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Overview:
Econometric leadership of the New Knowledge-based Service Economy

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In the process of economic development, the service sector and its operational efficiency assume an increasingly important role in both GDP creation and volatility generation. *Efficient* and *growth-generating* management of the such key elements of the service sector as shopping centers, tourism, financial instruments, exchange rate policy, the insurance market, asset pricing, Asian options, the stock market, and petroleum and other futures markets; must be balanced against concern for both *stability* (reductions in temporally predictable extreme fluctuations in the business cycle and rational speculative bubbles) and *self-immunization* against the vagaries of external natural, financial, petroleum-based, and political shocks. As service-sector markets are frequently co-integrated, it is also vital to determine whether investment in one can offset downside risk in the others, or whether all move together towards extreme peaks and troughs in national income. As if this were not already a great enough challenge, analysts and decision-makers must also be equipped to detect and correct for potential bias-inducing anomalies in datasets, including heavy tails, non-linear causality, risk aversion and disappointment, skewness, multiple-criteria decision making, extreme values, the degree of arbitrage, utility functions weighted un-weighted for spectral risk, and the possible divergence between predictions based on one criterion (say, tourist arrivals) and another (say, tourist expenditures).

This situation differs markedly from that of 50 years ago. The earliest tools and concept of econometric management were developed in the period when agriculture was still the predominant sector of the economy in both GDP and employment. Ricardo's theory of surplus value and diminishing returns, Griliches', Nerlove, Koyck, Almon and others' breakthroughs in the estimation of stochasticitiy in yields and lagged dependence; measurement and explanation of productive efficiency under technical change and inter-annual weather fluctuations; the stochastic frontier function; and the early applications of Box and Jenkins' ARIMA to the modeling of cobweb structures in the livestock sector all took real-world agricultural data as both their inspiration and data source.

Today, those fundamental econometric tools must not only be transferred to the service sector, they must be improved through further methodological advances to reflect the unique features of each subsector and market: the consumer market (retail shopping and tourism), financial markets (financial instruments, insurance, asset valuation, stocks, petroleum and other futures) and even the monetary and foreign exchange sector (exchange rate policy and reforms). While the end-users of agriculture-based econometrics were primarily farmers and macro-policy makers at two distinct and separate levels of society, the clientele base today has been enlarged and divided into multiple levels. It includes households desirous of alternative investment products to low-interest savings accounts; the managers of the stock exchange, insurance companies, and commodity markets; and of course the government itself in its roles of protector of the environment, stabilizer

of the external balance, socially responsible investor, off-setter of speculative bubbles, and provider of public goods.

This widening and complexification of the clientele base have led to a *de facto* decentralization in economic decision-taking by both domestic and foreign investors, who unfortunately must still access information of varying degrees of completeness, accuracy and predictive power. Econometricians must therefore move to the vanguard of the emerging Knowledge Economy by providing not only the disciplinary tools but also the empirical predictions necessary for stable and efficient growth on the one hand; and the avoidance of bubbles, runs, crashes, and depressions on the other. A new era of disciplinary advances in econometrics has dawned within the last decade and a half.

This special proceedings issue of the Thailand Econometric Society proudly focuses on the publication of seminal contributions in each of these subsectors of the service economy from authors working in countries around the globe: Australia, Germany, Hong Kong, Japan, the Netherlands, Singapore, Taiwan, Thailand, South Africa, Sweden, the United States, and Vietnam. In the remainder of this introductory chapter, we shall present a composite summary of the innovations, results, and implications of the 22 papers contained in this volume in the order of its four major subdivisions: disciplinary innovations, consumer markets and services, financial markets, and instruments of monetary policy.

Disciplinary innovations

Schoch *(Envy and generalized loss aversion*) provides a unique disciplinary contribution to understanding and predicting the underlying behavior of all actors in the emerging service sector of the global economy. To the extent that the search for speculation is motivated by envy, that portfolio diversification is motivated by loss aversion, and that the provision of tourist and other services is motivated by altruism, it becomes important to know whether and how envy, jealousy and loss aversion are interrelated. Schoch demonstrates how these three at least partially-economic emotions can be modeled as Kahneman-Tversky loss aversion in a reference-dependent preference framework. He congently contrasts interdependent and deference preferences; divides inequity-loving into triumph and *mitfreude*; introduces "reverse-envy neutrality", the disappointment function, and an index of loss aversion; and splits the utility function into basic utility and a disappointment valuation. He then tests this logical structure against ultimatum game results to demonstrate that inequality aversion exists whether one is the subject of envy (one is disadvantaged) or its object (one is advantaged). Methodologically, he obtains the basic utility function by diagonalization, departing from past studies which set the reference point at zero. This is correct because, unlike bo, as a reference; nor does it assume any intrinsic moral value.

Sriboonchtta, Nguyen, and Kreinovich *(How to relate spectral risk measures and utilities)* go on to discuss how those traditional utility functions may be weighted by spectral risk measures as explanations of actual decisions. They apply objective statistical formulations to deduce the transition function between the two in a more scientific, objective way than the heurism and approximations of past studies. They not only re-scale traditional utility from a statistical viewpoint, they formulate a spectral risk measure with its weight function. They show further that this type of problem has already been solved in the case of the congruence between M-methods and L-estimates. Finally, they apply their solution froms robust statistics back to the economic situation, which they solve through auxiliary functions.

Extreme values have recently been recognized as an anomaly that econometricians must take into account. Rakonczi and Tajvidi *(On Prediction of bivariate extremes)* contrast two competing ways to model high dimension extremes -- multivariate extreme value distribution (BEVD) and multivariate peaks over threshold models (BGPD) -- which they apply to wind-speed data in a sample of north German cities over half a century. The authors adopt a new definition for describing the distribution of the exceedances for all values that are above the threshold in at least one component. Arguing that one can use non-parametric dependence functions to model dependence among nearby locations, they use simulation to compare the new approach with standard block maxima. In addition to the three basic parameters (location parameter, scale and shape) in the block maxima approach, the peaks over threshold approach earmarks those observations that are higher than a really high threshold, which can be approximated by a generalized Pareto distribution (GPD). Testing these two approaches against German wind data, the authors conclude that the BEVD model provides remarkable good fit in all cases; while the BGPD is more biased at low Kendall-tau values, but less biased at high values. The BGPD also seemed to estimate more appropriate quantiles when compared to the observation.

Service markets dealing directly with consumers

Retail shopping

Chen et al. (*A Hybrid MDCM model for evaluating the environmental impacts of regional shopping centers)* seek both to evaluate the positive/negative environmental, economic, social, and cultural impacts of regional shopping centers; and to understand why protests against such centers have occurred in both Britain and Taiwan. To do so, they combine the DEMATEL (decision-making trial and evaluation laboratory), ANP (analytical network process) and AHP (analytical hierarchy process) to develop a hybrid multiple criteria decision-making (MCDM) model. The DEMATEL is used to decide the relative weights of criteria showing interdependence and feedback and to draw a network map among the various factors. A panel of experts determines the relationship among the four dimensions like a 16 cell correlation matrix with normalized direct effects. Directed maps are weighted by the criteria weights to build a super-matrix through pair-wise comparisons. The resulting clusters are similar to a Markov chain. After several matrix manipulations similar to solving a SAM, one ends of up with an impact-direction map of regional shopping, with the ultimate goal being to reduce the sum of the gaps. This approach was used on data from Taiwanese regional shopping centers to evaluate proposed policies. Although none of the four gaps was eliminated entirely, the smallest gap was associated with the economic dimension, and the largest with the cultural.

Tourism

The set of six tourism papers complement each other both in econometric approach and practical policy conclusions. First, while Chokethawarn et al. (*International tourist arrivals in Thailand: Forecasting with an ARFIMA-FIGARCH approach)* and Bunnag et al, *(Impacts of the real exchange rate on the volatility of international tourist arrivals to Thailand)* seek to explain and predict tourist arrivals; Chokethawarn et al. *(International tourist expenditures in Thailand: Modeling with the ARFIMA-FIGARCH approach*) and Manoj et al, (*International Tourists' Expenditure in Thailand: A Modelling the ARFIMA Approach)* go on to predict the total expenditures from those arriving tourists. The best ARFIMA-FIGARCH predictve

models in the two Chokethawarn et al papers have different levels of d and minimal levels of AIC and BIC in models for tourist arrivals and tourist expenditures. Secondly, while Chokethawarn et al do not distinguish among countries of origin, Bunnag et al *(Value at risk of international tourist arrivals to Thailand*) carefully categorize tourists into three types: short-haul from Malaysia, medium-haul from Japan and long-haul from the U.K. and USA. Third, both Chokethawan and Manoj et al. (*International Tourists' Expenditure in Thailand: A Modelling the ARFIMA Approach* forecast tourist arrivals and expenditures for the 18-month period from mid-2009 through the end of 2010. Since the Manoj model predicts that tourist expenditures will be at best constant or slow down, the authors recommend that the Thai government and private tourist industry further develop and promote tourism. In the light of the subsequent political disturbances that virtually paralyzed Bangkok tourism during key periods of 2010, these recommendations acquire even more force.

Methodologically, Bunnag et al employ a VaR model to explain both the volatility of international tourist arrivals and how to manage the resulting risk exposure. Such estimates can be of enormous help to financial institutions in estimating the level of reserves required to sustain long-term government projects and foreign exchange reserves. Their results point to a classic trade-off: both income and volatility in arrivals go *down* with distance from Thailand. Similarly, the GJR-X models show that fluctuations in the real exchange rate significant predictors of tourist arrivals only from short-haul Malaysia. This is likely because the investment costs and long-term travel planning of medium- and especially long-haul tourism from Japan, UK and the USA are harder to undo at the last minute in the event of an unexpected exchange rate or financial shocks. Moreover, the demand for tourism on the part of wealthier countries is probably much less price-elastic than in poorer Malaysia.

In contrast, Chukiat et al. *(A Panel Cointegration Analysis: An Application to International Tourism Demand of Thailand)* use panel cointegration analysis to test for the long-run causal linkages between the GDP, transportation cost and exchange ratetions faced by Thailand's major tourist source countries and international tourist arrivals for the period 1986-2007. Using Pedroni residuals, Kao residuals, Johansen Fisher panels; and OLS,DOLS and FMOLS model specifications; the authors demonstrate that income growth in Malaysia Japan, Korea, China, Singapore, and Taiwan and petroleum-based transportation cost increases have positive and negative impacts, respectively, on tourist arrivals. Since these variables can be monitored by transportation authorities and macro-economists, volatility in export earnings can be predicted and partially countered through targeted advertising and tourist promotion campaigns.

Insurance

As noted, financial and insurance risks are becoming increasingly integrated in today's globalized service economy. This leads Laubschagne and Nguyen (*A Universal framework for financial and actuarial pricing of risk: Myth or reality?*) to hypothesize that a single approach can be used to determine the fair value of risk in both domains. They synthesize the work of Wang and Hamada-Sherris to propose a universal framework for financial and actuarial prices of risk. The Black-Sholes-Merton pricing model, the Choquet integral, Wang's distortion function, the pricing of European call options, and the representation of credit risk are all systematically laid out and clearly interrelated. The authors conclude that although Wang's approach is easy to use, it must be further refined in two ways before it can become a universal

framework for pricing financial and actuarial risk. First, it must be proven that Wang's approach yields arbitrage-free models. Second, the Wang approach should be used to develop explicit pricing formulae in financial mathematics.

Asset valuation

Labuschagne and Offwood *(On the Fundamental theorems of asset pricing)* summarize and integrate various versions of the two fundamental theorems of asset pricing: no arbitrage to the existence of an equivalent Martingale (called a risk-neutral pricing measure), and the link between market completeness and the uniqueness of a price measure. These theorems are important because the main goal of mathematical finance is to price financial instruments in a fair, rational manner. With respect to the first theorem, for example, the faoums "No free lunch theorem" must be modified into "No Market free lunch if the market is incomplete." With respect to the second theorem, the authors carefully deduce that the security market is complete not only if every integrable claim is attainable but also if the distribution is dense in C with respect to the topology t. That is, a trader values a trading strategy by considering the expected time T payoff generated; but only if the trader's value is equal to x.

Woraphoj (*Asian Option pricing using Path Integral)* regrets that although options of various types are traded globally, their pricing is either tedious, mis-specified over over-simplified. Since the Black-Scholes formula for European options is based upon the assumption of Brownian motion. Since financial markets and quantum mechanics share this and other characeristics, path integrals may be used. To make such integrals more computationally tractable, Woraphot proposes a weighted Monte Carlo method. After clearly laying out the basics of quantum mechanics and path integral technology, the author modifies the Black-Scholes equation to reflect the path integral and finally specifies Monte Carlo simulations with appropriate weighting functions and payoffs.

Stock exchanges

Bodnar and Gupta (*Impact of skewness on the performance of optimal portfolios)* make a very practical contribution to the use of portfolio analysis in investments. They test for the influence of skewness in the determination of the composition, mean expected income, and variance of the Markowitz' traditional global minimum variance portfolio (GMVP) on the efficient return-variance frontier. They find that, if the assumption of normality of the symmetric model is violated, the choice and performance of optimal portfolios can change dramatically. If this approach were applied to a sample of key stocks on the New York or other stock exchanges, the results could make the GMVP more attractive for investors and researchers in the financial sector.

Bai et al *(Multivariate linear and non-linear causality tests*) are preoccupied with such cases of nonlinear causality as the relationship between stock prices and trading volume in Chinese stock markets. They use mulitivariate linear and non-linear causality tests as proposed by Hiemstra and Jones to improve upon the traditional linear form of the Granger test in a bivariate setting. Their logical, mathematical exposition is convincing and revelatory. For example, they note the disadvantage of the Hiemstra and Jones's original formulation (over-rejection bias on the null hypothesis of Granger non-causality), which has inspired other researchers to develop less biased but regrettably less powerful models.

Pham (*Rational Speculative Bubbles in Vietnamese Stock Market)* provides important insights for Vietnamese government policy-makers in their attempt to rectify current inefficiencies in the emerging Vietnamese stock market. She applies the duration dependence test (the most appropriate under conditions of data

paucity) to determine whether rational bubbles were responsible for the soaring stock index in 2006-8. The paper reports detailed run counts, hazard rates for positive and negative runs, and tests of duration dependence on a dataset spanning seven full years (2003:1-2009:4). The likelihood ratio tests indicate that positive surges ("fever") were at least partially led by rational expectations; but that significant negative runs were driven instead by chance or fads. Investors apparently chose not to withdraw their funds in the belief that the positive runs would more than compensate losses when the bubble burst. Her econometric results discredit two alternative explanations of the bubble: supply and demand imbalances and ineffective monetary policies. To dampen the fever and maintain investor confidence the Vietnamese economy, Pham recommends making the stock market more transparent by controlling illegal or inside trading and rumor-mongering.

Wiphatthanananthakul and Sriboonchitta *(ARFIMA-FIGARCH and ARFIMA-FIAPARCH modeling of the Thailand Volatility Index*) promote the use of the TVIX as a hedging diversification tool because of its high negative correlation with the SET 50 index. They show that the ARFIMA-FIAPARCH is superior to the ARFIMA-FIGARCH for accurately capturing long memory and asymmetry in both the basic and power-transformed conditional variance. They recommend that the SET and the Security Exchange Commission should develop and launch the TVIX as a hedging diversification tool for investors.

Wiphatthanananthakul and Sriboonchitta *(Comparisons among ARMA-GARCH, -EGARCH, -GJR and –PGARCH models in modeling the Thailand Volatility Index*) use various specifications of ARMA/ARFIMA, GARCH and GJR models to explore the behavior of the Thailand Volatility Index (TVIX) based on the Chicago Board of Exchange's VIX and the SET 50 data. Their work, which models volatility persistence and asymmetric properties, is designed to give planners and stock exchange managers tools for anticipating and partially offsetting financial crises. The authors demonstrate a significant asymmetry effect with all models, but no leverage effect, in contrast to previous work. The ARMA-PGARCH model is the best (lowest AIC) but the EGARCH has the lowest SBIC. In terms of the second moment, MAPE, and RMSE, the GJR-GARCH is however the best.

Petroleum and other commodity futures

Tansuchat et al *(Crude oil hedging strategies using dynamic multivariate GARCH*) evaluate crude oil hedging strategies using four dynamic multivariate volatility models (CCC constant conditional correlation, VARMA-GARCH, Engle's DCC dynamic conditional correlation and the Babba-Engle-Kraft-Kroner BEKK) on the Brent and West Texas Intermediate markets. Their goal is to calculate the optimal portfolio weights and hedge ratios and to help entrepreneurs obtain an optimal hedge ratio in this second most important commodity market in the world. The two markets should be used differently. The Brent market investor should hold more futures than spot; in West Texas, however, use of the CCC and VFARMA-GARCH model suggests one should hold more crude oil spot to futures. The hedging ratios are also time variant: short in crude oil futures, and long in crude-oil spot. Overall, the DCC is the best and BEKK the worst model for minimizing the variance of the portfolio.

Tansuchat et al (*Conditional correlations and volatility spillovers between crude oil and stock index returns*) broadens the above inquiry to analyze the conditional correlations and volatility spillovers between crude oil futures and stock index returns for the period January 1998 through November 2009. The

markets for these two commodities have developed strong symbiosis through the energy-dependent production processes of companies listed on the stock exchange. The two markets (West Texas and Brent) all are the same as in the previous paper; but the FTSE100, the NYSE, the Dow Jones and the S&P500 are analyzed; and VARMA-AGARCH replaces BEKK within the set of model formulations. If an investor used the CCC and the VARMA-GARCH and –AGARCH she would conclude that the conditional shocks are correlated only within the same market but not across markets. But the DCC suggests that the conditional correlations are not constant. Overall, the VARMA-AGARCH seems to perform with higher fidelity than the VARMA-GARCH or the CCC.

Foreign exchange

Ogawa and Yoshimi (*Analysis of βand σ convergences of East Asian currencies*) apply the analysis of Adam et al's 2002 β and σ convergences of 12 Asian currencies (10 in SE Asia plus China and South Korea) under the turbulent conditions of China's reform of the yuan, massive but unequal international foreign exchange flows, and the global financial crisis. They use the LLC and PIS tests of β-convergence and the ADF and PP tests of σ-convergence. The weighted average value and deviations of Asian money (AMU) show that, especially since 2005, Asian currencies have increasingly diverged from each other around the weighted average. Ogawa and Yoshimi further demonstrate that Chinese monetary authorities have stabilized the exchange rate exclusively against the US dollar (as opposed to the euro or the Japanese yen), belying Beijing's official pronouncement of a managed float, and diverging from the pan-Asian trend of gradual dissociation form the US dollar. The increasing volatility and misalignment of currencies within Asia leads to coordination failure, due to the inability of the nations of the region to adopt the same type of exchange rate system. Since the financial crises, exchange rate systems do demonstrate a tendency toward greater flexibility.

Choy's (*Comparison of different heavy-tailed stochastic volatility models for financial data in Thailand)* goal is to analyze the US dollar:Thai baht exchange rate and its relationship to BSE 40 stock market return data. Using the t-t SV, the t SVL and the modified SVL paradigms as stochastic volatility models for financial returns in Thailand, he develops innovative formulations of SV (stochastic volatility) and Student-t models. Choy further uses a Bayesian approach with Markov Chain Monte Carlo algorithms, whereby the deviance information criterion is used to find the minimum MCMC output. Overall, the modified Student-t SVL stochastic volatility with leverage models fits the index return data with the greatest fidelity. Choy concludes that heavy-tailed distributions are preferred in modeling return and volatility; and recommends e Bayesian WinUJGS software due to its efficiency and convenience.

In sum, the present volume of 22 original papers provides cutting edge insights for the academic econometrician practical forecasting tools private decision making; and policy recommendations for fostering vigorous, unbiased growth in the tertiary economy. As such, it should be enlightening and useful reading on both the demand and supply sides of service markets within the emerging global Knowledge Economy.