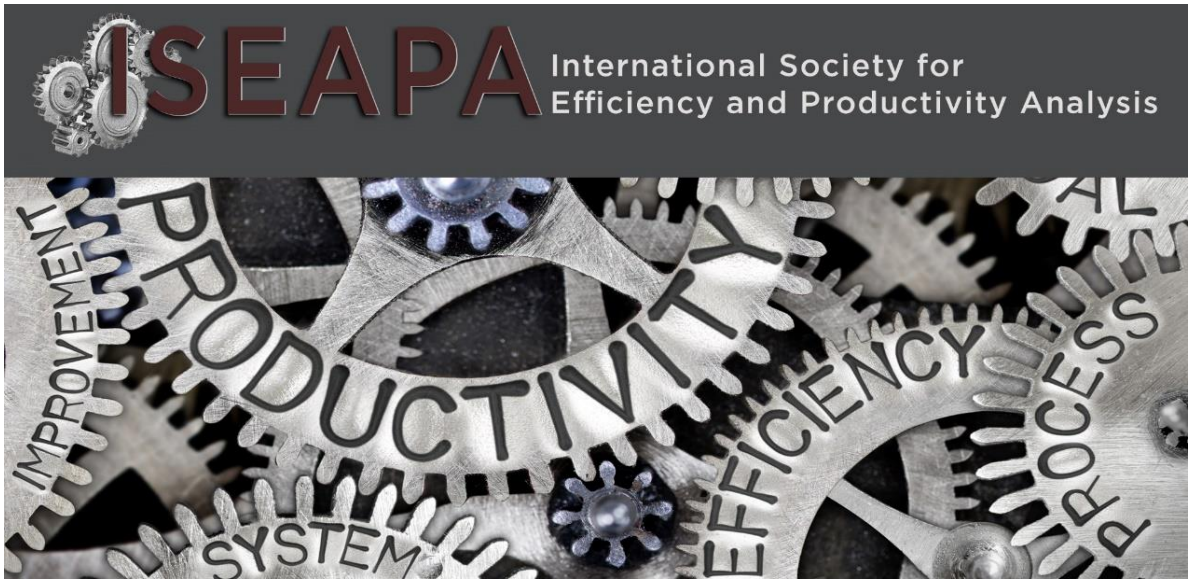

Asia Pacific Productivity Conference 2022

Virtual Meeting

organized by

National Taiwan University

and

Taiwan Efficiency and Productivity Association

October 8th, 2022

Taipei (GMT+8)	08:00 - 19:00
New York (GMT-4)	20:00 (7th) - 07:00
London (GMT+1)	01:00 - 12:00

Contents

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Keynote Speakers

Subal C. Kumbhakar, SUNY-Binghamton
Robin Sickles, Rice University

Conference Mechanics

- All events are hosted on Zoom through a single link.
  - https://zoom.us/j/92872521610?pwd=ZVVsY1dJZkRlbWZycEc4NkdqTUw1dz09

    Meeting ID: 928 7252 1610

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  - Select Room A, B, C, or D from the ***Breakout Rooms*** option at the bottom of the Zoom window to enter specific sessions.
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Program Overview

	Room A	Room B	Room C	Room D
Opening Remark (Taipei 08:00 - 08:10, NY (7th) 20:00-20:10, London 01:00 - 01:10)				
	Hung-Jen Wang			
Keynote Speech I (Taipei 08:10 - 09:00, NY (7th) 20:10-21:00, London 01:10 - 02:00)				
	Subal C. Kumbhakar			
Parallel Sessions I (Taipei 09:10 - 10:30, NY 21:10 - 22:30, London 02:10 - 03:30)				
	Environmental & Energy Efficiency	SFA Methods		
Parallel Sessions II (Taipei 10:40 - 12:00, NY (7th) 22:40 - 00:00, London 03:40 - 05:00)				
			Methodology	Wage and Labor Market
Keynote Speech II (Taipei 12:10 - 13:00, NY 00:10 - 01:00, London 05:10 - 06:00)				
	Robin Sickles			
Parallel Sessions III (Taipei 13:10 - 14:30, NY 01:10 - 02:30, London 06:10 - 07:30)				
	Sustainability & Efficiency	SFA Applications		
Parallel Sessions IV (Taipei 14:40 - 16:00, NY 02:40 - 04:00, London 07:40 - 09:00)				
			Firm-Level Efficiency	Empirical Micro
Parallel Sessions V (Taipei 16:10 - 17:30, NY 04:10 - 05:30, London 09:10 - 10:30)				
	Productivity: Theory and Practice	TFP and Wages		
Parallel Sessions VI (Taipei 17:40 - 19:00, NY 05:40 - 07:00, London 10:40 - 12:00)				
			Machine Learning	Empirical Policy

Session Schedules

Welcome and Opening Remark

Taipei (GMT+8)	New York (GMT-4)	London (GMT+1)
08:00 – 08:10	(7th) 20:00 – 20:10	01:00 – 01:10

Room A
Speaker: Hung-Jen Wang

Keynote Speech I

Taipei (GMT+8)	New York (GMT-4)	London (GMT+1)
08:10 – 09:00	(7th) 20:10 – 21:00	01:10 – 02:00

Room A
Speaker: Subal C. Kumbhakar
Title: Productivity and Efficiency: Golden Oldie (SFA) vs. Red-hot Modern Approaches

Parallel Sessions I

Taipei (GMT+8)	New York (GMT-4)	London (GMT+1)
9:10 – 10:30	(7th) 21:10 – 22:30	02:10 – 03:30

Room A: Environmental & Energy Efficiency
Session Chair: Subhash Ray

Technical and Structural Efficiency in Energy Use in Indian Manufacturing: An Inter-State Analysis (id: 41)
Subhash Ray, University of Connecticut

Opportunity Cost and Employment Effect of Emission Reduction: An Inter-Industry Comparison of Targeted Pollution Reduction (id: 37)
Chuang Li and Subhash Ray, University of Connecticut

Estimating the Water-Use, Technical Efficiencies and Drivers of Technical Efficiency of Small-Scale Sugarcane Growers in the Mpumalanga Province of South Africa (id: 40)
Mushoni Bulagi, Human Sciences Research Council

Emergence of Digital Banking and Labor Cost Efficiency in India: A Branch Level Analysis of a Public Sector Bank (id: 43)
Kankana Mukherjee, Babson College; Subhash Ray, University of Connecticut; Abhiman Das, Indian Institute of Management

Computing the Metafrontier Water Efficiency of Asian Economies (id: 45)
Jin-Li Hu, National Yang Ming Chiao Tung University; Po-Sheng Yang, National Yang Ming Chiao Tung University

Room B: SFA Methods
Session Chair: Hung-Pin Lai

Indirect Inference of Stochastic Frontier Models (id: 7)
Hung-pin Lai, National Chung Cheng University

The Heckman Selection Model with Stochastic Frontier Analysis and Endogeneity (id: 29)
Yi-Wun Chen, Binghamton University

Pre-Merger Performance and Merger Success: An Experimental Approach (id: 30)
Jung You, California State University East Bay

Six-Component Panel Stochastic Frontier Models (id: 48)
Pang-Yu Wang, Hung-Jen Wang, and Nan-Kuang Chen, National Taiwan University

Testing Impacts on Inefficiency in a Semiparametric Stochastic Frontier Model (id: 55)
Jen-Che Liao, Department of Economics, National Chengchi University; Xiaojun Song, Peking University; Hung-Jen Wang, National Taiwan University

Parallel Sessions II

Taipei (GMT+8)	New York (GMT-4)	London (GMT+1)
10:40 – 12:00	(7^{th}) 22:40 – 00:00	03:40 – 05:00

Room C: Methodology
Session Chair: Chin Yi Fang

A System Approach to Identification of Production Functions with Multi-Dimensional Productivity (id: 28)
Shunan Zhao, Oakland University

Central Limit Theorems for Double Perspective--Non-parametric Efficiency Estimators (id: 26)
Shirong Zhao, Dongbei University of Finance and Economics

Using Dual Code Theory to Evaluate the Facebook Marketing Efficiency of the Chinese Professional Baseball League (id: 32)
Chin Yi Fang, National Taiwan Normal University

Estimating the Revenue Efficiency of Public Service Providers in the Presence of Demand Constraints (id: 38)
Hong Ngoc Nguyen, The University of Queensland; Christopher O'Donnell, The University of Queensland

Room D: Wage and Labor Market
Session Chair: Chris Parmeter

The Stochastic Frontier Model with Ordered Multiple Choices (id: 5)
Yi-Wun Chen, Binghamton University

Will the "Failure Tolerance" of Executives Affect the Total Factor Productivity of Enterprises — On the Adjustment Effect of Board Structure (id: 16)
Mingzhen Huang, Harbin Engineering University; Jianzhong Xu, Harbin Engineering University

The Long-run Effects of Early External Examinations on Eventual Educational Attainment and Labor Market Outcomes (id: 33)
DI SIMA, Nanjing Audit University

What Explains Latin America's Low Share of Industrial Employment? (id: 44)
Rishabh Sinha, The World Bank

Keynote Speech II

Taipei (GMT+8)	New York (GMT-4)	London (GMT+1)
12:10 – 13:00	00:10 – 01:00	05:10 – 06:00

Room A
Speaker: Robin Sickles
Topic: Public Subsidies and Innovation: A Doubly Robust Machine Learning Approach Leveraging Deep Neural Networks

Parallel Sessions III

Taipei (GMT+8)	New York (GMT-4)	London (GMT+1)
13:10 – 14:30	01:10 – 02:30	06:10 – 07:30

Room A: Sustainability and Efficiency
Session Chair: Ming-Miin Yu

Target Setting for Airlines Incorporating CO2 Emissions: The DEA Bargaining Approach (id: 56)
Ming-Miin Yu and Ipsita Rakshit, National Taiwan Ocean University

Evaluation of Taiwan's IC Industry Production and Market Efficiencies under the Consideration of CSR (id: 6)
Tai-Yu Lin, National Cheng Kung University; Hsiao-Wen Chiang, Yung-Ho Chiu, Tzu-Han Chang, and Chung-Tzer Liu, Soochow University

An Efficiency Assessment of the Long-term Care in Taiwan's Administrative Regions (id: 47)
Ming-Chung Chang, Chilee University of Technology; Jin-Li Hu and Chih-Wei Liu, National Yang Ming Chiao Tung University

Evaluating Green Efficiency of Manufacture Sector and Its Determinants in East Java Province (id: 53)
Iqram Jamil, Ananda Putri, Nur Azizah Suryaatmaja, and Maman Setiawan, Padjadjaran University

Assessing the Impact of Agricultural Efficiency on the SDGs: Take African Coffee-Producing Countries for Example (id: 59)
Chih-Yu Yang and Yung-Ho Chiu, Soochow university

Room B: SFA Applications
Session Chair: Jen-Che Liao

Bank Efficiency and Credit Risk: Evidence from the Commercial Banks in China (id: 35)
Kai Du, University of Queensland

Market Sentiment and Housing Bubble: A Stochastic Frontier Model Application (id: 46)
Chia-Hsing Chen, Nan-Kuang Chen, and Hung-Jen Wang, National Taiwan University

Productivity and Its Determinants of the Micro Enterprises in The Indonesian Manufacturing Industry (id: 51)
Endang Rostiana, Maman Setiawan, Eva Ervani, Rudi Kurniawan, Universitas Padjadjaran

A Frontier Analysis of Transient and Persistent Eco-Efficiency Gap: Evidence from 25 European Countries (id: 2)
Golnaz Amjadi, Statec Research

Parallel Sessions IV

Taipei (GMT+8)	New York (GMT-4)	London (GMT+1)
14:40 – 16:00	02:40 – 04:00	07:40 – 09:00

Room C: Firm-Level Efficiency
Session Chair: Tsu-Tan Fu

Joint Analysis of Model Definitions with Human Resources and Variable Costs: A Data Envelopment Analysis to Lead Judicial Reform (id: 14)
Greta Falavigna, Research Institute on Sustainable Economic Growth of the National Research Council of Italy; Roberto Ippoliti, Bielefeld University

The Relationship between Technical Efficiency, Growth, and Firm Concentration in the Indonesian Palm Oil Industry (id: 52)
Berliana Septiani and Maman Setiawan, Padjadjaran University

The Causality Analysis of Market Share and Efficiency of Indonesian General Insurance Companies (id: 54)

Iqram Jamil and Maman Setiawan, Padjadjaran University

Assessing Efficiency Gains from Potential University Mergers in Taiwan using a Presampling DEA Approach (id: 57)
Tsu-tan Fu and Shu-Hua Wu, Soochow University

Economies of Scale in Taiwan Higher Education: Evidence from Quantile on Quantile Regression Approach (id: 58)
Zhen-Ting Gong, Zhanjiang Preschool Education College; Chih-Hung Hung, Feng Chia University; Yan-Bei Chen, Zhanjiang Preschool Education College; Yung-Leih Yang, Ling Tung University

Room D: Empirical Micro
Session Chair: Mei-Ying Huang

Style Consistency and Industry Concentration of Chinese Mutual Funds (id: 31)
Tiantian Tang, Shandong University

Review of Operations Research Models in Healthcare delivery (id: 12)
Chinasa Ikelu, Crown African Kids Education (CAKE) Foundation

Factors Influence on Purchase Intention Toward Apartments in a Metropolitan Area in Vietnam (id: 23)
Pham Han, Duy Tan University,

Multinomial Logistic Regression Analysis and Growth Trajectory of Poor Households in Nigeria (id: 9)
Chinasa Ikelu, Crown African Kids Education (CAKE) Foundation; Onyukwu Onyukwu, University of Nigeria

Parallel Sessions V

Taipei (GMT+8)	New York (GMT-4)	London (GMT+1)
16:10 – 17:30	04:10 – 05:30	09:10 – 10:30

Room A: Productivity: Theory and Practice
Session Chair: Kristiaan Kerstens

Revisiting the Public Capital Productivity Puzzle (id: 4)
Zhezhi Hou, Southwestern University of Finance and Economics

Energy Productivity and Greenhouse Gas Emission Intensity in Dutch Dairy Farms: A Hicks-Moorsteen By-Production Approach under Nonconvexity and

Convexity with Equivalence Results (id: 21)
Frederic Ang, Wageningen University; Kristiaan Kerstens, CNRS-LEM; Jafar Sadeghi, Ivey Business School

Internationalisation, Innovation Efforts and Labour Productivity: Evidence from Indian Manufacturing Plants (id: 39)
Anshul Aggarwal, IIM Lucknow

Gender and Productivity Spillovers: Evidence from Indonesia (id: 49)
Mohammad Zeqi Yasin, The University of Jember; Samuel Harianto, Ministry of National Development Planning; Dyah Sari, Faculty of Economics and Business

Axiomatic Modeling of Fixed Proportion Technologies (id: 36)
Xun Zhou, University of York; Timo Kuosmanen, University of Turku

Room B: TFP and Wages
Session Chair: Chih-Sheng Hsieh

Productivity Dispersion and Aggregate Consequence: Markup and Labor Share (id: 1)
Chao Shen, The Graduate Institute, Geneva (IHEID)

Pandemic, Contact-Intensity and Wage Inequality: A General Equilibrium Approach (id: 08)
Gouranga Das, Hanyang University, South Korea; Sugata Marjit, Centre for Studies in Social Sciences

Exogenous Wage Decline, Childcare Policy, Endogenous Fertility, Human Capital Accumulation, and Achievement of Fiscal Soundness (id: 27)
Kei Murata, Shizuoka University

On the Elasticity of Substitution between Labor and ICT and IP Capital and Traditional Capital (id: 34)
Vahagn Jerbashian, University of Barcelona

Parallel Sessions VI

Taipei (GMT+8)	New York (GMT-4)	London (GMT+1)
17:40 – 19:00	05:40 – 07:00	10:40 – 12:00

Room C: Machine Learning
Session Chair: Jin-Li Hu

Efficiency Analysis Trees and the Estimation of Technical Efficiency: An Example of Use (id: 13)
Miriam Esteve and Juan Aparicio, Miguel Hernández University

An Unsupervised Learning-Based Approach to Estimate Technical Efficiency Using One-Class Support Vector Machines (id: 20)
Raul Moragues, Juan Aparicio, and Miriam Esteve, Miguel Hernández University

An Additive Adaptation of Multivariate Adaptive Regression Splines for the Estimation of Production Functions in the Context of Data Envelopment Analysis (id: 22)
Víctor España, Juan Aparicio, Xavier Barber, and Miriam Esteve, Miguel Hernández University

How to Measure Technical Efficiency in Multi-Output Multi-Input Production Processes by Adapting Gradient Tree Boosting (id: 24)
María Guillén, Juan Aparicio, and Miriam Esteve, Miguel Hernández University

Support Vector Frontiers: Mixing Support Vector Machines and Production Functions (id: 25)
Daniel Valero-Carreras, Juan Aparicio, and Nadia Guerrero, Miguel Hernández University

Room D: Empirical Policy
Session Chair: Maman Setiawan

Trade Liberalization and Firms' Corruption Engagement: Theory and Evidence from China (id: 42)
Ge Song, University of Colorado Boulder

Innovation and dynamic productivity growth in the Indonesian food and beverages industry (id: 50)
Maman Setiawan, Rina Indiastuti, Nury Effendi, B. Budiono, and Mohamad Fahmi, Universitas Padjadjaran

Elections and Indian State Budgets: The Political Budget Cycle Hypothesis (id: 15)
Muhammed Shameer K, University of Hyderabad

The Changing Nature of External Debt Scenario in India: An Analysis with Respect to Economic Reforms of 1990's (id: 19)
Bineetha Bose, University of Hyderabad

Paper Abstracts (by ID)

ID:01

Productivity Dispersion and Aggregate Consequence: Markup and Labor Share

Author:
Chao Shen; The Graduate Institute, Geneva (IHEID)

Abstract:
By developing a heterogeneous firm model with endogenous spillover effects on real wage and industrial change, the paper shows that a change in the firm (total factor productivity) TFP distribution could quantitatively explain three crucial phenomena in the U.S economy: (1) the decline in labor share; (2) the market concentration; (3) and the rising markup. The model modifies the Nested-CES demand system by linking up the firm TFP with markup structure and markup. A change in an individual firm TFP endogenously spillovers in both the real wage and market structure. The inter-industry concentration grants leading firms more market power to exploit higher market power, summing up a macro rise of markup that declines the labor share. The rising markup power implies a significant rising efficiency loss relative to the planner's allocation between 2015 and 1970. The robustness checks show that the change in the firm TFP distribution is the only way to systematically drive the story.

ID:02

A frontier analysis of transient and persistent eco-efficiency gap: Evidence from 25 European countries

Author:
Golnaz Amjadi; STATEC RESEARCH

Abstract

This study aimed to evaluate an environmentally adjusted production efficiency, hereafter referred to as eco-efficiency, across 25 European countries in the period 1999 – 2018. The criterion for this evaluation was the ratio of Gross Domestic Product (GDP) to the total carbon dioxide equivalent of greenhouse gas (GHG) emission controlling for the countries' use of capital, labor, and energy. To this aim, I used a stochastic frontier panel model with a four-component error term, which allows separating country-fixed effects, long-run (persistent), and short-run (transient) eco-inefficiency from random noise. Furthermore, I investigated how (or indeed even whether) the estimated long- and short-run eco-inefficiency will be affected by a few policy-related variables. Finally, I provided the marginal effects of such policy variables on country-level eco-inefficiencies.

JEL classification: C01, E23, L60
Keywords: Eco-Efficiency; Gross Domestic Product; Greenhouse gas emission; Stochastic Frontier Panel Model; Persistent and transient inefficiency.

ID:04

Revisiting the Public Capital Productivity Puzzle

Author:
Zhezhi Hou

Abstract:
Although public capital is crucial in production and economic growth, most empirical studies that assume Cobb-Douglas production technology find that the estimated returns of the public capital are either negative or statistically insignificant when fixed effects are controlled. We hypothesize that these counter-intuitive estimates may be due to restrictive functional forms and/or ignoring cross-sectional dependence in the estimation of the production technology. To investigate this hypothesis, we deploy several semi/nonparametric models with fixed effects and/or multi-factor error structures to re-examine the impact of public capital on state GDP in the U.S. during 1970 to 1986. After going through a battery of models, we find positive neutral effects, negative non-neutral effects, and heterogeneous overall effects of public capital on output. The heterogeneity helps explain the negative or insignificant effects estimated from a constantelasticity parametric model which captures only the mean/median effect. We also find that controlling cross-sectional dependence tends to increase the above estimates. In addition, when public capital is disaggregated into its components, we find positive effects for the water and sewer systems, mixed effects for the highways, and negative effects for other buildings.

ID:05

The Stochastic Frontier Model with Ordered Multiple Choices

Author:
Yi-Wun Chen; Binghamton University, State University of New York

Abstract:
This paper develops the stochastic frontier model with multiple endogenous regimes to solve biased and inconsistent estimates due to sample selection bias. If we encompass heterogeneous observations into one regression equation, then the estimated parameters may be invalid. Moreover, if heterogeneous observations did not randomly fall into regression equations with reasonable coefficients, this statistically implies that sample selection bias exists (Heckman, 1976, 1979). This paper extends the stochastic frontier model with two endogenous regimes discussed by Lai (2015) to include multiple regimes and expand the empirical application. Based on the sample selection/regime switching information, I derived the closed form of the likelihood function and the estimator of the technical efficiency index for the proposed model. Additionally, I rendered an estimate using the maximum likelihood estimation. In this empirical study, I analyzed the cost efficiency of doctoral-granting universities in the United States and applied this to the proposed model with three regimes. Evidence suggests that considering sample selection and the multiple-regime model is necessary when observations are heterogeneous.

ID:06

Evaluation of Taiwan's IC Industry Production and Market Efficiencies under the Consideration of CSR

Author:
Tai-Yu Lin; National Cheng Kung University
Hsiao-wen Chiang; Soochow university
Yung-ho Chiu; Soochow university
Tzu-Han Chang; Soochow University
Chung-Tzer Liu; Soochow University

Abstract:
Semiconductors are an indispensable resource in the digital age and the cornerstone of technological development. Taiwan has a complete semiconductor industry chain and plays an important role in global semiconductor manufacturing. In addition to considering operational conditions, companies have also attached importance to Corporate Social Responsibility (CSR) in recent years. This research thus takes 60 integrated circuit (IC) companies in Taiwan as a research sample and adopts the Meta Two-stage dynamic RDM DDF under exogenous CSR model to explore the impact of CSR on the operational efficiency of its semiconductor industry from 2018 to 2020. This study divides 60 IC companies into three groups (IC design group, IC manufacturing group, an IC packaging and testing group) to evaluate their market stage efficiency and production stage efficiency. The findings are as follows. 1) The overall efficiency value considering CSR is higher than that without CSR. Most IC companies practice CSR. 2) The market stage efficiency and production stage efficiency of the IC packaging and testing group are better than those of other groups.

ID:07

Indirect Inference of Stochastic Frontier Models

Author:
Hung-pin Lai; National Chung Cheng University

Abstract:
The standard method to estimate a stochastic frontier model is the maximum likelihood approach with the distribution assumptions of a symmetric two-sided stochastic error v and a one-sided inefficiency random component u. When v or u has a nonstandard distribution, such as v follows a generalized t distribution or u has a Chi-squared distribution, the likelihood function can be complicated or untractable. This paper introduces using indirect inference to estimate the stochastic frontier models, where only least squares estimation is used. There is no need to derive the density or likelihood function, thus it is easier to handle a model with complicated distributions in practice. We examine the finite sample performance of the proposed estimator and also compare it with the standard maximum likelihood estimator as well as the maximum simulated likelihood estimator using Monte Carlo simulations. We found that the indirect inference estimator performs quite well in finite samples.

ID:08

Pandemic, Contact-Intensity and Wage Inequality: A General Equilibrium Approach

Author:
Gouranga Das; Hanyang University, South Korea
Sugata Marjit; Centre for Studies in Social Sciences, I

Abstract:
Drawing on stylized evidences and empirical literature, we offer a theoretical model to delineate the mechanism underlying the evolution of post-Covid structural shifts due to external shocks causing supply and demand side adjustment. A 3-sector-4 factor hybrid specific factor General Equilibrium model is developed to offer insights about the pandemic-induced effects on intra-skill differentials in returns in online sectors vis-à-vis the cultural sector to show that under some plausible sets of conditions, the skilled talent in the entertainment sector suffers more than those skilled workers employed in virtual commerce. In fact, even the low-skilled workers could gain at the expense of the performing artists—creating inter-skill wage inequality--unless automation-driven labor-elimination displaces the unskilled workers. Further extensions are outlined to show a longer run implications of such adverse Covid shock jeopardizing all the economies alike. The core model and its realistic extensions show that: (i) in the longest run, the cultural sectors (e.g., opera) could be subject to finite change and even vanish; (ii) also extreme polarization with online virtual sector and casual sector could occur with the demise of entertainment sector and could result in disguised unemployment; (iii) under plausible sets of conditions extreme wage inequality could result between software or computer experts absorbed in the virtual sector, the informal sector workers, as well as for those involved in the creative cultural contents; (iv) in the shortest run with fixity of wages and restricted intersectoral capital mobility, unemployment could emerge esp. in the entertainment industry and the casual sectors.

ID:09

Multinomial Logistic Regression Analysis and Growth Trajectory of Poor Households in Nigeria

Author:
Chinasa Ikelu
Onyukwu Onyukwu; University of Nigeria

Abstract:
INTRODUCTION Nigeria like other countries in Africa has experienced real growth in the past few years but not enough poverty reduction has been recorded. However, countries that do well on poverty reduction take agriculture and the livelihoods of smallholders' farmers seriously (especially Africa's millions of women) – through more relevant agricultural research, smallholder friendly infrastructure and improved marketing. We therefore aim to understudy the twin phenomena by running a regression analysis to see if there exists relationship between them and advise policy in this regard.

MATERIALS AND METHODS The study utilised the quantitative research methodology with waves one and two data obtained from the General Household Survey (GHS) of Nigeria's National Bureau of Statistics (NBS). Also, the multinomial logistic regression was employed for the regression analysis. The well-detailed merging of the data was carried out using a unique identifier found in the individual variant of the planting and harvest dataset. These two datasets were then merged to form final individual planting and harvest for wave one. At the household level, the planting and harvest datasets were merged to be merged with the individual variant to allow for a final wave one data. This process was repeated to obtain wave two version of our data.

RESULTS We found that households with greater value of assets have a reduced likelihood of being chronically poor and descending into poverty in the whole and rural sample. We also found that an increase in improved water for households in the whole sample and rural subset is associated with a reduced likelihood of descending into poverty relative to escapers. In addition, households, both in the whole and rural sample, that have access to private toilet have a reduced likelihood of descending into poverty and being chronically poor. Households with limited access

to electricity descend into poverty in the whole sample and have a greater chance of descending into poverty in the rural subset. Furthermore, an increase in household size is associated with an increase in being chronically poor and descending into poverty for the whole, rural and urban sample. Moreso, heads in non-farm employment both in the whole and rural sample have an increased likelihood of descending into poverty and a reduced likelihood of being chronically poor respectively. Subsequently, households in the south-west have the least likelihood of being chronically poor for the whole and urban samples.

SUMMARY Our paper examined and investigated poverty dynamics and patterns of growth incidence using a regression analysis framework. A direction for further research will be to study the role that structural transformation plays in the economic growth process of countries in Africa (since in this study, we were able to establish a relationship between the concepts) thereby ensuring a more inclusive and rigorous study on how households in chronic poverty and those being impoverished react and impoverishment nets of poverty react to this transformation. In addition to this, one can study how this growth can lead to jobs thereby avoiding the trap of jobless growth and poor-quality job. We therefore recommend that program managers and policy makers focus appropriate interventions on key areas for sustainable development.

ID:10

Karush-Kuhn-Tucker (KKT) Optimality Conditions of an Optimization Problem in rural Rwanda

Author:
Chinasa Ikelu

Abstract:

INTRODUCTION

The Kuhn-Tucker conditions are the natural generalization of the Lagrange multiplier approach, from classical differential calculus replacing equality constraints by inequality constraints, to take account of the possibility that the maximum or minimum in question can occur not only at a boundary point but also at an interior point. In this study, we will use it to better obtain an optimal solution to the optimization problem we are studying – to account for sustainability. Specifically, we base our questions on: given several distribution plants, each having fixed capacity with total supply capacity equaling demand capacity, which distribution plant should supply which destination center to minimize transportation costs? More so, given a network of drone-aided health care services in Rwanda, is the problem convex? Can the problem be verified and solved using the KKT optimality conditions? Does a solution exist? If it does, what is the optimal value of the cost function? These questions were answered with the aim of finding the total value of the objective function subject to the condition that total supply capacity equals the demand capacity.

MATERIALS AND METHODS

Simulation was carried out by randomly generating cost, supply, demand, capacity, delay, and time data on a programming language due to inaccessibility of these kinds of sensitivity data. These data were then placed on CPLEX. On CPLEX, the model needs to be written in computer form from the mathematical form - as we have them in the text document. After writing the model in mathematical form, the data was placed side-by-side with the model and then the configuration was done on CPLEX to obtain the respective values of x, y and travel as the feasible solutions and the optimal value of the solution. After this process on CPLEX, an Excel solver was used to obtain the solution to the dual problem since CPLEX only gives the basic

feasible solution to the primal problem. Hence the need to obtain an optimal solution to the optimization problem.

RESULTS

The result from the dot product and the hessian matrix function approaches show that the entries of the inner product function are greater than or equal to zero and all the entries of the second differential of the function are non-negative and zero(s) respectively. Preliminary results from the Integer Linear Programming using the necessary conditions – the gradient, admissible and complementarity conditions - for the KKT show optimality with a value. Similarly, since the objective function of the problem is a convex one, it is safe to conclude that the necessary conditions are also sufficient for optimality.

SUMMARY

Our study has utilized the optimization technique and applied the KKT to predict what will likely happen when using real data. Here, we have seen how the KKT optimality conditions can be used to verify the obtained feasible solutions numerically. Other methods exist for this test, but we have chosen this method owing to the gap in literature. Drone-aided network using a mathematical optimization model and the KKT optimality conditions help in finding an optimal solution to the transportation problem.

ID:11

Sensitivity Analysis of an Optimization problem in rural Rwanda

Author:
Chinasa Ikelu

Abstract:
INTRODUCTION
Transporting health care products from one point to another using innovative technology like drones can be difficult to achieve especially in hard-to-reach areas in rural Rwanda. The basic objective of the sensitivity test is to identify sensitive parameters so that special attention can be given them during their estimation and in selecting a solution which performs well for most of their likely values. One way to do this is to re-compute the solution using different values. Hence, one must study how the optimal solution will change due to changes in output results. This is known as the post-optimality test or the sensitivity test. Further, it is important to study these changes to convert the static linear programming solution to a dynamic solution.
MATERIALS AND METHODS
Using the classical transportation model, we analyzed the second model, after the primal, called the Dual. Duality is an extremely important and interesting feature of linear programming. Duality in linear programming is an advanced topic in linear programming. For every linear program, there is a related unique linear program involving the same data which also describes the original problem. The given original program is called the primal program and the solution to the dual program can be found in a manner like that was used for the primal so that the optimal solution of the dual gives complete information about the optimal solution of the primal and vice versa.
RESULTS
The sensitivity tests show how the model behaves when there is an increase in a variable in the right-hand side (RHS) value of the constraint. For example, if we increase demand at a particular node by one unit and decrease demand at another node by one unit, what will be the change in the objective function? The experiments were then conducted, using the methodology below, to check how sensitive our model is to this kind of changes. Sensitivity tests also known as post-

optimality tests were conducted to study the effect of changes in parameters on the optimal solution to convert the static linear programming solution to a dynamic solution. The result show that there are parameters that are sensitive when we increase the demand in a certain node and decrease demand in another node by the same unit. Simultaneously, when there is an increase in the demand and supply at respective nodes, the objective function tends to be different with a new optimal solution.

SUMMARY

We have conducted a post-optimality test by way of estimating how sensitive the model is to changes in the constraints. We have seen how the optimal solution and the corresponding primal and dual variables can be used to verify the sensitivity of the model to changes in the constraints. Although the study covered a small number of locations, we recommend (based on available results) that these sensitive variables be paid closed attention to understand how they behave during demand and supply push periods.

ID:12

Review of Operations Research Models in Healthcare delivery

Author:
Chinasa Ikelu

Abstract:
INTRODUCTION
Identifying the models and methods of Operations Research (O.R.) in health care delivery is necessary and important for decision making and prediction. In the wake of a global pandemic, predictive methodology like the use of modeling and simulation can enable health care program managers understand the interplay between a health challenge and what needs to be done that can lead to quick decision making. Some of the questions the study seeks to answer include but not limited to: Does it involve the use of operations research in healthcare? Does it involve the use of artificial intelligence in operations research? Generally, what O.R. models and methods in health care are best suited for countries lagging in terms of health care delivery?
MATERIALS AND METHODS
The focus of our review search was on papers that examined and studied the applications of operations research in health care delivery. This search was conducted using words like “Operations research in health care,” “Mathematical models in Operations research,” “Applications of Operations research in health care delivery” on Google website. We focused our review on selected papers that were made available through researchers in developed countries as most of the articles were not open access. Afterwords, a thorough review of all papers were done to ascertain their eligibility for citation since some authors write obfuscatingly. The aim of this review is to provide operations researchers in health care delivery and health care practitioners - the mathematical modeling tools and optimization techniques needed to make better decision with precision. Further, in the healthcare review, we focused solely on studies that have utilized these modeling techniques in health care systems while in the blockchain review, the goal was to show that blockchain can be used as a technique in health care technology to reduce cost.
RESULTS
The findings from this review show that most areas of O.R. application in healthcare

delivery are evolving and wide gap remains for researchers to explore these areas to advise policy for development. The current study supports and corroborates findings from the blockchain technology review in that it achieved the aim of reducing cost associated with medicine. In our case, it achieved the aim of reducing costs associated with transporting health care products like blood (using innovative technology like drone) thereby obtaining the optimum point and value. What is currently not known in all the blockchain papers reviewed is how these methods and models can be backed with a theoretical framework to better understand the processes involved in utilizing such a technology.

SUMMARY

We reviewed papers on the application of operations research in health care delivery thereby pointing to the need for embedding information and blockchain technology in medical sciences to have proper understanding of these methodologies in health care delivery. In summary, the known fact about blockchain technology network is that to protect patient's personal health privacy and make the statistical analysis of medical disease trends more effective, all Electronic Medical Records (EMRs) are transformed and encrypted before being uploaded to the medical blockchain network for storage and sharing.

ID:13

Efficiency Analysis Trees and the estimation of technical efficiency: an example of use

Author:
Miriam Esteve; Miguel Hernández University
Juan Aparicio; University Miguel Hernandez of Elche

Abstract:
In production engineering and microeconomics, an issue of interest is the measurement of technical efficiency of firms. In the literature, there is a plethora of methods for estimating production frontiers through parametric and non-parametric techniques. However, there have been few attempts to approach this problem from the perspective of Machine Learning (ML), despite currently being one of the methodologies with the greatest repercussion. In this presentation, we show how a recent technique called Efficiency Analysis Trees (EAT), which is based on regression trees in ML, works. The technique is able to draw the efficient frontier in high dimensions through a tree structure and overcome the overfitting problem suffered by traditional non-parametric techniques as Free Disposal Hull (FDH) and Data Envelopment Analysis (DEA). Finally, an example of the use of the new R package “eat” is presented. The package implements the main algorithms associated with the recent methodology. Also, it encompasses the estimation of radial measures, oriented Russell efficiency measures, the directional distance function, the weighted additive model, and the determination of a ranking of input variable importance.

ID:14

Joint analysis of model definitions with human resources and variable costs: a Data Envelopment Analysis to lead judicial reform

Author:
Greta Falavigna; Research Institute on Sustainable Economic Growth of the National Research
Roberto Ippoliti; Bielefeld University

Abstract:
This work investigates the Italian judicial system and discusses the designing of a policy reform to boost the efficiency of courts, considering the human resources available as well as the expenditure generated by the process to deliver justice. The authors present the benchmarks and shed light on how policy makers embarking on such a process of reform may be misled by inappropriate model definition. In addition, the most significant drivers of judicial inefficiency are analyzed. In detail, the authors propose a comparative analysis of technical efficiency scores computed using DEA, adopting the same output (number of settled cases) and two alternative sets of inputs (judicial expenditure and human resources). According to the results, without considering the information extracted from the two complementary benchmark analyses, the DMUs identified as false benchmarks are equal to 35%, causing policy makers to be misled in the reform process. Regarding the elements that affect the performance of courts, it may be possible to improve the efficiency of judicial districts by working on judicial procedures (e.g., ordinary civil procedures, labour and pension). Hence, these are the domains where interventions by policy makers may prove successful. As for policy implications, the models and benchmarks presented here could be used to devise a reform of the judicial system aimed at enhancing its technical efficiency, while also keeping public expenditure under control.

ID:15

Elections and Indian State Budgets: The Political Budget Cycle Hypothesis

Author:
Muhammed Shameer K; University Of Hyderabad

Abstract:
The Political Budget Cycle (PBC) theory deals with the increased spending or decreased revenue collection or the combination of both in proximity of election by the incumbent government to retain office. This study considers 28 states in India to examine the public policy choices of politicians in India, a large well-established democracy with remarkable subnational variation. This paper attempt to study the fiscal profligacy of the state governments for re-election prospectus in alternate and swing states. Notably, the concentration of funds towards current account expenditure- especially on its development and social service funding- during an election period exhibits the visible spending. The fiscal composition of swing and alternative states are heavily upon current account spending as election appears, especially to its visible items, as a token of payment for electoral win. The choice of capital expenditure and non-development funds are made during non-election period. On the revenue side, it also shows a supportive results to PBC theory. Indian States are creating “Visible” cycles during the election period to gain political profit. We have used the System-Generalized Methods of Moments (GMM) for the panel of 28 Indian State budgets data over last 3 decades, i.e., 1990-91 to 2019-2020 fiscal years. The concentration of funds on visible items over targetable/specific groups brings the “Visibility hypothesis” rather than “Targetability hypotheses” in action.

ID:16

Will the "failure tolerance" of executives affect the total factor productivity of enterprises —— On the adjustment effect of board structure

Author:
Mingzhen Huang; Harbin Engineering University
Jianzhong Xu; Harbin Engineering University

Abstract:
This paper discusses the influence of executive compensation stickiness with the nature of "failure tolerance" on the total factor productivity of enterprises, and attempts to clarify the interaction mechanism and boundary conditions between the two. Select the unbalanced panel data of A-share listed enterprises in CSMAR financial database from 2007 to 2020, and follow the general sample selection rules: A. eliminate the samples of missing data, marked with ST, * ST and financial enterprises; B. Take natural logarithm for all variables except proportional variables in the model; C. All continuous variables were winderized at 1% and 99% levels, and the final sample size was 31536. Stata / MP 16.0 was used for data processing and regression. The fixed effect model is selected by Hausman test to verify the hypothesis of this paper. The research finds that executive pay stickiness can improve the total factor productivity of enterprises, and non efficiency investment plays a "masking effect" between them; In the structure of the board of directors, the relationship between the chairman and general manager and the supervision of independent directors is positively regulated, and the regulating effect of the board size is not significant; The first type of agency cost is the intermediary transmission channel between executive pay stickiness and total factor productivity, while the second type of agency cost does not play a significant intermediary role; The executive compensation contracts of "punishing the inferior" and "rewarding the inferior" will lead to the distortion of the enterprise's production efficiency. Only when the performance drops, the "not punishing the inferior" or even the low degree of "rewarding the superior" will help to improve the total factor productivity; The promotion effect of executive pay stickiness on total factor productivity of enterprises is significant when the internal financing constraint is low and the market competition is high.

ID:19

The changing nature of External Debt Scenario in India: An analysis with respect to Economic Reforms of 1990's

Author:
Bineetha Bose; University of Hyderabad

Abstract:
Indian economy has amassed a massive amount of external debt since 1991. According to data collected in 1991-92, the country's external debt was $83801. The BoP crisis brought on by recurrent current account deficits, which in turn raised the economy's borrowing needs, was blamed for the high level of gross External debt reported by India during 1990-91. The Government of India initially turned to external finance; subsequently, to address the long-term balance of payment issue, it began the process of reforms in a step-by-step manner. The data shows that despite rising external debt, most indices of a country's financial health suggest that the country's debt situation is improving. The government's initiatives, such as restricting short-term debt, focusing on exports, and restraining debt-creating flows, accounted for this change.As a consequence of proactive policy, the percentage of sovereign debt has decreased gradually but noticeably, indicating a reduction in the dependence on concessional loans from multilateral and bilateral sources under the auspices of international development aid programmes. The overall analysis gives hope as the signs for a crises is not severe in India.
Keywords : External Debt, Indian Economy, Bop Crises, Economic Reforms, Policy Measures.
JEL Classification: F34, H12, H63.

ID:20

An unsupervised learning-based approach to estimate technical efficiency using One-Class Support Vector Machines

Author:
Raul Moragues; Miguel Hernandez University
Juan Aparicio; University Miguel Hernandez of Elche
Miriam Esteve; Miguel Hernández University

Abstract:
In this paper, a new unsupervised machine learning-based approach is introduced to estimate production frontiers and thus estimate technical efficiency. This algorithm estimates the production technology as the support of a statistical distribution and has as its foundation a One-Class Support Vector Machine with Piecewise Linear transformation function. One of the main objectives is to reduce the overfitting problem present in classical Data Envelopment Analysis (DEA) techniques, while generalising the classical DEA model. It satisfies basic axioms of microeconomics in production theory, such as convexity and free disposability, but it does not meet minimal extrapolation; which is the cause of overfitting in the case of applying standard methods as Data Envelopment Analysis (DEA). It is also described how to measure technical inefficiency using this approach using the directional distance function. Finally, the performance of the method is evaluated through a computational experience, comparing the achieved MSE and bias with those obtained using classical DEA. We achieve improvements of up to 83% in MSE.

ID:21

Energy Productivity and Greenhouse Gas Emission Intensity in Dutch Dairy Farms: A Hicks-Moorsteen By-Production Approach under Nonconvexity and Convexity with Equivalence Results

Author:
Frederic Ang; Wageningen University
Kristiaan Kerstens; CNRS-LEM (UMR 9221)
Jafar Sadeghi; Ivey Business School

Abstract:
The agricultural sector is currently confronted with the challenge to reduce greenhouse gas (GHG) emissions, whilst maintaining or increasing production. Energy-saving technologies are often proposed as a partial solution, but the evidence on their ability to reduce GHG emissions remains mixed. Production economics provides methodological tools to analyse the nexus of agricultural production, energy use and GHG emissions. Convexity is predominantly maintained in agricultural production economics, despite various theoretical and empirical reasons to question it. Employing nonconvex and convex frontier frameworks, this contribution evaluates energy productivity change (the ratio of aggregate output change to energy use change) and GHG emission intensity change (the ratio of GHG emission change to polluting input change) by Hicks-Moorsteen productivity formulations. We consider GHG emissions as by-products of the production process by means of multi-equation modelling. Given our empirical specification, nonconvex and convex Hicks-Moorsteen indices can coincide under certain circumstances, which leads to a series of theoretical equivalence results. The empirical application focuses on 1,510 observations of Dutch dairy farms for the period of 2010-2019. The results show a positive association between energy productivity change and GHG emission intensity change, which calls into question the potential of on-farm, energy-efficiency-increasing measures to reduce GHG emission intensity.

ID:22

An additive adaptation of Multivariate Adaptive Regression Splines for the estimation of production functions in the context of Data Envelopment Analysis

Author:
Víctor España; Miguel Hernández University of Elche
Juan Aparicio; University Miguel Hernandez of Elche
Xavier Barber; Miguel Hernández University
Miriam Esteve; Miguel Hernández University

Abstract:
The presented paper introduces a new methodology for the estimation of production functions that satisfies classical axioms in production theory, such as monotonicity and concavity, through the adaptation of the additive version of the Multivariate Adaptive Regression Splines (MARS) machine learning technique. This new approach, baptized as Additive Adaptive Frontier Splines (AAFS), shares with Data Envelopment Analysis (DEA) the shape of the predictor as a piecewise linear function. However, AAFS overcomes the overfitting problems presented in DEA by making use of the generalized cross-validation technique as well as a wide range of hyperparameters that allow controlling the complexity of the performed model. In this article, a computational experiment has been used to measure the performance of AAFS, showing that this new approach significantly reduces the mean square error and the bias of the estimator of the true production functions compared to DEA and other recent methodologies, such as Corrected Concave Non-Parametric Least Squares (C2NLS).

ID:23

Factors Influencong Purchase Intention Toward Apartments In A Metropolitan Area In Vietnam

Author:
Pham Han

Abstract:
This study aims to investigate factors to increase the purchase intention of an apartment of consumers in Ho Chi Minh City, Vietnam post – Covid 19. Based on extending the theory of planned behavior (TPB), eight constructs are identified, and eight hypotheses are proposed. A total of 517 responses were collected from the questionnaire survey, and a structural equation model (SEM) was used to test the proposed hypotheses. Attitude toward behavior was found to be the most important determinant, followed by subjective norms and perceived behavioral control. In addition, project facilities, location, environmental issues, and price & credit have a positive effect on attitude toward behavior and an indirect effect on behavioral intention through attitude toward behavior. Meanwhile, the relationship between physical quality and attitude toward behavior is insignificant. Thus, attitude toward behavior plays an important role in enhancing the consumer's apartment purchase intention at this stage.

ID:24

How to measure technical efficiency in multi-output multi-input production processes by adapting Gradient Tree Boosting

Author:
María Guillén; University Miguel Hernandez of Elche
Juan Aparicio; University Miguel Hernandez of Elche
Miriam Esteve; University Miguel Hernandez of Elche

Abstract:
The goal of this paper is to demonstrate how to compute various efficiency measures using the technology estimator created by adapting the Gradient Tree Boosting technique. This adaptation solves the issues with data overfitting of the conventional non-parametric FDH (Free Disposal Hull) method while maintaining its main characteristics. However, the new method introduces thousands of decision variables, making it challenging to address from a computational perspective. We also suggest and test an heuristic approximation to the exact measures to address this issue. Finally, we also show that the new method outperforms the traditional FDH method in terms of bias and squared mean error via a computational experience. Additionally, we demonstrate how the new technique might be considered a potential solution to the curse of dimensionality problem.

ID:25

Support Vector Frontiers: mixing Support Vector Machines and production functions

Author:
Daniel Valero-Carreras; University Miguel Hernández
Juan Aparicio; University Miguel Hernandez of Elche
Nadia Guerrero; University Miguel Hernandez of Elche

Abstract:
Support Vector Machines (SVM) is a popular machine learning technique used in different areas for classification or regression depends on the nature of the outputs. It is a multiobjetive problem which tries to minimize the error committed when we evaluate an observation that it is not in the train sample (also known as generalization error) and to minimize the error committed when we evaluate the observations which are in the train sample (also known as empirical error). Additionally, in microeconomics, a production function is a concave, non-decreasing function that envelops the data from above. In the literature, there exist different techniques, as Free Disposal Hull (FDH) or Data Envelopment Analysis (DEA), which permit the construction of a production function and the measurement of technical inefficiency, calculating the distance from observations to the production function. However, these traditional approaches present different problems, as data overfitting.
In this paper, we present a new methodology that combines these two apparently separated worlds (machine learning and the measurement of technical efficiency). In this sense, in this paper, we have developed a new method, called Support Vector Frontiers (SVF), which is based on SVM. This new approach permits the determination of production frontiers, in compliance with the principles of concavity and free disposability, which are estimated through a data driven process. In addition, we have established a new concept of efficiency, called -insensitivity efficiency inherited from Support Vector Regression. Finally, for demonstrating the advantages of the new approach, we run several experiments that prove that the new methodology improves FDH and DEA in mean squared error and bias.

ID:26

Central Limit Theorems for Double Perspective--Non-parametric Efficiency Estimators

Author:
Shirong Zhao; Dongbei University of Finance and Economics

Abstract:
Statistical properties of traditional (or optimistic) efficiency estimated via non-parametric efficiency methods, has been derived recently by Kneip et al. (2015), while no asymptotic theory has been established for pessimistic efficiency, which complements to the optimistic efficiency through providing a different perspective to measuring efficiency by benchmarking the producers to the fully inefficient producers. We develop full asymptotic theory for pessimistic efficiency through extending the theoretical results in Kneip et al. (2015). More importantly, we propose a new efficiency measure through combining the optimistic and pessimistic efficiency and thus this measure is based on double perspective--non-parametric efficiency estimators, which is found to directly connect to many economics questions, such as measuring the bargaining power of two parties (e.g., buyers and sellers). Full asymptotic theory is established for this new measure. As a result, the developed theories open a path to make statistical inference on bargaining power estimates.

ID:27

Exogenous Wage Decline, Childcare Policy, Endogenous Fertility, Human Capital Accumulation, and Achievement of Fiscal Soundness

Author:
Kei Murata; Shizuoka University

Abstract:
The Cabinet Office (2022) establishes that both ideal and actual numbers of children per household are historical low in recent Japan. The primary reason households do not bear the ideal number of children is “the cost burden of childcare and education”. In addition, wage decline by Covid-19 in various industries is a serious problem and Japanese government expands childcare supports and provides a subsidy to add child allowances. This study builds an overlapping-generations model featuring endogenous fertility and human capital. We assume that childcare supports are financed by income tax and national debt. We consider the effects of childcare support policy on fertility rate, human capital accumulation, and economic growth when wage rate exogenously declines. This study confirms that childcare policy to increase a subsidy financed only by national debt surely results in higher fertility rate and promote human capital accumulation when parental human capital has a large influence on children’s human capital. Moreover, we show that even if Covid-19 pandemic prolongs and this policy increases national debt to infinity at the first stage, redemption and fiscal soundness by tax increase are possible at the second stage when economic recovery is enough. Three conclusions emerged. (a) Childcare policy to increase a subsidy financed only by national debt can recover fertility rate and promote human capital accumulation even if wage rate declines by exogenous economic shock when parental human capital has a large influence on children’s human capital. (b) Although childcare policy to increase a subsidy financed only by national debt can recover fertility rate and promote human capital accumulation even if wage rate declines by exogenous economic shock, national debt may increase to infinity. (c) Even if wage decline by exogenous economic shock prolongs and childcare policy to increase a subsidy increases national debt to infinity at the first stage, redemption and fiscal soundness by tax increase are possible at the second stage when promoting economic growth is enough. Our overall finding is even if Covid-19 pandemic prolongs and this policy increases national debt to infinity at the

first stage, government can recover economy and achieve fiscal soundness at the second stage if parental human capital has a large influence on children's human capital and financial collapse does not occur at the first stage.

ID:28

A System Approach to Identification of Production Functions with Multi-Dimensional Productivity

Author:
Shunan Zhao; Oakland University

Abstract:
There is growing empirical evidence that firm heterogeneity is technologically non-neutral. This paper extends Gandhi et al.'s (2020) proxy variable framework for structurally identifying production functions to a more general case when latent firm productivity is multi-dimensional, with both factor-neutral and (biased) factor-augmenting components. Unlike alternative methodologies, our model can be identified under weaker data requirements, notably, without relying on the typically unavailable cross-sectional variation in input prices for instrumentation. When markets are perfectly competitive, we achieve point identification by leveraging the information contained in static optimality conditions, effectively adopting a system-of-equations approach. We also show how one can partially identify the non-neutral production technology in the traditional proxy variable framework when firms have market power.

ID:29

The Heckman Selection Model with Stochastic Frontier Analysis and Endogeneity

Author:
Yi-Wun Chen; Binghamton University, State University of New York

Abstract:
This paper develops the Heckman selection model with endogeneity and includes the stochastic frontier model as the main equation, in which we can solve the problem of selectivity and endogeneity bias simultaneously in the stochastic frontier model, otherwise estimated parameters are biased and inconsistent. The proposed model can be applied to three cases of endogeneity, including the endogeneity only exists in the stochastic frontier model (main equation), only in the selection equation, or in both. For the proposed model, I derived the closed form of the likelihood function and the estimator of the technical efficiency index based on the information of selectivity and endogeneity. By using two-step estimation, we can easily estimate the proposed model without facing complicated procedure of estimation. In the empirical study, I analyzed the operating efficiency of air carriers in the United States. Evidence suggests that considering the selectivity and endogeneity as necessary, otherwise the predicted technical efficiency indices are invalid.

ID:30

Pre-merger performance and merger success: an experimental approach

Author:
Jung You; California State University East Bay

Abstract:
We investigate how firms' characteristics and cultural integration affect merger success by using laboratory experiments. We collect performance data of firms before and after mergers, while allowing the subjects in experiments to develop a culture. Using a panel model that captures the dynamics of culture formation, we estimate the stable performance level of each firm after the culture is fully developed. We subsequently assess the effect of pre-merger characteristics and organizational culture on post-merger performances. We find that firms with efficient organizational culture play critical roles in merger success.

ID:31

Style Consistency and Industry Concentration of Chinese Mutual Funds

Author:
Tiantian Tang; Shandong University

Abstract:
This paper provides a comprehensive analysis on the relationship between the mutual funds style consistency and performances in China. Using characteristic-based and factor-based analysis, our results indicate that mutual fund managers have stock picking talents over time, with relative weak ability to time the market. Our results suggest that style-consistent and industry-concentrated fund managers perform better after controlling for common risk factors using both the conditional and unconditional models. Further analysis confirms our main results when using decile portfolio approaches and conclude that the style effect is more significant for small funds and growth funds.

ID:32

Using Dual Code Theory to Evaluate the Facebook Marketing Efficiency of the Chinese Professional Baseball League

Author:
Chin Yi Fang; National Taiwan Normal University

Abstract:
Purpose: Social media has been a popular marketing vehicle for consumer products. Facebook has 2.93 billion users and ranked at the top in 2022. Even though there is a paucity of research investigating the marketing efficiency of posting a message on Facebook (Lo & Fang, 2018), there is no literature examining the marketing performance of posing messages for sports-related industries on Facebook. This study aims to (1) develop a performance evaluation model for 3,774 baseball marketing posts on the non-sport social network- Facebook; (2) distinguish four quadrants based on efficiency and customer attention; Theoretical background and Literature review: This study uses the dual-code theory (Paivio, 1990) to measure the marketing efficiency of posting messages on the Facebook pages of five teams in the Chinese Professional Baseball League (CPBL). Methodology: This paper utilized the slack-based measure Data Envelopment Analysis (SBM-DEA) developed by Tone (2001) and meta-frontier-to DEA (O'Donnell et al., 2008) to assess the marketing efficiency with three inputs (text lengths, number of photos, and video length) and three outputs (number of emoji, number of comments, number of shares). Results/findings and Discussion: This paper collects 3,774 posts among five teams in the CPBL during 2022. The average efficiency of CPBL in 2022 was 37.97%, indicating that there will be a 62.03% improvement to achieve the efficiency frontier. The average efficiencies of Brothers, Dragons, UniLions, Guardians, and Monkeys are 40.62%, 41.58%, 41.37%, 40.11%, and 39.79%, respectively. The Meta Technology Ratios (MTRs) of each team assessed by meta-frontier-to-DEA ranged from 0.945 to 0.971, indicating that the UniLions team achieved the most efficient frontier in 2022 of CPBL. Using the matrix-based analysis with two axis-efficiency and customer attention from Facebook, this research provides specific improvement suggestions for Facebook marketing posts for five teams in CPBL. Conclusion: This paper is the first attempt to develop a performance evaluation model for baseball marketing posts on Facebook and cultivate a quadrant-based decision tool to identify the most

efficient and attractable marketing post messages for baseball teams on Facebook.

ID:33

The Long-run Effects of Early External Examinations on Eventual Educational Attainment and Labor Market Outcomes

Author:
DI SIMA; Nanjing Audit University

Abstract:
Previous research provides extensive evidence for the positive effects of external examinations (exclusively focus on secondary education) on test scores and adult outcomes. Still, critics warn that such examinations are high-stakes and may inhibit the development of higher-order thinking or soft skills. This paper mainly relies on the epidemiological approach and studies the long-term effects of external examinations at the end of primary education on adult outcomes among immigrants in the United States. Exploiting variation in examination types within countries of birth and over time, we provide the first evidence that external examinations exert negative effects on educational achievement, earnings, and career development. IV strategy confirms this pattern. Such adverse effects are primarily driven by cohorts with younger graduation age, and could work through channels such as reducing educational attainment, inhibiting creativity for teaching, and promoting obedience formation.

ID:34

On the Elasticity of Substitution between Labor and ICT and IP Capital and Traditional Capital

Author:
Vahagn Jerbashian; University of Barcelona

Abstract:
I estimate CES aggregate production functions for the US, the UK, Japan, Germany, and Spain using data from the EU KLEMS database. I distinguish between three types of capital: information and communication technologies (ICT), intellectual property (IP) capital, and traditional capital. I assume that the aggregate output is produced using labor and these three types of capital and allow for differences in the elasticities of substitution between labor, an aggregate of ICT and IP capital, and traditional capital. The estimated elasticities of substitution between ICT and IP capital are strictly below one for all sample countries implying gross complementarity. ICT and IP capital together are gross substitutes for labor while traditional capital is a gross complement.

ID:35

Bank Efficiency and Credit Risk: Evidence from the commercial banks in China

Author:
Kai Du; University of Queensland

Abstract:
Using a Chinese commercial bank panel data set, this paper investigates the effects of credit risk on the production frontier and technical efficiency. To do this, a semi-parametric model of stochastic frontier analysis is employed that accommodates correlation between production inputs and the statistical noise in the context of a production function. The empirical results reveal that an increase in loan loss provision (equity) as a proportion of total assets would increase (decrease) the labour productivity of an average commercial bank. In other words, an increase in the loan loss provision suggests that the quality of loans has worsened but increase in equity ratio simply represents a decrease in financial leverage.

ID:36

Axiomatic modeling of fixed proportion technologies

Author:
Xun Zhou; University of York
Timo Kuosmanen; University of Turku

Abstract:
Understanding substitution (transformation) possibilities of inputs (outputs) is critical for efficient resource allocation and firm strategy. There are several important examples of fixed proportion technologies where some inputs or outputs are non-substitutable or non-transformable. However, there is widespread confusion about the appropriate modeling of fixed proportion technologies in data envelopment analysis. We point out and rectify some misconceptions in the existing literature, and show how the fixed proportion technologies can be correctly incorporated into the axiomatic framework.

ID:37

Opportunity Cost and Employment Effect of Emission Reduction: An Inter-Industry Comparison of Targeted Pollution Reduction

Author:
Chuang Li; University of Connecticut

Abstract:
All nations stand to benefit from addressing the problem of global warming caused by greenhouse gas emissions. However, the economic impact of pollution reduction in the form of reduction in industry production and jobs lost will be different for different countries and across different industries. In this paper, we estimate the opportunity cost of emission reduction in terms of the loss of intended output and, collaterally, the effect on employment that would result from a reduction in the consumption of fuel for various industries of different countries by using the data constructed from the World Input-Output Database. We conceptualize industry-specific production technology for a number of manufacturing sectors with one intended output (industry gross production) and one undesirable output (CO2 emission) produced from labor, capital, and materials (treated as neutral input) and fuel (treated as the polluting input). The nonparametric Data Envelopment Analysis model following by-production is employed. The results show that the cost of emission reduction in the basic metals industry is generally the lowest across countries in our sample, and the cost is generally high in coke and refined petroleum products among the observed countries.

ID:38

Estimating the Revenue Efficiency of Public Service Providers in the Presence of Demand Constraints

Author:
Hong Ngoc Nguyen; The University of Queensland
Christopher O'Donnell; The University of Queensland

Abstract:
Evaluating the performance of public service providers is often complicated by the fact that they must choose input levels before demands for their services are known. We consider an even more complicated situation in which service providers have no opportunity to directly influence demands. This means that their predetermined inputs may be more than what is required to meet realised demands. In such cases, conventional measures of revenue efficiency used in the operational research literature will generally mis-classify rational and efficient managers as inefficient. We develop a more appropriate measure of revenue efficiency that accounts for exogenously-determined demands. We explain how data envelopment analysis (DEA) methods can be used to estimate our measure, and also how they can be used to assess the consequences (if any) of providers having to choose input levels before demands are known. The methodology is applied to hospital and health service (HHS) providers in Queensland (Australia). We obtain estimates of revenue efficiency that are quite different from estimates obtained using a conventional approach. Our results also indicate that HHS providers were not disadvantaged by having to choose input levels before demands were known.

ID:39

Internationalisation, innovation efforts and labour productivity: Evidence from Indian manufacturing plants

Author:
Anshul Aggarwal; IIM Lucknow

Abstract:
This study investigates the effects of internationalisation and innovation on labour productivity for Indian firms. The individual and combined effects of internationalisation on labour productivity represented by the use of intermediate imported inputs, foreign investment, and exports, and R&D representing innovation are tested. The study applies the empirical framework of production function using an exhaustive Annual Survey of Industries (ASI) dataset from 2015-16 to 2017-18, providing more than 94,000 observations for analysis. For analysis, we use alternative production function models and estimation techniques that take care of potential econometric issues. The estimates suggest a strong positive impact of imported intermediate inputs and exports on labour productivity. The combined effect of imports along with capital and domestic input, on labour productivity, is significantly negative. This indicates the Indian manufacturing sector's dependence on foreign technology, which tends to work better with imported inputs. The impact of R&D and foreign investment is found positive and significant. However, their contribution to determining labour productivity is not sizable. This is one of a select few studies that use large datasets like ASI to examine how intermediate imports, exports, R&D, and foreign investment affect productivity. In the Indian context, most of the previous research relies on corporate databases, which primarily include publicly listed large companies. The use of the ASI database also allows us to examine the effects for small and medium-sized companies as well, which is typically overlooked due to the unavailability of their data.

ID:40

Estimating the water-use, technical efficiencies and drivers of technical efficiency of small-scale sugarcane growers in the Mpumalanga province of South Africa

Author:
Mushoni Bulagi; Human Science Research Council

Abstract:
This study measures the technical and water-use efficiency of small-scale sugarcane growers in the Mpumalanga province of South Africa. The paper applied the input-oriented approach assuming a variable return to scale Data Envelope Analysis (DEA), Slack Based Measure (SBM) model and Truncated regression model to estimate determinants of technical efficiency. The multi-stage sampling technique was applied to collect cross-sectional data from 90 small-scale sugarcane growers for the 2021-2022 production season using a questionnaire. The estimated mean technical and water use efficiency decomposed using the input-oriented DEA and SBM were 90.8% and 90.55%, respectively. Using the truncated regression analysis, we found that education, off-farm income, farming experience, extension support, and land size were significant determinants of technical efficiency. However, farming experience together with extension support were negatively related to technical efficiency during Covid-19. We propose policy reforms aimed at stimulating optimal sugarcane production by improving technical and adaptation of water use efficiencies which are managerially driven rather than natural induced production issues.

ID:41

Technical and Structural Efficiency in Energy Use in Indian Manufacturing: An Inter-State Analysis

Author:
Subhash Ray; University of Connecticut

Abstract:
In light of the rising energy costs one the one hand and the threat of catastrophic climate changes caused by global warming due to greenhouse gas emissions, efficient utilization of has become a top priority in Indian manufacturing. This paper uses state-level data for total manufacturing from the Annual Survey of Industries for the years 2010-11 through 2017-18 to examine to what extent it would be possible to reduce energy consumption without reducing the (aggregate value of) industrial production or increasing any of the non-energy inputs (labor, materials, and capital). For each state, the free disposal convex hull of the output and inputs per firm is used to construct the production possibility set. An energy-oriented measure of technical efficiency is obtained for the average unit in each state. The implied reduction in energy use per firm is scaled by the total number of firms from the state to measure the state-level reduction in energy use.
In an alternative model, the optimal number of units in any state is endogenously determined from a mixed integer programming problem along the lines of Maindiratta (1997) and Ray and Hu (1999). Because the observed number of units in any state is always a feasible solution to this problem, the potential energy saving at the state level cannot be any lower than what is found with the number of units (firms) held unchanged. Because, the total manufacturing output in any state in a particular year is held fixed, when the optimal number of firms is lower (higher) than the actual, the implication is that the state has too many (few) firms and reduce (increase) the number by increasing the size of an average firm. The potential reduction in energy use with the number of firms held unchanged is an indicator of technical efficiency of the average firm Any further reduction achievable by altering the number of firms (and there by the size of an average firm) is an indicator of the structural efficiency of the manufacturing sector in a state .Our empirical analysis shows considerable extent of both technical and structural inefficiency in multiple states over the years.

ID:42

Trade Liberalization and Firms' Corruption Engagement: Theory and Evidence from China

Author:
Ge Song; University of Colorado Boulder

Abstract:
This paper studies the role of trade liberalization in shaping domestic corruption. I develop a model of trade with heterogeneous firms that features endogenous corruption and export participation decisions. In the model, firms face a trade-off between engaging in corruption, thereby obtaining higher profits in the domestic market, or preserving their non-corrupt status in foreign markets to obtain higher export profits. I predict that in equilibrium there is an inverted U-shaped relationship between firm productivity/size and corruption engagement. This prediction is confirmed in firm-level and aggregate data on international trade. I then calibrate the model to China and evaluate the extent to which trade policy is an effective tool for fighting domestic corruption. My findings suggest that, conditional on the same reduction in the level of domestic corruption, trade liberalization is preferable to direct anti-corruption campaigns in terms of the associated gains in consumer welfare.

ID:43

Emergence of Digital Banking and Labor Cost Efficiency in India: A Branch Level Analysis of a Public Sector Bank

Author:
Kankana Mukherjee; Babson College
Subhash Ray; University of Connecticut
Abhiman Das; Indian Institute of Management, Ahmedabad, India

Abstract:
In the immediate aftermath of the 1990s financial sector reforms in India, computers made a slow entry into the Indian banking sector. Although the newly licensed private sector banks were able to leverage technology in a big way, on the broader banking landscape computers had no significant presence. In fact, the Reserve Bank of India started reporting the numbers of ATMs, number of credit and debit card and related volume of transactions only in 2011. The rapid speed of the spread of electronic banking can be judged by the fact that the total number of ATMs (online and offsite) across all banks increased by more than 100% between April 2011 and March 2014. Comparable increases are found for credit and debit card transactions. However, no study has examined the issue of labor cost efficiency in Indian banking at the branch level during the diffusion of ATM technology. This is mainly due to a lack of publicly available data at the branch level.

We see the introduction of computers as a labor augmenting technical change in Indian banking. We hypothesize that this allowed for an overall rationalization and reorganization of the individual tasks performed by different categories of employees, thereby potentially reducing labor cost. In this study we focus on a major public sector Indian bank with nationwide presence and examine the labor use efficiency of 325 branches across four large metropolitan cities, Chennai, Delhi, Kolkata, and Mumbai. We utilize DEA to analyze data for the financial years 2008 and 2014. The year 2008 was the final year of what is often described as India's short-lived era of 'golden growth' while the year 2014 is characterized as the first year of the neo liberal regime under the current Modi government. An examination and comparison of labor cost efficiency in the two years provides an understanding of the

effect of computerization on labor use during the take-off of digital banking in India. This permits us to offer new and valuable insights into the performance of the Indian banking industry at a disaggregated branch level. With the ongoing spread of digital banking and electronic transactions across countries our modeling structure should be applicable to banks in other economies with a large network of bank branches.

We propose a representation of the production technology in the form of an expenditure set in the output and expenditure space as an alternative to the standard free disposal convex hull of input-output vectors. We show that when all units pay the same input prices, one can construct a free disposal convex hull of outputs and total expenditures to solve the cost minimization problem. We use the proposed model to evaluate the labor use efficiency of our sample of branches. Our empirical findings indicate that there is significant inefficiency in labor use in the branches and cost could be curtailed substantially by addressing overstaffing. Across the three types of labor, reducing the expenditure on clerks would have the highest impact for cost saving. We do find, however, that the extent of overspending on clerks has decreased in 2014, which apparently is a direct consequence of computerization of routine jobs. Efficiency varies across regions. In general, Chennai branches are more efficient than branches from other regions whereas Kolkata branches are the least efficient.

ID:44

What explains Latin America's low share of industrial employment?

Author:
Rishabh Sinha; The World Bank

Abstract:
This paper investigates the relative importance of different channels in explaining the low share of industrial employment in Latin America. There is limited evidence that import competition drives this phenomenon in Brazil and Mexico. The two economies are relatively more unproductive in non-industrial sectors compared to highly industrialized nations. Replacing their productivity profile with those of the latter lowers their comparative advantage in industrial production and further depresses the sector's employment share. Instead, differences in labor market wedges and sector-specific value-added intensities are critical in accounting for the variation in industrial employment shares. Counterfactual experiments also reveal that growth will be sufficient to shrink the industrial share gap in the two countries unless sectoral productivity dynamics undergo a relative shift. However, this finding does not apply more generally to developing economies. For instance, rising income without any change in relative sectoral productivity can generate substantial industrialization in India.

ID:45

Computing the Metafrontier Water Efficiency of Asian Economies

Author:
Jin-Li Hu; National Yang Ming Chiao Tung University
Po-Sheng Yang; National Yang Ming Chiao Tung University

Abstract:
This paper combines the metafrontier analysis and total-factor water efficiency (WE) in order to compute the metafrontier WE of Taiwan's regions. The total-factor WE is a ratio of target water input over actual water input. Therefore, the WE is a disaggregate input efficiency measure. This project applies an input-oriented three-step approach. This paper's step 2 will compute the water TGRs and then finds the metafrontier water efficiency (MWE) by multiplying the group WE in the first step and the TGR score in the second step, making sure that the meta WE scores are no more than one.
There are three inputs and two outputs factors analyzed in this study. The three inputs are the capital stock, the labor force, and total final energy consumption. The desirable output is GDP deflated to 2017 US dollars. The undesirable output is CO2 emissions generated from burning fossil fuels as well as the second proportion of GHG behind water vapor The data source of real GDP and labor force is World Development Indicators (World Bank, 2019). The data of CO2 Emissions come from Emissions Database for Global Atmospheric Research (EDGAR) v5.0 (Muntean et al. 2018). The data of total final energy consumption come from International Energy Agency (IEA) World Energy Statistics and Balances (IEA, 2019). There are 44 Asian economies in the year of 2018 included in this study. These economies are separated into two groups, non-East Asia and East Asia. A variable-returns-to scale slack-based measure (VRS-SBM) is used to compute the target inputs, target outputs, and total slacks.
The average group pure technical efficiency (GPTE), technical gap ratio (TGR), and metafrontier pure technical efficiency (MPTE) of the non-East Asian economies are 0.786, 0.855, and 0.689. The average GPTE, TGR, and MPTE of the East Asian economies are 0.913, 0.696, and 0.618. That is, the non-East Asian economies in general perform better than East Asian economies with respect the overall resource efficiency scores.

The average group residential water efficiency (GRWE), residential water technical gap ratio (RWTGR), and metafrontier residential water efficiency (MRWE) of the non-East Asian economies are 0.762, 0.897, and 0.697. The average GRWE, RWTGR, and MRWE of the East Asian economies are0.883, 0.701, 0.583.

The average group industrial water efficiency (GIWE), industrial water technical gap ratio (IWTGR), and metafrontier industrial water efficiency (MIWE) of the non-East Asian economies are 0.727, 0.913, and 0.650. The average GIWE, IWTGR, and MIWE of the East Asian economies are 0.939, 0.741, and 0.679.

To sum up, the non-East Asian economies perform better than non-East Asian economies with respect to residential industrial water efficiency, whereas the East Asian economies perform better than the non-East Asian economies with respect to industrial water efficiency. Both groups have much room to improve their water efficiencies.

ID:46

Market Sentiment and Housing Bubble: A Stochastic Frontier Model Application

Author:
Chia-Hsing Chen; National Taiwan University
Nan-Kuang Chen; National Taiwan University
Hung-Jen Wang; National Taiwan University

Abstract:
This paper uses a stochasitc frontier model to examine whether there is a housing price bubble in Taipei and how this bubble relates to market sentiment. The model not only identifies the existence of bubbles, but also estimates the size of them and perform statistical tests on them. We found that the model with a heterogeneous inefficiency of half-normal distribution is the most compatible setting for the data. The empirical results show that the housing bubble exists in Taipei City, and the size of the bubble peaks in 2015 and accounts for about 30% of the market price. At the same time, we also observe that there is a significant positive relationship between the bubble and market sentiment. If the market sentiment is not taken into account, the housing price bubble will be underestimated. The paper further finds that the marginal effect of market sentiment on the housing bubble is not linear. As market sentiment rises, the marginal effect on the housing bubble becomes more intense, which is also in line with hypotheses in behavioral economics such as the herding behavior. Finally, we repeat the analysis on the data of Kaohsiung City, and the result shows that the housing price in Kaohsiung City does not have significant bubbles.

ID:47

An Efficiency Assessment of the Long-term Care in Taiwan's Administrative Regions

Author:
Ming-Chung Chang
Jin-Li Hu; National Yang Ming Chiao Tung University
Chih-Wei Liu; National Yang Ming Chiao Tung University

Abstract:
Taiwan is currently an aging society and will be a super-aging society in the near future. The resource allocation and effectiveness of long-term care is an important topic of the government's long-term care policy. This study uses two models of data envelopment analysis - Slack-based Model (SBM) and Dynamic DEA-Slack-based Model (DSBM), to analyze the efficiency of 22 counties and cities in Taiwan. This study uses the actual cost and the number of workers for the long-term care as input, and the number of long-term care services as output for each county and city from 2017 to 2019. In addition, this study applies the output orientation to analyze how the number of people served by counties and cities can be expanded. The empirical results show that: (1) DSBM model has higher efficiency than SBM due to consideration of the carry-over variable. (2) From the implementation of Long-term Care 2.0 in 2017 to 2019, the efficiency of most counties and cities has improved. (3) Counties and cities with poor efficiency are mainly due to the high gap ratio of other services. After resource allocation is adjusted and the effectiveness of other services is improved, many counties and cities can achieve a state of efficiency. The government can refer to the results of this study and set relevant long-term care service promotion targets based on existing resources in order to improve the effectiveness of long-term care.

ID:48

Six-Component Panel Stochastic Frontier Models

Author:
Pang-Yu Wang
Hung-Jen Wang; National Taiwan University
Nan-Kuang Chen; National Taiwan University

Abstract:
In this paper, we propose a six-component panel stochastic frontier (SF) model that extends the two-tier panel SF model of Polachek and Yoon (1996) in two major ways: (1)It includes individual heterogeneity which is treated as a random effect. (2) It shows how the time-invariant inefficiency effects in both of the tiers can be identified. The model of Polachek and Yoon (1996) includes the time-invariant inefficiency effects, but they are not identified in the estimation. We use the two-step estimation approach of Kumbhakar et al. (2014) to estimate the model. The approach is easy to conduct and does not require a closed form of the convoluted density of all the model's six random components. We consider three distributional assumptions on the inefficiency terms: truncated-normal, half-normal, and exponential. For the case of the truncated-normal, we are the first in the literature to derive key density functions which are used in the second step of the estimation; we also derive the (in)efficiency indexes of Jondrow et al. (1982) and Battese and Coelli (1988) for such a model. Our model nests many of the existing SF models as special cases. This indicates that our model is one of the more general models in the literature. Finally, we present Monte Carlo simulations to observe biases and mean squared errors of the estimates in our model with two-tier normal-exponential specifications.

ID:49

GENDER AND PRODUCTIVITY SPILLOVERS: EVIDENCE FROM INDONESIA

Author:
Mohammad Zeqi Yasin; The University of Jember
Samuel Harianto; Ministry of National Development Planning
Dyah Sari; Faculty of Economics and Business

Abstract:
The debate on whether inward foreign direct investment (FDI) in a form of multinational companies (MNCs) benefits host country's economy remains developing a growth of studies. Most importantly, the channels through which FDI spillovers affect local economies have been extended and thus resulted a strand of literatures of spillovers: demonstration, labour mobility, and competition. While demonstration effect and competition channels have been well addressed by many studies (e.g. Esquivias & Harianto, 2020; Sari et al., 2016; Sugiharti et al., 2022; Suyanto et al., 2014), labour mobility channel which captures the way in which knowledge transmission occurs through the informal exchanges between workers or labour mobility firms has not gained sufficient attention. Moreover, despite some studies have accommodated gender presence of labour channel for FDI spillovers in developed economies (see. Ahmed et al., 2022; Blanton & Blanton, 2015), the labour channel on FDI spillovers has not accommodated the gender effect for developing economies contexts that might lead to the different implications (Sherif et al., 2022). Theoretically, because men and women possess different comparative advantage in the market works (Chesnokova et al., 2019), international development policy of a country through inward FDI might have gender specific effects on the firms' performance, such as productivity. In these regards, we aim to identify whether gender, specifically female, promotes firms' productivity following FDI spillovers. In this study, we employ Indonesian firm-level datasets of Statistik Industri for the years of 2011-2015. Empirically, the study of Indonesia is intriguing as the pro-women policies, such as the Presidential Instruction Number 9/2000 on Gender Mainstreaming in National Development for integrating women's perspectives into planning by both central and local governments, have been promulgated in 2000. Indonesia with high heterogeneity may also result interesting findings, notably for the effect of FDI spillovers incorporating gender that has not achieved a consensus.

Moreover, data of Statistics Indonesia in 2011-2015 reveals that only four out of 23 subsectors in manufacturing industries that possesses female-to-total labour ratio more than averagely 50%, indicating an gender inequality that might occur in the industrial firms. Our study contributes to literatures by extending the proxy of gender spillovers of Sherif et al. (2022) that proximate within-industry spillover with the spatial spillover (within-province) strategy as in Yasin et al. (2022). We infer that labour mobility will be likely to occur in the spatial dimension. We refer to the proxy of Levinsohn and Petrin (2003) that uses intermediate inputs as the productivity shock instead of investment (Olley & Pakes, 1996) (see Rodríguez-Pose et al., 2013; Vial, 2006). By employing Fixed-Effect estimator using Driscoll and Kraay (1998) standard errors to deal with cross-sectional dependence in the spillover models (Baltagi & Pesaran, 2007), we found robust significant effect of FDI spillovers due to female contribution to the firms' productivity only for spatial dimension, but not the sectoral one. An intriguing result is that the positive spillovers is shown for production female workers instead of non-production female workers. This finding indicates that in terms of labour mobility channel, female production workers that are presumably less skilled workers are more likely to create positive externalities for local firms' productivity within-province. All these estimations are robust across different sub-samples (domestic samples and Java-Sumatera samples).

ID:50

Innovation and dynamic productivity growth in the Indonesian food and beverages industry

Author:
Maman Setiawan; Padjadjaran University
Rina Indiastuti; Universitas Padjadjaran
Nury Effendi; Universitas Padjadjaran
B. Budiono; Universitas Padjadjaran
Mohamad Fahmi; Universitas Padjadjaran

Abstract:
This paper investigates the relation between innovation and dynamic productivity growth in the Indonesian food and beverages industry. Dynamic Luenberger productivity growth indicator is applied to calculate the dynamic productivity growth while the innovation is represented by a process innovation. This research uses the firm-level data for the period 1980-2015 sourced from the Indonesian Central Bureau of Statistics. This research uses panel data regression model to estimate the relation between innovation and dynamic productivity growth. This research finds that the innovation is relatively low in the Indonesia food and beverages industry. The dynamic productivity growth declines steadily during the period of estimation. This research also finds that innovation affects positively the dynamic productivity growth after the introduction of the competition law in Indonesia.

ID:51

Productivity and Its Determinants of The Micro Enterprises in The Indonesian Manufacturing Industry

Author:
Endang Rostiana; Universitas Padjadjaran
Maman Setiawan; Padjadjaran University
Eva Ervani; Universitas Padjadjaran
Rudi Kurniawan; Universitas Padjadjaran

Abstract:
Micro enterprises (MEs) play an essential role in the Indonesian manufacturing industry, contributing about 93.58% to the total number of firms and 46.55% of employment absorption in the manufacturing industry. However, the MEs only contribute about 4.45% to the industry's output. This research investigates the productivity of the MSEs and their determinants in the manufacturing industry. We used the stochastic frontier approach (SFA) to estimate the Total Factor Productivity (TFP). We used 82345 firm data in 2019 sourced from the annual survey of the Indonesian micro and small firms (MSEs) by the Indonesian Bureau of Central Statistics (BPS). The results show the average TFP level of MEs is about 110 and varies between 33 subsectors, excluding subsector number 19. The productivity of the MSEs is determined by the internal conditions of MEs and the external factors, which include firm size, firm age, owner and worker education level, partnership, market orientation, and access to financial resources. The different conditions of internal and external factors lead to the varying productivity levels of MEs. Our results can be used to map the MEs' productivity level in 32 manufacturing industry subsectors, identify the low productivity subsectors, and set the appropriate strategies to address the issue.

ID:52

The relationship between technical efficiency, growth, and firm concentration in the Indonesian palm oil industry

Author:
Berliana Septiani; Universitas Padjadjaran
Maman Setiawan; Padjadjaran University

Abstract:
This study examines causality from efficiency to firm growth, then firm growth to market structure to validate the existence of quiet life (QL) and efficient structure (ES) hypotheses. This research uses the data of firms from the Indonesian Bureau of Central Statistics (BPS) for the period from 1990 to 2017. The efficiency score is calculated using data envelopment analysis (DEA). Furthermore, the two-step generalized method of moments (GMM) and panel vector auto regression (PVAR) methods were used to account for endogeneity in estimation models. This research reveals that technical efficiency can increase the company's market share, increasing market concentration and market power. This finding supports the ES hypothesis. We also found that market structure has an impact on firm efficiency, supporting the QL hypothesis. As a result, there is an intriguing cycle in the industry between the ES and QL hypotheses. It suggests that policymakers must find the right balance between both the level of competition and firm concentration.

ID:53

Evaluating Green Efficiency of Manufacture Sector and Its Determinants in East Java Province

Author:
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Ananda Putri; Universitas Padjadjaran
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Abstract:
East Java is one of the provinces in Indonesia that carries out intensive development in the industrial sector to improve the welfare of its society. However, massive industrial activity will pose its challenges, such as increased emissions and environmental degradation. This study aims to determine the manufacturing sub-sector that produces CO2 emissions and has the lowest green efficiency as well as its determinant variables. There are three stages of analysis applied in this research i.e. carbon emission measurement, Slack Based Measurement-Data Envelopment Analysis (SBM-DEA), and Tobit regression. The study use 5-digit manufacturing subsector data based on the International Standard Industrial Classification (ISIC) system, obtained from the Indonesian Central Agency of Statistics (BPS) which is deflated against the East Java Regional Gross Domestic Product (GDRP) deflator with 2010 as the base year. The results of the analysis show that in general, the manufacturing subsector in East Java produces quite high CO2 emissions of 85.28 tons. The subsector with the highest average CO2 emissions in East Java in 2017 was the fertilizer industry, in 2018 the non-ferrous base metal manufacturing industry, and in 2019 the steel rolling industry. Then, the drying industry and tobacco depreciation became the sub-sector with the lowest average green efficiency in East Java Province in 2017. Meanwhile, in 2018 it was the milling industry of various nuts (including Leguminous) and in 2019 it was the coffee processing industry. The Tobit regression results show that the energy structure and industrial concentration have no significant effect on the green efficiency value of the manufacturing subsector. Meanwhile, spending on R&D has a significant negative effect on green efficiency. Therefore, the recommendations given are encourage the use of environmentally friendly raw materials and fuels, increasing green innovation, and increasing

consumer awareness regarding environmental issues.

ID:54

The Causality Analysis of Market Share and Efficiency of Indonesian General Insurance Companies

Author:
Iqram Jamil; Universitas Padjadjaran
Maman Setiawan; Padjadjaran University

Abstract:
This study aims to analyze the relationship between market share and technical efficiency of companies in the Indonesian general insurance industry. This study utilizes the data of general insurance companies for periods 2010-2020 from The Indonesian Financial Services Authority (OJK). The result shows that efficient companies came from group of firm with relatively high market share and group of firm with relatively low market share. Furthermore, the panel Granger-causality test indicates a one-way direction of causality, where only the market share has an impact on the technical efficiency score. Also, the results of panel regression show that market share has a negative impact on technical efficiency scores. These results suggest that the quiet-life hypothesis applies in the Indonesian general insurance industry.

ID:55

Testing impacts on inefficiency in a semiparametric stochastic frontier model

Author:
Jen-Che Liao; Department of Economics, National Chengchi University
Xiaojun Song; Peking University
Hung-Jen Wang; National Taiwan University

Abstract:
This paper is concerned with significance testing of the effects of exogenous determinants on the one-sided deviation term of a semiparametric stochastic frontier model. Two nonparametric significance tests for all or a subset of the determinants of inefficiency are proposed. The proposed tests are based on conditional moment restrictions and stochastic processes, with critical values simulated by means of a multiplier bootstrap procedure. Our testing methodology addresses the omitted variable bias that arises naturally in stochastic frontier models when accommodating the determinants of inefficiency, and accounts for the estimation effects that appear from using the estimated composite error when constructing the test statistics. We investigate the theoretical properties of the proposed tests and the resampling approximations. The proposed tests are illustrated through simulation experiments and two empirical examples in which the hypotheses of no impacts on inefficiency need to be tested.

ID:56

Target Setting for Airlines incorporating CO2 Emissions: The DEA Bargaining Approach

Author:
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Ipsita Rakshit

Abstract:
Long-term sustainability in airlines transportation entails mitigating the detrimental impact of CO2 emissions on the environment. However, it is also necessary that it does not affect the airlines performance. In this regard, it is important to achieve optimal and efficient targets by inputs, good outputs, and undesirable outputs. The purpose of this study is to compute the input and output targets using the bargaining approach for a sample of major global airlines for the period 2018. This has been undertaken utilising the proposed data envelopment analysis (DEA)-based Nash bargaining model wherein its novelty lies in incorporating weakly disposable undesirable outputs. This model achieves reasonable and optimal targets for not just inputs and outputs but also for undesirable outputs by carrying out an unbiased, rational negotiation between the inputs and outputs. The results show that the weakly efficient airlines attain the optimal targets by improving their environmental performance and inefficient airlines can achieve their input/output targets by carrying out an unbiased, rational negotiation between the inputs, good outputs, and bad output. The policy implications emanating from the findings have also been highlighted.

ID:57

Assessing efficiency gains from potential university mergers in Taiwan using a presampling DEA approach

Author:
Tsu-tan Fu; Soochow University
Shu-Hua Wu; Soochow University

Abstract:
The negative impact of low birth rate on higher education industry in Taiwan has become obviously. As the student enrollment rate decreases over time, some universities have suffered. The ministry of education has implemented a merger promotion project for public universities to facilitate its enforcement in 2012. Research on the impact of mergers' benefit has been mainly qualitative and theoretical oriented. Few research has been done on a quantitative and statistical based, which fails to provide objective evidence for educational authorities policy formation references. This research intends to fill up this research gap. We adopt a nonparametric DEA model coupling with Tone(2013)'s presampling procedure to simulate the potential efficiency gain from mergers between public universities in Taiwan. We use the data of 34 Taiwanese public universities in 2019. Those universities having full efficiency (technical efficiency =1) are hypothesized to be pairwise merged with each other. We also include those potential merger cases suggested by the ministry of Education in the empirical simulation. Empirical results have identified some best possible cases for university merger in Taiwan.

ID:58

Economies of Scale in Taiwan Higher Education: Evidence from Quantile on Quantile Regression Approach

Author:

Zhen-Ting Gong; Zhanjiang Preschool Education College

Chih-Hung Hung; Feng Chia University

Yan-Bei Chen; Zhanjiang Preschool Education College

Yung-Leih Yang ; Ling Tung University

Abstract:

For the driven that the DEA conducted a series of researches on the efficiency of higher education, yet the outcome of them is still incapable of guiding the higher education clearly to improve their efficiency and performance. For the purpose of capturing the performance and efficiency of higher education of Taiwan, which is regarded not only as a key information to inspect the efficiency of higher education, but also can be taken to direct the higher education reform, we first calculate the performances and productivity index by utilizing the DEA model. Further we shed new light on the intrigue relationship between total factor productivity and the technical efficiency by using a novel quantile-on-quantile regression approach so as to provide more information to discuss whether the technical efficiency has different impact on total factor productivity under different quantiles.

ID:59

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Assessing the impact of agricultural efficiency on the SDGs : take African coffee-producing countries for example

Abstract

The destruction of ecological environment caused by climate change affects the coffee production and sustainable development vision of African coffee producing areas. This study uses Two stage Dynamic Network Direct Distance Function(DN-DDF) and Dynamic Network Total Factor Productivity(DN-TFP) to evaluate the coffee production efficiency and sustainable development efficiency of 19 African coffee-producing countries(ACPC) from 2014 to 2018. According to the empirical results, the highest overall efficiency is in Central African Republic, Ethiopia, Liberia, Uganda, and Zambia This study has three main contributions: (1) using a two-stage model to assess the impact of coffee production efficiency on sustainable development efficiency. (2) The dynamic model uses forest area as an intertemporal variable, which is closer to the phenomenon that coffee in the real world depends on forest mixed planting. (3) Taking precipitation as an exogenous variable to objectively assess the impact of extreme weather on coffee production. The research results can promote African coffee-producing countries to improve coffee production efficiency, and have important reference value for sustainable development.

Keywords: coffee production efficiency, SDGs, extreme climate, DN-DDF, DN-TFP