chicago: Test for the trickle-down effects using an input-output model
     by *Geoffrey J.D. HEWINGS, Kijin KIM*
  2. The semi-closed input-output model and its application to income policy analysis
     by *Quanrun CHEN, Albert E. STEENGE*
  3. Open, closed and semi-closed IO models; Theory and Application
     by *Albert E. STEENGE*
  4. Youth unemployment in Europe: The North-South divide interpreted using a bi-regional demoeconomic model
     by *Andre CARRASCAL, Geoffrey J.D. HEWINGS*

- **Location: Venue C: B106**
  Topic: 516C Special session: Exploring the Interface between IOA and CGE

  Chair: Sangwon SUH

  1. On the Interface between input-output and CGE models
     by *Sangwon SUH*
  2. Exploring the Relations between Input-Output Models and Computable General Equilibrium Models
     by *Faye DUCHIN*

3. Bridging Input-Output Analysis and Computable General Equilibrium modeling for Consequential LCA: Rectangular Choice-of-Technology model with price-elastic demand
   by *Arne KÄTELHÖN, Matthias LAMPE, Björn BAHL, André BARDOW, Sangwon SUH*
4. Incorporating behavioral aspects into input-output model
   by *Yasushi KONDO, Sangwon SUH*

• **Location: Venue D: B109**
Topic: 516D Trade in Value-added

Chair: Jiemin GUO

1. Decomposition of gross exports into value-added exports at the bilateral level: an alternative gross exports accounting system
   by *Masaaki KUBONIWA*
2. Value Added Trade and Wage Stagnation in Taiwan
   by *Shih-mo LIN, Jin-Xu Lin, Kuei-Feng Chang*
3. An Input-Output Analysis of the U.S. Economy Over the Last Seven Decades
   by *Jiemin GUO, Erich H STRASSNER*
4. Singapore's Trade in Value Added: Importance and Implication of Information from the OCED-WTO TiVA Database
   by *Mun-Heng TOH*

• **Location: Venue E: B110**
Topic: 516E Enviromental Analysis for Development (2)

Chair: Kazuyo MATSUBAE

1. Evaluating deep decarbonization impact on productivity and growth
   by *Andrey POLBIN, Oleg LUGOVOY, Vladimir POTASHNIKOV*
2. Reducing Carbon Emissions Via Structure Change Along A Consumption Turnpike: A Remesey-Tsukui-Leontief Dynamic Environment System Of China
   by *Xue FU*
3. Greenhouse gas emissions by agriculture in the Brazilian amazon
   by *Gisalda C. FILGUEIRAS, Denise IMORI, Joaquim J.M. GUILHOTO, Carlos R Azzoni*
4. The drivers of China's regional carbon emission change -a structural decomposition analysis from 1997 to 2007
   by *Ling YANG*

Tuesday, July 5

• **Location: Venue F: B112**
Topic: 516F Environmental IO Modelling (2)

Chair: Kurt KRATENA

1. The Effects of Optimal Production Resource Reallocation on Carbon Footprint of Nations
   by *Hirotaka TAKAYABU, Shigemi Kagawa, Hidemichi FUJII, Shunsuke MANAGI*
2. Analyzing hotspots in environmental pressures of Swedish consumption using the Environmentally Extended Input Output database EXIOBASE 3.0
   by *Bertram F. DE BOER, Joao Rodrigues, Arnold Tukker*
3. The Carbon Footprint of European Households and Income Distribution
   by *Kurt KRATENA*
4. Using consumption-based emissions for policy analysis: the difference between average and marginal consumption-based emissions
   by *Hector B. POLLITT, Richard WOOD, Umed TEMURSHOEV, Simone SALOTTI, José M. RUEDA-CANTUCHE, Eva S. ALEXANDRI, Annela ANGER-KRAAVI*

• **Location: Venue W: 101**
Topic: 516W Special session: Global Production Networks: Theory and Empirics (2)

Chair: Davin CHOR

1. Trade Costs, Global Value Chains and Economic Development
   by *Yuan ZI*
2. How Do GVCs Affect Shock Transmission across Borders?
   by *Rudolfs BEMS*
3. Non-Tariff Measures Trickling through Global Value Chains
   by *Robert STEHRER*
4. Fragmentation, Global Trade and Domestic Value-Added Ratio
   by *Edwin L. LAI, Han Steffan QI*

• **Location: Venue X: 110**
Topic: 516X Regional Trade Agreement and Trade Governance

Chair: Hubert ESCAITH

1. NAFTA Trade in Value Added and its distribution, 1995-2011
   by *Rosario CERVANTES, Jorge Ignacio Villaseñor - Becerra*
2. The impact of services liberalization on GVC participation
   by *Woori LEE*

Tuesday, July 5

3. Pakistan's Entry into the Proposed Regional Comprehensive Economic Partnership (RCEP) - A CGE Approach
   by *Naseeb ZADA, Muhammad Aamir KHAN, Kakali MUKHOPADHYAY*
4. An Evaluation of Public Procurement Import Penetration: Liberalisation Effects of Preferential Trade Agreements for South Korea
   by *Surabhi R. JOSHI, Sangeeta Khorana*

• **Location: Venue Y: 113**
Topic: 516Y Energy IO Modelling (2)

Chair: Sangwon SUH

1. Inter-Sector Inter-Region Energy Model: Estimating Investment Projects in Energy Sector of Russian Economy
   by *Nikita I. SUSLOV, Vladimir BUZULUTSKOV*
2. Shadow Prices of Energy in Economic Sectors of Iran
   by *Nooraddin SHARIFY*
3. Emissions trading in China: a partial transmission and indirect emissions input-output analysis
   by *Yan XIA*
4. Assessing the economic impacts of nuclear energy in Malaysia
   by *M. Yusof SAARI*

• **Location: Venue Z: 115**
Topic: 516Z IO Accounts and Statistics (1)

Chair: José M. RUEDA-CANTUCHE

1. New Approach to Household Disaggregation in the System of National Accounts-2008 and Its Application in Input-Output Models
   by *Zorikto B. DONDOKOV*
2. The SUT-EURO and the SUT-RAS methods: extensions and fair comparisons
   by *José M. RUEDA-CANTUCHE, Juan Manuel Valderas Jaramillo, Elena Olmedo Fernández, Joerg Beutel*
3. Projecting Malaysia Input-Output Table Using Euro Method
   by *Norhayati SHUJA', Bee Wah Yap*
4. A Generalized Cross Entropy formulation for matrix balancing with both positive and negative entries
   by *Esteban FERNANDEZ-VAZQUEZ*

18:30 - 22:00 *IIOA Economic Systems Research - Editorial Board Meeting (invitation only)*
Location: Room 201

Wednesday, July 6

09:00 - 09:30 *Flash Session 1*
Location: **Auditorium**

09:30 - 10:30 *Keynote Speech 2*
Location: **Auditorium**

Klaus HUBACEK
Professor, Department of Geographical Sciences,
University of Maryland, College Park
(Chair: Sangwon SUH, University of California, Santa Barbara)

10:30 - 11:00 *Coffee Break*

11:00 - 12:30 *IIOA General Assembly*
Location: **Auditorium**

12:30 - 14:00 *Lunch*

14:00 - 18:00 *Excursion*

18:00 - 22:00 *Conference Dinner*

Thursday, July, 7

09:00 - 09:30 *Flash Session 2*
Location: **Auditorium**

09:30 - 10:30 *Keynote Speech 3*
Location: **Auditorium**

Sanjiv MAHAJAN
Head of International Strategy and Coordination, National Accounts Coordination Division, UK Office for National Statistics
(Chair: José M. RUEDA-CANTUCHE, JRC-IPTS, European Commission)

10:30 - 11:00 *Coffee Break*

11:00 - 12:30 Parallel Session 3

- **Location: Venue A: B101**
  Topic: 711A Special session: Flow of Funds Data and its Applications (1)

  Chair: Chihiro SAKURABA

  1. Financial footprint of nations: A global analysis
     by *Yafei WANG*
  2. Inter-industry Analysis in Flow of funds Accounts: Policy Evaluations and Computational Simulations
     by *Jiyoung KIM, Takuto SAKAMOTO*
  3. Flow-of-Funds Analysis in Brazil: Applying Input-Output Analysis Methods
     by *Erika BURKOWSKI, Jiyoung KIM*

- **Location: Venue B: B103**
  Topic: 711B Methodological Aspects of IO Analysis (1)

  Chair: Erik DIETZENBACHER

  1. The Generalized Dynamic Input-Output Principle
     by *GUANGMING FENG*
  2. The relationship between labor, output and the interindustry input structure: an evaluation of Schefold's explanation of empirical wage-profit curves
     by *Daniel TORRES*
  3. The Linear Matrix-Valued Cost and Production Functions in the Rectangular and Square Input–Output Models
     by *Vladimir MOTORIN*

Thursday, July, 7

• **Location: Venue C: B106**
Topic: 711C Social Accounting Matrix

Chair: Manuel A. CARDENETE

1. Economic impact assessment of food waste on European countries throughout Social Accounting Matrices
   by *Pilar CAMPOY-MUÑOZ, Manuel A. CARDENETE, Maria C. Delgado*
2. Analysis of a developing economy using linear multi-sectorial models based on a home production for home consumption Social Accounting Matrix: the Kenya case
   by *Alfredo J. MAINAR CAUSAPÉ, Pierre BOULANGER, Hasan DUDU, Emanuele FERRARI*
3. The Linkages between Real and Financial Sectors in the Indian Economy- A Financial Social Accounting Matrix Approach
   by *Chandrima SIKDAR*

• **Location: Venue D: B109**
Topic: 711D Productivity and Efficiency (1)

Chair: Kazuhiko NISHIMURA

1. Productivity and Efficiency in the Handbook of Input-Output Analysis
   by *Thijs TEN RAA*
2. Determination of relative prices
   by *Akiko Nakajima*
3. Can the Value-Added-Rate Reflect the Quality of Economic Growth?
   by *Jin FAN*

• **Location: Venue E: B110**
Topic: 711E Special session: SIC-OECD-IDE/JETRO Joint special sessions on Development, Employment and Inequality (1)

Chair: Yaxiong ZHANG

1. Divergent and Convergent Evolutions of Jobs and Value Added Contents in International Trade
   by *Norihiko YAMANO, Peter Horvát*
2. Income distribution, technological progress, and structure change
   by *Chen LIN*
3. GVCs-Linked Spillovers and Development: Firm-Level Evidence
   by *Davide RIGO*

Thursday, July, 7

• **Location: Venue F: B112**
Topic: 711F Inequality and Environment

Chair: Kazuyo MATSUBAE

1. Regional Net-Impacts and Distributive Effects of Promoting Renewable Energies in Germany
   by *Johannes TÖBBEN*
2. Inequalities and household carbon footprint: the allocation of emissions embodied in investment
   by *Mònica SERRANO, Narasimha Desirazu Rao, Jordi Roca*
3. Does Income Inequality Increase Carbon Emissions? The cases of France and India
   by *Jihoon MIN, Narasimha Desirazu Rao*

• **Location: Venue W: 101**
Topic: 711W Special session: APEC TiVA: SUTs with Firm Heterogeneity (1)

Chair: Jiemin GUO

1. The value added of introducing heterogeneous technologies in CGE models with implications on trade liberalization
   by *Jiansuo PEI, Cuihong YANG*
2. Extended Supply-Use Tables in Basic Prices with Firm Heterogeneity: A Proof of Concept for the United States
   by *Jiemin GUO, Erich H STRASSNER, James J Fetzer, Thomas F Howells, Zhi Wang*
3. Gaps in imported intermediate ratio between exporting and non-exporting firms in Japan
   by *Satoru HAGINO, Maki TOKOYAMA*

• **Location: Venue X: 110**
Topic: 711X Employment Analysis (1)

Chair: Joaquim J.M. GUILHOTO

1. Accounting for technology, trade and final consumption in employment: an Input-Output decomposition
   by *Mathilde PAK, Aurélien POISSONNIER*
2. Impact of European integration on employment and value added creation
   by *Jozef KUBALA, Martin HUDCOVSKY*
3. Using labor footprints to investigate the self-sufficiency of labor in autarky
   by *Timon I. BOHN, Erik DIETZENBACHER*

• **Location: Venue Y: 113**
Topic: 711Y Special session: Analysing Environmental and Economic Consequences of Globalisation Using MRIO-SDA

Chair: Rutger HOEKSTRA

1. What accounts for the growth in Carbon dioxide emissions in advanced and emerging economies? The role of Consumption, Technology and global supply chain trade
by *Gaaitzen DE VRIES*
2. The dominance of the US and China in CO2 emissions growth through international sourcing
by *Sangwon SUH, Rutger HOEKSTRA, Bernhard MICHEL*
3. The contribution of foreign sourcing to changes in factor shares: a global structural decomposition analysis
by *Bernhard MICHEL, Rutger HOEKSTRA, Sangwon SUH*

• **Location: Venue Z: 115**
Topic: 711Z Special session: Compilation Issues of Supply, Use and Input-Output Tables

Chair: Isabelle REMOND-TIEDREZ

1. The impact of the new ESA rules on Goods for Processing and Merchanting on the Belgian SUT and IO tables
by *Bart M. J. VAN DEN CRUYCE*
2. Compilation of SUTs as an integral part of the National Accounts in the United Nations Handbook
by *Sanjiv MAHAJAN*
3. Strategies for dissemination of input-output data and analyses. Comparison of Statistics Denmark and other national statistical institutes.
by *Peter R. JENSEN*

12:30 - 14:00 *Lunch*

14:00 - 16:00 Parallel Session 4

• **Location: Venue A: B101**
Topic: 714A Special session: Competitive and Complementary Economic Relationships between Korea and Japan

Chair: Kiyoshi FUJIKAWA

1. Structural Propagation of Productivity Shocks: The Case of Korea and Japan
by *Kazuhiko NISHIMURA, Jiyoung KIM, Satoshi NAKANO*

2. An empirical study on the trade network between Korea and Japan
   by *Kiyoshi FUJIKAWA, Bawoo Kim*
3. Development and Challenge of the Japan-Korea-China International Input-Output Table
   by *Mitsuo YAMADA, Zaizhe Wang, Kozo Miyagawa*
4. Cost Structure Comparison of Korea and Japan using Input-Output Tables
   by *Hyok Jung KIM, Jinmyon LEE*

• **Location: Venue B: B103**
Topic: 714B Methodological Aspects of IO Analysis (2)

Chair: Albert E. STEENGE

1. The analytical complementarity of input-driven and output-driven models
   by *Aleix ALTIMIRAS-MARTIN*
2. Probabilistic, Bayesian updating of IOTs: application to WIOD
   by *Oleg LUGOVOY, Andrey POLBIN, Vladimir POTASHNIKOV*
3. The Hadamard-multiplicative GLS-based Model for Matrix Updating with a Solution Space of Reducible Dimension
   by *Vladimir MOTORIN*
4. Towards a Unified Economic Theory: A Classical-Keynesian GE Model
   by *Atef KHELIFI*

• **Location: Venue C: B106**
Topic: 714C Special session: Computable General Equilibrium Modeling for Policy Impact Analysis

Chair: Jong H. KO

1. Analyzing Important Elasticity Parameters of a Korean CGE Model
   by *Kiho JEONG, Seongyoon HWANG, Dongsu LEE*
2. The Effects of China-US Free Trade Agreement (CHUSFTA)
   by *Yaxiong ZHANG*
3. The China-Korea Free Trade Agreement and Its Economic Impact in Explicit Consideration of Foreign Direct Investment: A CGE Approach
   by *Jong H. KO*
4. Introducing Carbon Taxes in Pakistan: A CGE Framework
   by *Zeshan MUHAMMAD, Jong H. KO*

• **Location: Venue D: B109**
Topic: 714D Productivity and Efficiency (2)

Chair: Shigemi KAGAWA

1. Productivity Growth of Resource Accumulation in the Cities of Japan
   by *Shogo EGUCHI, Shigemi Kagawa*
2. Measurement of Total Labor Productivity Growth by using Eora MRIO and OECD WIOD
   by *Yanjuan DAI, Hiroshi IZUMI, Jie LI*
3. Labor productivity, technological change and functional income distribution in Brazil and Mexico
   by *Martín Carlos PUCHET ANYUL, Eduardo MORENO REYES, Kaio Vital, Manuel García Álvarez*
4. Key sectors in economic development: a perspective from input-output linkages and cross-sector misallocation
   by *Julio LEAL*

• **Location: Venue E: B110**
Topic: 714E Special session: Economic and Environmental Relationship in Asian-Pacific (1)

Chair: Makiko TSUKUI

1. Constructing a time-series of physical input-output tables for Australia using RAS
   by *Jacob FRY, Timothy M Baynes, Manfred LENZEN, James West*
2. Water Demand Management and Adaptation to Climate Variability for the Pro-Growth Taiwan Economy
   by *Huey-Lin LEE*
3. Transnational Interregional Water Footprint Analysis in China and South Korea and Japan
   by *Taku ISHIRO*
4. Analysis of CO2 emissions embodied in the urban water use in China
   by *Qian ZHANG, Yuichi MORIGUCHI, Jun NAKATANI*

• **Location: Venue F: B112**
Topic: 714F Environmental IO Modelling (3)

Chair: Rosa DUARTE

1. Carbon, Water and Land use accounting: Consumption vs Production perspectives
   by *Yousaf ALI*
2. Assessing the drivers of CO2 emissions: An hybrid MRIO-panel data analysis
   by *Ana SERRANO, Rosa DUARTE*
3. Swedish Footprints: Policy-Relevant Indicators for Consumption and Environment
   by *Richard WOOD, Viveka Palm*

4. Tracing CO2 Emissions Transfer in China's Domestic Value Chains
   by *Lin GUO, Jinjun XUE, Bo MENG*

• **Location: Venue W: 101**
Topic: 714W Special session: Input-Output Virtual Laboratories (1)

Chair: Manfred LENZEN

1. An Input-Output Virtual Laboratory in practice – Development, uptake, application and impact of the first operational IELab
   by *Thomas O. WIEDMANN*
2. A global MRIO Lab – overview of concepts and architecture
   by *Yanyan XIAO, Arne GESCHKE, Muhammad Daaniyall ABD RAHMAN, Keiichiro Kanemoto, Manfred LENZEN*
3. New opportunities with EXIOlab – how virtual laboratories can help make IO-based research more timely and topical
   by *Rachel C. REYES, Tatyana Bulavskaya, Arne GESCHKE, Arjan de Koning, Hagen Schulte in den Baeumen, Konstantin STADLER, Arnold Tukker, Richard WOOD*
4. Updating the WIOD database in the virtual laboratory environment
   by *Muhammad Daaniyall ABD RAHMAN, Bart LOS, Arne GESCHKE, Yanyan XIAO, Keiichiro Kanemoto, Manfred LENZEN*

• **Location: Venue X: 110**
Topic: 714X Special session: Taxation

Chair: Kurt KRATENA

1. Corporate income tax reform in the EU
   by *Maria Teresa ALVAREZ-MARTINEZ, Maria Gesualdo, Dimitrios Pontikakis, Jonathan Pycroft*
2. China's energy-water nexus: Spillover effect of energy and water policy
   by *Yuanchun ZHOU*
3. Taxing CO2 in production and consumption in Europe: The socio-economic and environmental impact of three tax reform options
   by *Kurt KRATENA, Mark Wolfgang Sommer*
4. GHG emissions' tax in Brazil using an input-output model
   by *Kenia B. DE SOUZA, Lucio Flavio da Silva Freitas, Luiz Carlos Santana Ribeiro, Geoffrey J.D. HEWINGS*

• **Location: Venue Y: 113**
Topic: 714Y Special session: Economic and Environmental Impacts of Renewable Energy Targets in Asia

Chair: Kakali MUKHOPADHYAY

1. India's Renewable Energy target at 2030 : An Integrated CGE and I-O exercise
by *Medhavinee N. WATVE, Kakali MUKHOPADHYAY*
2. Renewable Energy Goals in the Philippines at 2030
by *Kakali MUKHOPADHYAY, Krista Danielle Sy Yu*
3. Impact of Proposed Energy Vision 2025 of Pakistan
by *Muhammad Aamir KHAN, Kakali MUKHOPADHYAY*
4. Green energy & local economic development: Mapping impacts of solar scale up on Indian economy
by *Surabhi R. JOSHI, Pritee Sharma*

• **Location: Venue Z: 115**
Topic: 714Z IO Accounts and Statistics (2)

Chair: José M. RUEDA-CANTUCHE

1. The statistical structure of the US input matrices: 1947-2007
by *Daniel TORRES, Jangho Yang*
2. Input-Occupancy-Output Economics
by *Xinjian LIU*
3. Beyond Intermediates: The Role of Consumption and Commuting in the Construction of Local Input-Output Tables
by *Kristinn HERMANNSSON*
4. Measuring the economic relevance of sports - the sport satellite account (SSA) approach
by *Gerd AHLERT, Iris an der Heiden*

16:00 - 16:30 *Coffee Break*

16:30 - 18:00 Parallel Session 5

• **Location: Venue A: B101**
Topic: 716A Special session: Flow of Funds Data and its Applications (2)

Chair: Chihiro SAKURABA

1. Modelling the interest payments and receipts of households and non-financial corporations in the euro area
by *Louis BÊ DUC*

2. On the determinants of firms' surpluses and deficits
   by *Riccardo DE BONIS, Tatiana Cesaroni, Luigi INFANTE*
3. Public Debt in the Flow-of-Funds Perspective
   by *Masako TSUJIMURA, Kazusuke TSUJIMURA*

• **Location: Venue B: B103**
Topic: 716B Methodological Aspects of IO Analysis (3)

Chair: Kazuhiko NISHIMURA

1. A quantity output-driven model with heterogeneous intermediate and final outputs
   by *Aleix ALTIMIRAS-MARTIN*
2. Time Lag Model for Input-Output Multiplier
   by *Xinru LI*
3. A Quantitative Study on the Problem of Aggregation Bias in Input-Output Model
   by *Zhengxi ZHENG, Ning CHANG, Mingfang ZHANG*

• **Location: Venue C: B106**
Topic: 716C Special session: Development of CGE Models for Transportation Policies

Chair: Euijune KIM

1. Impact of Railroad Investments on Regional Economies: an Approach of Spatial CGE Model with a Microsimulation Module of Railroad and Highway Networks
   by *Yoojin Yi, Euijune KIM*
2. Contribution of Fiscal and Financial Options of Infrastructure Development on Income Distribution and Growth in Indonesia: an Application of Financial CGE Model
   by *Euijune KIM, Yasir N. SAMUDRO*
3. Estimation of Dynamic Impact of Port Shutdown on Spatial Economies Using CGE Model with a Micro-Simulation Module of Seaport Activities
   by *Min-Kyu LEE, Euijune KIM*

• **Location: Venue D: B109**
Topic: 716D Special session: Asian Trade with Latin America: Impact and Evolution

Chair: Marcel VAILLANT

1. Evolution and Impact on its economy of the Chilean trade with Asian countries.
   by *Patricio AROCA, Nicolas GARRIDO*

2. Complementarity, sustituibility and rivality in trade between South East Asian and Latin-American countries
   by *Marcel VAILLANT, Enrique GILLES*
3. Brazil and Mexico: Relative advantages of the trade with Asia vis a vis those with MERCOSUR and NAFTA
   by *Martín Carlos PUCHET ANYUL, Kaio Vital, marta reis castilho*

• **Location: Venue E: B110**
Topic: 716E Special session: SIC-OECD-IDE/JETRO Joint special sessions on Development, Employment and Inequality (2)

Chair: Yaxiong ZHANG

1. Study on China's Medium and Long Term Energy Demand Forecasting Model System
   by *Yaxiong ZHANG*
2. Skills and Activity Upgrading in Global Value Chains: Trends and Drivers for Asia
   by *Quanrun CHEN, Gaaitzen DE VRIES*
3. Geographical concentration of supply chains and its implication for economic growth. An input-output approach.
   by *Sofía JIMÉNEZ, Erik DIETZENBACHER, Rosa DUARTE, Julio Sánchez Chóliz*

• **Location: Venue F: B112**
Topic: 716F Technology and Environment

Chair: Kirsten S. WIEBE

1. How existing technologies can contribute to reducing global CO2 emissions
   by *Hauke WARD, Armin Fügenschuh, Alexander Radebach, Jan Christoph Steckel, Ingmar Vierhaus*
2. Mapping global value chains of low carbon technologies diffusion from OECD to ASEAN countries using input-output analysis
   by *Ambiyah ABDULLAH*
3. The spatial distribution of consumption, production and pollution – A different perspective on technology transfer possibilities
   by *Kirsten S. WIEBE*

Thursday, July, 7

• **Location: Venue W: 101**
Topic: 716W Special session: APEC TiVA: SUTs with Firm Heterogeneity (2)

Chair: Cuihong YANG

1. Do Exporters' and Non-exporters' Factor Inputs Differ? -- A Study Based on Employer-Employee Matched Data for Japan.
by *Ivan DESEATNICOV, Kyoji Fukao, Koji ITO*
2. The role of Dutch SMEs in the Dutch economy: An analysis using an extended SUT
by *Marcel VAN DEN BERG, Stephen Chong, Rutger HOEKSTRA, Oscar LEMMERS, Ilke Van Beveren, Ron Van der Wal, Piet Verbiest*
3. Compiling SUTs with firm heterogeneity: methods and challenges for the case of China
by *Cuihong YANG, Rui WEI, Kunfu ZHU*

• **Location: Venue X: 110**
Topic: 716X Employment Analysis (2)

Chair: Joaquim J.M. GUILHOTO

1. Technological Unemployment in Mexico. An Analysis of Structural Decomposition
by *Brenda MURILLO VILLANUEVA, Martin Carlos PUCHET ANYUL*
2. How important is a structural change to employment development: a comparison of Germany vs. Slovakia
by *Martin HUDCOVSKY, Jozef KUBALA*
3. Structural Change, labor market mismatch and Jobless Growth in Iran
by *Hadi MOUSAVI-NIK, Sholeh BAGHERI PORMEHR, Afsaneh SHERKAT*

• **Location: Venue Y: 113**
Topic: 716Y Energy IO Modelling (3)

Chair: Keisuke NANSAI

1. A Quasi-Input-Output model to evaluate emission factors of purchased electricity from interconnected grids
by *Sai LIANG, Sai LIANG, Shen Qu, Hongxia Wang, Ming Xu*
2. Why there is large energy consumption variations between China and other countries: perspective from the final demand side
by *Ce WANG, Hua LIAO*
3. Evaluation of the reform in Turkish electricity sector: A CGE Analysis
by *K. Ali AKKEMIK, Erisa Dautaj Senerdem*

Thursday, July, 7

• **Location: Venue Z: 115**
Topic: 716Z Special session: International Trade Data Analysis in the Framework of Supply, Use and Input-Output Tables

Chair: José M. RUEDA-CANTUCHE

1. Development of a quality adjusted labour productivity index in the European Union – Example of the employment embodied in European exports
by *Isabelle REMOND-TIEDREZ, Antonio F. AMORES, José M. RUEDA-CANTUCHE*
2. European Full International and Global Accounts for Research in Input-Output Analysis
by *José M. RUEDA-CANTUCHE, Isabelle REMOND-TIEDREZ*
3. Trade flows estimation within inter-country input-output compilation
by *Pedro MARTINS FERREIRA*

18:00 - 22:00 *Young Researchers' "Get Together"*

Friday, July, 8

09:00 - 10:30 Parallel Session 6

- **Location: Venue A: B101**
  Topic: 809A Regional IO Modelling (1)

Chair: Peter R. JENSEN

1. Refining the Application of the FLQ Formula for Estimating Regional Input Coefficients: An Empirical Study for South Korean Regions
   by *Anthony T. FLEGG, Timo TOHMO*
2. Research on Division of Labor of China's Domestic Value Chain from the Perspective of Global Value Chain
   by *Shantong LI, Jianwu HE*
3. Assessing the Accuracies of the Modified FLQ visa-viz CHARM in Generating RIOTs: Case Study of Gilan Province, Iran
   by *Ali/A. Banouei, Sharareh Kavoosi, parisa mohajeri, narges sadeghi*

- **Location: Venue B: B103**
  Topic: 809B Innovation and Technological Transfer

Chair: Hubert ESCAITH

1. Growth, R&D expenditure and spillover effects: An input-output approach.
   by *Sofia JIMÉNEZ, Rosa DUARTE, Julio Sánchez Chóliz*
2. Measuring Supply-Side Inefficiency Spillovers in Global Value Chains
   by *Hubert ESCAITH, Sebastien Miroudot*
3. Technological Contents of China's Exports and Its Dynamic Changes----a New Measure based on global input-output model
   by *Hongfu NI, Jiechang Xia*

- **Location: Venue D: B109**
  Topic: 809D Special session: Modeling Impacts of Structural Change in Emerging Economies (1)

Chair: Anushree SINHA

1. Adult education, labour market outcomes and income distribution in India: An Analysis using a CGE model
   by *Ganesh Kumar ANAND, Runu Bhakta*
2. Alternative Growth Scenario and Nutritional Outcome using Recursive Dynamics CGE Approach : A Study of India
   by *Mythili GURUMURTHY*
3. Conceptualizing Gender CGEs with Intra-Household Bargaining
   by *Anushree SINHA*

Friday, July, 8

• **Location: Venue E: B110**
Topic: 809E Special session: SIC-OECD-IDE/JETRO Joint special sessions on Development, Employment and Inequality (3)

Chair: Norihiko YAMANO

1. Trade in value-added, employment and productivity
   by *Sebastien MIROUDOT*
2. Measuring Smile Curves in Global Value Chains
   by *Bo MENG, Ming Ye*
3. What matters in measuring domestic value added in exports by international or single country model
   by *Hongxia ZHANG, Geoffrey J.D. HEWINGS*

• **Location: Venue F: B112**
Topic: 809F Environmental IO Modelling (4)

Chair: Yosuke SHIGETOMI

1. GINFORS (version 3): A global simulation model on the basis of WIOD and its application
   by *Gerd AHLERT, Martin Distelkamp, Mark Meyer*
2. A Review Assessment of Health and Economic Impacts of Global Heat Waves
   by *Yang XIA*
3. Correlation Analysis between Embodies Emissions and Revealed Comparative Advantage(RCA)
   by *Miran JANG, Yong Gun Kim*

• **Location: Venue W: 101**
Topic: 809W Methodological Aspects of MRIO Analysis

Chair: Erik DIETZENBACHER

1. Generalized Global Unit Structures and Global Production/Value-added Networks: A World Input Output and Social Network Approach
   by *Tae-jin KIM, Jungu KANG, Seung-jin SHIM*
2. Hypothetical extractions from a global perspective
   by *Erik DIETZENBACHER, Bob van Burken*
3. Decomposition of Average Propagation Length
   by *Taiji HAGIWARA*

Friday, July, 8

• **Location: Venue X: 110**
Topic: 809X IO Analysis for Policy-making (1)

Chair: Jiemin GUO

1. Input Output Linkages and Agglomeration: Evidence from Turkey with Panel Data Analysis
by *Necla AYAS, Aykut SARKGUNESİ*
2. The economic impact of the preservation and adaptive reuse of rail tracks, the high line in New York City:regional impact analysis and property value change analysis
by *Jiyoon SONG*
3. A Web-Based Regional Economic Simulation Tool for U.S. Army Corps of Engineers' Civil Works Program
by *Wen-huei CHANG, Yue Cui, Ed Mahoney*

• **Location: Venue Y: 113**
Topic: 809Y Tourism Industry Analysis

Chair: Ana SERRANO

1. Comparing the tourism carbon footprint performance between Taiwan and Japan
by *Ya-yen SUN*
2. Measuring Economic Impact of Tourism toward Poverty Alleviation in Indonesia: An Input-output Analysis
by *Oscar TIKU*
3. Assessing the importance of international tourism for the Iran economy: A social accounting matrix approach
by *Fatemeh BAZZAZAN, atefe farahani*

• **Location: Venue Z: 115**
Topic: 809Z International Trade (1)

Chair: Pablo RUIZ NAPOLES

1. The Heckscher-Ohlin theorem and the open Mexican economy: a structural analysis
by *Pablo RUIZ NAPOLES*
2. The Bias in measuring the industrial linkage between China and the rest of World
by *Ruixiang LIU*
3. Good at goods, bad at services? The interaction between trade in goods and trade in services of China
by *Yang FAN, Lianling YANG*

10:30 - 11:00 *Coffee Break*

Friday, July, 8

11:00 - 12:30 Parallel Session 7

- **Location: Venue A: B101**
  Topic: 811A Regional IO Modelling (2)

  Chair: Peter R. JENSEN

  1. Cross-Hauling and Regional Input-Output Tables: Can CHARM Make Adequate Adjustments for Cross-Hauling?
     by *Anthony T. FLEGG, Yongming HUANG, Timo TOHMO*
  2. Economic interaction, productive chains and formation of manufacturing clusters in the functional economic North Central region of Mexico: a case of regional input- output from the top-down approach.
     by *Cristina VAZQUEZ, Normand E ASUAD, Krista Zafra*
  3. Statistical assessment of the top-down and bottom-up approaches for the construction of regional input-output tables
     by *Normand E ASUAD*

- **Location: Venue B: B103**
  Topic: 811B Disaster Analysis

  Chair: Yasuhide OKUYAMA

  1. Impacts of Local Water Scarcity Risk on Global Trade Network
     by *Sai LIANG, Shen Qu, Zeqi Zhu, Ming Xu*
  2. Intra- and Inter-regional Economic Effects of the Population Flow after the Great East Japan Earthquake
     by *Ryoma HASHIMOTO, Shigemi Kagawa*
  3. A Hypothetical Supply Chain with the Disruption of Production Shock: From HEM to Hypothetical APL
     by *Michiya NOZAKI*

- **Location: Venue C: B106**
  Topic: 811C CGE/econometric IO Modelling (2)

  Chair: Manuel A. CARDENETE

  1. Fiscal policy for low income households and public budget constraint in Italy
     by *Irfan AHMED*
  2. Identification of key sectors in a General Equilibrium Model: A comparative empirical analysis for Andalusian economy
     by *Jorge M. LÓPEZ ÁLVAREZ, Manuel A. CARDENETE*

3. Technology and Skill Upgrading Effects of Globalization: An Applied General Equilibrium Approach
   by *Jaewon JUNG*

• **Location: Venue D: B109**
Topic: 811D Special session: Modeling Impacts of Structural Change in Emerging Economies (2)

Chair: Anushree SINHA

1. Carbon Footprints and Household Consumption Pattern in India: A SAM Based Analysis
   by *Radhika PIPLANI*
2. Structural Changes in the Indian Economy: An Input Output Multiplier Analysis
   by *Ganesh Kumar ANAND, Manoj K. PANDA*
3. Increasing women's access to newer opportunities: A multi-year Indian SAM analysis for women's work
   by *Avantika PRABHAKAR, Anushree SINHA*

• **Location: Venue E: B110**
Topic: 811E Special session: SIC-OECD-IDE/JETRO Joint special sessions on Development, Employment and Inequality (4)

Chair: Norihiko YAMANO

1. Prospect of Economic Growth in China from the 13th FYP Period to 2030
   by *Shantong LI, Jianwu HE*
2. Comparative Study of Economic Structural Change and Growth Impetus —Based on 2007 and 2012 China input-output table
   by *Jianqin YUAN, Yaxiong ZHANG*
3. North-South-Divide: How developed nations depend on cheap labour and inequality abroad.
   by *Arne GESCHKE, Ali Alsamawi, Joy Murray, Manfred LENZEN*

• **Location: Venue F: B112**
Topic: 811F Network Analysis for Environment

Chair: Thomas O. WIEDMANN

1. Identifying Air Pollution Clusters within Asian Supply Chain Networks
   by *Fumiya NAGASHIMA, Shigemi Kagawa, Keisuke NANSAI*

2. Analyzing Structural Changes in the CO2 Emission Clusters within Global Supply Chain Networks
   by *Shohei TOKITO, Shigemi Kagawa*
3. Identifying critical value chains in CO2, energy, material, monetary and employment consumption-based accounts
   by *Anne OWEN, John Barrett*

• **Location: Venue W: 101**
Topic: 811W MRIO Modelling and Database

Chair: Kirsten S. WIEBE

1. A Local-Currency-Based Multi-Sectoral Model for Global Economic Analysis: The Data and Structure
   by *Takashi YANO, Tsubasa Shibata*
2. Brazilian States in Global Value Chains: Spatial Production Systems Interpreted by Feedback Loop Analysis
   by *Joaquim J.M. GUILHOTO, Geoffrey J.D. HEWINGS, Denise IMORI*
3. The OECD's approach to disaggregating industries in the inter-country input-output table
   by *Kirsten S. WIEBE, Peter Horvát, Norihiko YAMANO*

• **Location: Venue X: 110**
Topic: 811X IO Analysis for Policy-making (2)

Chair: Kiho JEONG

1. Sectoral Linkages and Labour Productivity: Panel Data Analysis for Turkey
   by *Aykut SARKGUNESİ, Necla AYAS*
2. Estimation of Government Spending Multipliers for Russian Economy
   by *Alexander O. BARANOV*
3. Research on the Intermediate Consumption of Manufacturing Industry during Inserting into the Global Value Chain in Yangtze River Delta Area of China
   by *Xiaohui YUAN, yan ling HUA, Jin FAN*

• **Location: Venue Y: 113**
Topic: 811Y LCA and Industrial Ecology (1)

Chair: Yasushi KONDO

1. On the Simultaneous Estimation of Physical and Monetary Commodity Flows
   by *Johannes TÖBBEN*

2. Development of Inter-industrial Metal Network with Input-Output based Material Flow Analysis
   by *Hajime OHNO, Wei-Qiang CHEN, Thomas Graedel, Philip NUSS*
3. The Environmental Consequences of Lifetime Extension of New and Used Cars: Japan's Case
   by *Yuya NAKAMOTO, Daisuke NISHIJIMA, Shigemi Kagawa*

• **Location: Venue Z: 115**
Topic: 811Z International Trade (2)

Chair: Robert STEHRER

1. Accounting for dualistic production technologies in input-output analysis
   by *Chakrin UTIT, M. Yusof SAARI, Nur adilah HAMID*
2. Economic Shocks and Changes in Global Production Structure: Evidence from Annual Inter Country Input-Output Tables for 1995-2011
   by *Yoshihiro HASHIGUCHI, Colin WEBB, Norihiko YAMANO*
3. Measuring Industrial Upgrading in Global Value Chains: A Latent Variables Approach
   by *Kailan TIAN, Erik DIETZENBACHER*

12:30 - 14:00 *Lunch*

14:00 - 16:00 Parallel Session 8

• **Location: Venue A: B101**
Topic: 814A Regional IO Modelling (3)

Chair: Sanjiv MAHAJAN

1. Expenditure and Displacement Impacts of Students' Consumption: Interregional Input-Output Analysis of a City-Region
   by *Kristinn HERMANNSSON*
2. Spatial Analysis Of Regional Input Output Of The Automotive Supply Chain And Its Impact On Economic Development In The Economic Functional Region Northeast Mexico.
   by *Marcos N. MAYA, José M. SANCHEZ, Normand Asuad Sanen*
3. Exploratory analysis of the use of a multi-regional Input-Output Matrix for the analysis of the main urban impacts of the new Mexico City International Airport.
   by *Karina GARDUÑO, José M. SANCHEZ, Normand Asuad Sanen*
4. Estimating Trade in a Regional Input-Output Table
   by *Johannes BROECKER, Johannes BURMEISTER*

Friday, July, 8

• **Location: Venue B: B103**
Topic: 814B Special session: Disaster Impact Analysis

Chair: Yasuhide OKUYAMA

1. Investigation on CGE Models for Disaster Impact Analysis: Implications form the Case Study of the 2011 Great East Japan Earthquake
by *Yoshio KAJITANI, Hirokazu Tatano*
2. Economic Impact Analysis of Natural Disasters: CGE Modeling Approach
by *Masato YAMAZAKI, Atsushi KOIKE, Yoshinori SONE, Hirokazu Tatano*
3. A Framework of Economic Loss Estimation due to Transportation Network Disruptions
by *Satoshi TSUCHIYA, Hirokazu Tatano*
4. Disaster Impact Analysis: Environmental Considerations?
by *Yasuhide OKUYAMA*

• **Location: Venue C: B106**
Topic: 814C Special session:Economic Impacts of Specific Foods: Kimchi, Tsukemono, Tomato

Chair: Jinmyon LEE

1. Separating and Reflecting Technical Change into Tomato Sector in Korean IO
by *Kiho JEONG, Dongsu LEE*
2. Food Choices, Health and Environment: Effects of the Dynamics of Chinese Diet
by *Haiyan Zhang, Michael L LAHR*
3. Compilation and Analysis of Input-Output Table for Korean Kimchi and its Related Commodities
by *Youngho LEE*
4. Economic effects of Japanese pickles industry
by *Kiyoshi FUJIKAWA, Mariko Makita*

• **Location: Venue D: B109**
Topic: 814D Region/country-specific Analysis

Chair: Bo MENG

1. Import Dependency of Turkish Economy and Major Determinants in Sectoral Level: An Input Output Analysis
by *Necla AYAS*
2. A method to identify key sectors and their feedback loops for a certain industry in one economy and its application in the evaluation of the role of real estate industry in Chicago
by *Xiuli LIU, Geoffrey J.D. HEWINGS*

3. Industrial agglomeration and regional economic development: the case of China
   by *Rui WEI, Wencheng ZHANG*
4. Industrial Structural Changes of Beijing Economy A Field of Influence Approach
   by *Xinjian LIU*

• **Location: Venue E: B110**
Topic: 814E Special session: Economic and Environmental Relationship in Asian-Pacific (2)

Chair: Huey-Lin LEE

1. Waste generation embodied in international trade between China and Japan : China-Japan WIO Analysis
   by *Makiko TSUKUI, Chen LIN*
2. Balancing Economic and Environmental Goals for Sustainable Development: An Environmentally Extended Input-Output Analysis of India
   by *Huey-Lin LEE, Anindita GANDHI*
3. Chinese Environmentally Extended Input-Output (CEEIO) Database
   by *Sai LIANG, Xiaoping Jia, Shen Qu, Anthony shun Fung Chiu, Ming Xu*
4. Prediction of economic impact brought about by the increase of non-metallic mineral wastes in Japan
   by *Ryoji HASEGAWA, Hirofumi Nakayama, Takayuki Shimaoka*

• **Location: Venue F: B112**
Topic: 814F Trade and Environment

Chair: Pablo RUIZ NAPOLES

1. Emissions in exports versus emissions replaced by imports: testing the testing of hypotheses
   by *Bingqian YAN, Erik DIETZENBACHER*
2. Revisiting the Long-range Transboundary Black Carbon: The Role of International Trade and Atmospheric Transport
   by *Jing MENG*
3. Dynamics of China's pollution terms of trade and their determinants
   by *Yuwan DUAN, Xuemei Jiang*
4. Measuring and comparing the international carbon trade efficiency of major countries
   by *Jingli FAN*

Friday, July, 8

• **Location: Venue W: 101**
Topic: 814W Special session: Input-Output Virtual Laboratories (2)

Chair: Thomas O. WIEDMANN

1. Biofuel Assessments in the Australian IELab
   by *Arunima MALIK, Arne GESCHKE, Manfred LENZEN*
2. Exploring transnational city carbon footprint networks with the Industrial Ecology Virtual Laboratory
   by *Guangwu CHEN, Yafei WANG, Thomas O. WIEDMANN*
3. Multi-regional sub-national MRIOs for policy making in China: Using the Chinese MRIO Lab
   by *Yafei WANG*
4. A New Subnational MRIO Table for Indonesia
   by *Futu FATURAY*

• **Location: Venue X: 110**
Topic: 814X Structural Change and Dynamics

Chair: Cuihong YANG

1. A Cross-country Analysis of Material and Energy Implications of Structural Change
   by *Kayoko SHIRONITTA, Shigemi Kagawa, Keisuke NANSAI, Sangwon SUH*
2. Estimating the Technological Factor's Contribution in Economic Dynamics
   by *Alsu SAYAPOVA, SHIROV Alexander, Nikita Vasilyevich NEZHELSKIY*
3. Growth and structural change of the Chinese economy prior to reform
   by *Chen LIN*
4. The Digital Transformation of Manufacturing Industry - A Scenario Analysis for Germany
   by *Anke M. MOENNIG, Marc Ingo Wolter*

• **Location: Venue Y: 113**
Topic: 814Y LCA and Industrial Ecology (2)

Chair: Yasushi KONDO

1. Many a mickle makes a muckle: truncation error in lifecycle assessment
   by *Hauke WARD, Jan Christoph Minx, Jan Christoph Steckel, Leonie Wenz*
2. Net emission transfer of toxic chemical substances: Empirical study for U.S. manufacturing industries
   by *Hidemichi FUJII, Shunsuke OKAMOTO, Shigemi Kagawa, Sangwon SUH, Shunsuke MANAGI*

3. Integrated hybrid MRIO analysis of biofuels production in Spain: climate change and socio-economic effects
   by *Cristina DE LA RUA, Yolanda LECHON*
4. Product Lifetime, Energy Efficiency and The Environment: A Case Study of Air Conditioner in Japan
   by *Daisuke NISHIJIMA, Shigemi Kagawa*

• **Location: Venue Z: 115**
Topic: 814Z International Trade (3)

Chair: Bart LOS

1. Counting borders in global value chains
   by *Kirill MURADOV*
2. The impact of real effective exchange rate of RMB on China's export and value-added export
   by *Yishu KONG, Xinru LI*
3. Drivers of the Malaysian economy under dualistic trade structures
   by *Nur adilah HAMID, M. Yusof SAARI, Azman HASSAN, Chakrin UTIT*
4. Peak Trade? An Anatomy of the Recent Global Trade Slowdown
   by *Bart LOS, Robert STEHRER, Gaaitzen DE VRIES, Marcel Timmer*

16:00 - 16:30 *Coffee Break*

16:30 - 17:00 *Closing Session*
Location: **Auditorium**