

出國報告（出國類別：國際會議）

第七屆亞太商業研究國際研討會

The 7th Asia Pacific Business Research Conference

服務機關：國立中正大學經濟學系

姓名職稱：劉文獻 副教授

派赴國家：新加坡

出國期間：103年8月25日至8月28日

報告日期：103年9月1日

摘要

本次國際會議（第七屆亞太商業研究國際研討會，The 7th Asia Pacific Business Research Conference）由澳洲的 World Business Institute 主辦，於新加坡的 Bayview Hotel Singapore 舉行。晚學於 103 年 8 月 25 日上午搭乘長榮航空公司 BR225 班機由桃園國際機場出發，於當日中午抵達新加坡樟宜國際機場後，隨即參與 8 月 25 日的研討會，並於 8 月 26 日上午發表一篇英文論文“Forecasting the Semiconductor Industry Growth: A Bayesian Model Averaging Approach”，與在場的國際學者進行意見交流。會議結束後，於當地進行一天的（8 月 27 日）參訪行程，最後於 103 年 8 月 28 日下午搭乘長榮航空公司 BR226 班機返抵國門，結束本次出國訪問。

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一、目的

本次出國的主要目的為參加由澳洲 World Business Institute 主辦之第七屆亞太商業研究國際研討會 (The 7th Asia Pacific Business Research Conference)，並發表一篇英文論文。除與國際學者針對此篇英文論文進行意見交流外，並於會議結束後參訪新加坡當地著名景點，以進一步了解當地風土民情，好納入未來課堂教學教材。

二、過程

此次國際會議於新加坡的 Bayview Hotel Singapore 舉行，晚學於 103 年 8 月 25 日 (星期一) 上午 03:30 由台中住家出發，04:50 抵達桃園國際機場，07:40 搭乘長榮航空公司 BR225 班機出發(約延誤 30 分鐘起飛)，於當日中午 12:20 抵達新加坡樟宜國際機場，13:30 通關及提領行李後，先至投宿飯店 (Royal Hotel at Queens) 辦理住宿登記及放置行李，隨即於 15:30 趕往 Bayview Hotel Singapore 報到並領取註冊收據後，參加下午 16:15-18:15 場次 (Finance Session) 的研討會。此一場次共有六篇論文發表 (敬請參見附件一，議程第 12-13 頁)，其中五篇皆為同一個學校 (印尼的 Institut Teknologi Bandung) 的師生所發表，以非常簡單之計量方法進行各類財務議題之分析，論文水準普通，另一篇則由來自菲律賓 Partido State University 的 Cedocia N. Oco 教授發表，主要探討菲國破除文盲計畫 (Literacy Enhancement Program) 對女性微創業者 (Women Micro-entrepreneurs) 的影響，為該場次較有水準之論文。

晚學的論文被大會安排在 8 月 26 日 (星期二) 早上的第一個場次 (8:30-10:30, Economics Session) 發表，本場次共安排六篇論文 (敬請參見附件一，議程第 13-14 頁)，但原定順序第四篇 (#216) 的論文發表人 (淡江大學之 Shui Lien Chen 及 Chung Hui Tu) 於本場次結束前皆未出現，故最後僅有五

篇論文發表。其中，第一篇論文為逢甲大學國貿系許鈺珮副教授所發表，探討對外投資型態（獨資或合資）如何受廠商特性（總要素生產力）影響，並以 Kolmogorov-Smirnov (KS) test 進行無母數統計檢定，實證結果發現，同時採用兩種策略的廠商之總要素生產力較只採其中一種的廠商來得高。

第二篇論文為晚學所發表之論文 “Forecasting the Semiconductor Industry Growth: A Bayesian Model Averaging Approach” (敬請參見附件二)，以貝氏模型平均法 (Bayesian Model Averaging, BMA) 預測半導體產業之成長率。有別於以往文獻主觀地選取預測迴歸式之解釋變數，本文採取客觀之統計分析方法，計算 70 個潛在解釋變數的後驗納入機率 (posterior inclusion probability) 後，再據此計算潛在模型的平均預測值，實證結果顯示，以 BMA 進行的中、長期 (medium- and long-term) 樣本外預測 (out-of-sample forecast) 結果比隨機漫步 (random walk) 模型及最佳配適 ($R^2=0.98$) 之單變量自我迴歸移動平均 (univariate ARMA) 模型來得優異，擔任場次主席之 Ahmed Mehrez 教授 (Qata University) 與同場次之 Peter Oyelere 教授 (United Arab Emirates University) 皆對此研究方法表示興趣，並建議可向半導體廠商推銷此預測方法。

此外，第三篇論文由來自土耳其的 Aysen ARAC (Hacettepe University) 所發表，以歐元區實證資料驗證短期與長期利率預期假說 (Expectations Hypothesis of Interest Rates)；第四篇論文由印尼的 Ahza Rasyid (Institut Teknologi Bandung) 發表，以簡單的時間序列方法預測電信公司網路服務需求；最後一篇論文由 United Arab Emirates University 的 Peter Oyelere 教授發表，探討阿拉伯聯合大公國廠商的成本與銷售額的不對稱反應現象。整體而言，本場次的五篇論文品質均較晚學於 8 月 25 日下午及 8 月 26 日所參加的其他場次 (11:00-13:00 Finance, 14:00-16:00 Banking, Economics and Finance, 16:15-18:15 Finance) 的論文來的嚴謹。所有大會論文於 8 月 26 日 18:15 報告完畢。

8月27日晚學搭乘新加坡地鐵 (Mass Rapid Transit, MRT) 前往數個新加坡著名景點參觀，如魚尾獅公園、金沙飯店及空中花園及聖淘沙的名勝世界。最後，於103年8月28日下午13:10搭乘長榮航空公司BR226班機，於18:00返抵國門，結束本次出國訪問。

三、心得與建議

1. 本次為晚學第一次參加 World Business Institute 主辦之亞太商業研究國際研討會，相較於以往參加美國西部國際經濟學會 (Western Economics Association International, WEAI) 所舉辦之國際研討會，本次會議論文品質較參差不齊，以後如有機會，可能會優先考慮 WEAI 所主辦之國際研討會。
2. 同場次有臺灣學者報名後卻未出席研討會發表論文 (no show)，對臺灣國際學術形象有嚴重的負面影響。建議科技部對這些 no show 學者進行瞭解及道德勸說。
3. 新加坡地狹人稠，但在發展觀光與吸引外資上展現比臺灣更大的企圖心。以成功招攬美國金沙集團與馬來西亞雲頂集團為例，這兩個集團所帶來的外資與工作機會的確為新加坡的觀光業注入一股活泉。臺灣擁有許多比新加坡人造景點 (如魚尾獅公園、金沙飯店及空中花園或名勝世界) 條件更好的天然美景 (如太魯閣、玉山、雪霸國家公園、阿里山、溪頭)，可惜這些景點並無完善之外語 (主要為英語) 告示導覽系統，使歐美自助觀光客望之卻步。相較之下，新加坡之主要共同語言為英語，所有街道及地圖皆有完整英語告示，因此，街道上所見之歐美觀光客比例相對較高。建議經濟部觀光局如果有心提升觀光業，吸引消費能力較高之歐美觀光客來台旅遊，未來應加強外語導遊人才的培訓及外語導覽系統的建置。
4. 相較於新加坡貨運量為全球第一，臺灣雖擁有基隆、台中、高雄及花蓮等四座條件更好、腹地更深之國際大港，近年貨運量卻年年下滑。雖然政府已注

意到此現象，並將原本港務局改組為民營之臺灣港務公司，期盼如桃園國際機場改組為民營公司後浴火重生，但政府相關配合單位（如海關）之行政效率的提升卻也需同步進行。

5. 樟宜機場的出關速度（尖峰時間約需等候 50 分）並不比桃園機場快，但其旅客行李裝卸速度卻明顯優於桃園地勤公司。建議桃園機場應重視並積極改善此現象，減少旅客等候行李時間。
6. 新加坡賭場對於非國際觀光客之本國人收取每次新幣 100 元（約新台幣 2400 元）之入場門票，在吸引國際觀光客的同時，亦可避免新加坡國人沈迷於賭博，值得經濟部未來開放博奕事業時參考。

四、附件

附件一 會議議程

7th Asia-Pacific Business Research Conference

PROGRAM

25 – 26 August, 2014

Theme: “Research for Development”

Venue: Bayview Hotel Singapore
30 Bencoolen Street, Singapore 189621
Ph: +65 6337 2882

*****IMPORTANT: Bayview Hotel is located on Bencoolen Street, however access to the hotel via this street is temporarily closed due to construction on the road. Therefore you have to enter the hotel from the back via a small pathway called ‘Lor Payah’ which is off Waterloo Street that runs parallel to Bencoolen Street. If you are arriving via taxi, please mention this information to them.**

Prof. Dr. William Lim
York University
Canada
Conference Chair

Prof. Dr. Mohammad Zia-ul Hoque
World Business Institute
Australia
Conference Coordinator

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Global Review of Accounting and Finance | Journal of Accounting Finance and Econ
Journal of Islamic Finance and Business Research***

Please Carefully Read all Instructions Below

• How to Reach the Conference Venue

The 7th Asia-Pacific Business Research Conference is being held at Bayview Hotel Singapore which is 22 KM away from Changi Airport which is well connected by train which is known as MRT. Please follow the sign and direction at the airport for Train. You can buy train ticket at the airport and drop at Dhoby Ghaut MRT station. Bayview Hotel is in walking distance and is located at 30 Bencoolen Street, Singapore 189621. For more information you may contact the hotel via following details- Tel : (65) 6337 2882 Fax : (65) 6338 2880 Email : bayviewsingapore@bayviewhotels.com and Website: www.bayviewhotels.com/singapore

Alternatively, you can take a taxi and go to your hotel or directly come to the conference venue from the Airport. Taxis in Singapore run on metre and are very safe for travel. Please use the marked taxis only. At Changi airport, please follow the signs for taxi as there is a stand at the airport and you may have to line up for a taxi during peak periods. The ride from the airport to the hotel is upto 30 minutes long.

The hotel is also conveniently located only 2 KMs from the city centre or 5 minutes by taxi. The nearby attractions are:

- Raffles City Shopping Centre
- Suntec City Convention Centre
- 24-hour food courts around the area
- Orchard Road
- Little India
- The Singapore Art Museum
- Bugis Village
- Marina Square
- The National Museum

• How to Complete Registration?

When you reach the hotel, please proceed to the conference rooms. The registration desk will be located inside **conference room Emerald 2 located on the 4th Floor**. If you cannot find the room, please ask the Hotel Reception Desk to direct you for the conference room.

Please report either to Prof. Dr. Hoque and/or Mrs. Khaleda Akhter for your registration. If you have already fully paid for the registration, you will receive a yellow envelope which will contain the following items:

- Your Name Tag
- Payment Receipt
- Participant Certificate (please note that only attending authors will receive a participant certificate for ethical reasons, Co-authors will not receive this certificate unless they pay for registration and attend the conference. Please also note that the Participant certificate does not include the paper title or the authors of the paper. It is just a certificate to prove that you did attend and participate in the conference)
- Conference Program

- Lunch Coupons- (these will be at the back of your name card pockets)

If you have not yet paid your registration fees, please complete your cash payment on arrival. **We do not accept any other mode of payment except cash in American dollars (we will NOT accept Singaporean Dollars or any other currencies) and please bring exact money as no change will be given there and hope you will not negotiate with us for other mode of payment such as bank cheque or credit cards.** Please collect your envelope which will contain all of the abovementioned materials.

The name badge is required for all participants/spouse/guests to participate in all sessions/events, refreshments, buffet lunch, receptions, tea/coffee breaks and dinner.

- **Presentation Rooms and Conference Secretariat**

We will be using two rooms on both days called **Emerald 1 and Emerald 3**. There will be signs posted to help you locate the rooms and the conference secretariat but if you are still unable to locate us please ask the hotel reception about where **Emerald 2** room is for conferences.

- **What You Should Bring Along For Your Presentation**

OPTIONAL:

Please bring in 15-20 copies of your (printed) paper (power point slides or full paper) for distribution at your session to other participants (**this is optional**).

MANDATORY:

Please print out at least 1 copy of your full paper and hand it to the chair of the session at the beginning of your presentation.

If you do not provide a copy of the full paper to the session chair or the conference organisers, we will be unable to email you an evaluation report for your paper.

Each author will have about 15 minutes for presentation and 5 minutes for questions and discussion. **We suggest you to spend less time (not more than 5 minutes) on introduction and literature review sections of your paper. Please focus and spend more time (the remaining 10 minutes) on your model, data, result analysis/findings and significance or implication of your research.**

Every room has LCD and laptop computer and please bring your pen-drive or USB stick for power-point presentation. However, we do not guarantee that they will work without any failure. Please do not embarrass us by asking for pen-drive as we do not prove this.

In the past, we have faced issues where authors have put their USB in their unaccompanied luggage which did not arrive with them or they have emailed the presentation to themselves. We **highly recommend** that you carry your USB with you at all times and not put it with your unaccompanied luggage and that you also do not just email the presentation to yourself. You should save your presentation on a USB stick as well.

*****Please ensure that you save your presentation file both in 2003 and 2007/2010 versions incase the computers do not support the latest version._If you have only a**

2007 version and the laptops provides only 2003 office software, we will not take any responsibility for converting your presentation from 2007 to 2003.

*****Please note that we do not offer any internet access at the conference venue. However you may obtain wifi password from the reception desk of the hotel which may be available at extra cost which is payable by you.**

- **What About Tea/Coffee Break and Lunch?**

Break-foods and Tea/coffee in the morning and afternoon will be served inside room Emerald 2. Buffet Lunch will be provided at the **Bayview Café located on 1st Floor**. We will have a reserved section for seating in the restaurant for our conference delegates. When entering the restaurant, please hand over your lunch voucher, that will be at the back of your name tag, to our representative who will be standing at the front of the restaurant. Please take note that this is a buffet lunch with selection of many different foods catered to all. The area is a smoke-free environment and please respect this requirement.

For Muslim Delegates halal meat has been arranged separately, in addition to the buffet menu - please let staff at the restaurant and Prof. Hoque know if you have this special dietary requirement. Please take note that you can eat fish, rice, noodles, bread, vegetables and salad, in addition to Halal meat if you are a Muslim.

*****PLEASE NOTE: If you do not attend lunch on either day 1 or day 2, you cannot use the other coupon to feed your family members or friends as we have a set number of people we have ordered the lunch for on the 2 separate days.**

- **Conference Proceedings**

As informed previously, conference proceedings with ISBN 978-1-922069-58-0 will be provided electronically. Please visit www.wbiworldconpro.com to view your paper after 23 August 2014. Please read the instructions there and then view or download your and/or other authors' papers. Please note that a number of authors have asked only for the abstract of their paper to be published in the proceedings. Those who have not yet paid for their registration, your paper will only be published in the proceedings once the payment has been made/ received by us.

The proceedings will be there for a number of years which is visited by the readers from the globe. We remind the authors that we will upload the paper or abstract as per the option you have indicated in the registration form. Once your paper or abstract is uploaded, you cannot change it again in any form unless you pay US\$100 for any change.

- **Best Paper Award**

Best paper is selected on the basis of 1. Originality 2. Research Rigor 3. Contribution to the body of knowledge and 4. Relevance to current and emerging issues. The papers are considered on the basis of the evaluation by the reviewers and the assessment made by the members of the panel. Panel members will observe and assess the presentation of the short-listed authors and then report to the conference team. The name of the winners will be announced via email 2 - 3 weeks after the conference. Papers selected as "Best Papers"

will be published in the Journal of Business and Policy Research, after compliance to the editorial review report. If you do not wish to publish the paper in this journal please advise us. The winners will receive an award certificate and fellowship certificate from the World Business Institute.

- **Paper Evaluation Report (PER) and Editorial Review Report (ERR)**

Unlike other conferences in the world, we provide written feedback on your paper in the form of Paper Evaluation Report (PER). This report will be sent to the authors via email within 2 months after the conference. Please do not contact us in between this time regarding these reports. However, if you do not receive them by this deadline, then contact us via email: njahanwbi@gmail.com

Please note that even if you have paid to attend the conference but you do not present the paper at the conference, then you will not receive a PER for your paper. Similarly, if you collect your registration envelope pack but do not present your paper, the department in your university will be notified.

For those of you who have paid for publication of your paper in our journals, you will receive Editorial Review Report (ERR) within 5-6 months after the conference, in addition to the PER.

- **Publication of Your Paper (Please read carefully)**

All accepted papers recommended by the reviewer (see your acceptance letter point number 2 to know the name of the journal) for a particular journal will be published provided that you have paid submission fee and complied to the review report, editorial comments, feedback at the conference and journal's guidelines. You are required to send us your revised full paper (after compliance to the PER and ERR and editorial observations, comments, if any, you received at the conference) within 2 months after we send you the ERR.

If your invitation and acceptance letter does not mention any journal name, it means that your paper was not accepted for any of our journals, However, if you improve your paper according to the feedback you receive at the conference and/or via review report, we can reconsider the paper for journal publication at that stage. Please note that it is not guaranteed that your paper will be selected for a journal even after the revisions.

If you have already paid publication fee, you **must indicate in red ink** the new or additional materials you have added or inserted in compliance to written feedback and/or comments at the time of revision. **We will endeavour, though not guaranteed, to publish your paper within six-nine months after the conference** if you comply fully to all requirements and requests. No reminder notice will be sent. **If you do not send your revised paper by the deadline** or if you **failed to comply in full to the review reports** within the due time set by us and do not comply to our any request for reorganising the paper as per journals' guidelines or fail to make the paper camera-ready or do not respond to our emails within 6 months after the conference, **your paper will not be published and no money or fee will be refunded.**

If your paper has already been accepted for our journal and you have not paid any publication fees but are interested to publish can make cash payment at the registration desk. The cost of Print and online publication is USD \$350 or for online publication only is USD \$200. If you would like to pay at a later time, then please contact Nuha Jahan via njahanwbi@gmail.com to arrange this.

- **Who to Contact**

For any issues relating to conference matters please contact Prof. Dr. Hoque on +614 11 496 791 (Australian mobile number)

- **Correspondence After Conference**

If you have any concerns or questions after the conference, please contact Ms. Nuha Jahan via our email address njahanwbi@gmail.com. Please do not send any email to singaporepaps@gmail.com as this email address will be unmonitored after 26 August 2014.

- **Future Conferences**

If you would like to join our future conferences, please continuously visit our website www.wbiworld.org to find out more information. You can also follow us on facebook by liking our page “World Business Institute” or follow Nuha Jahan on Linked in by sending her a request..

- **List of Participating Countries**

The 7th Asia-Pacific Business Research Conference is proud to welcome delegates from 22 countries of the world.

Australia, Bahrain, Brazil, Czech Republic, France, Germany, India, Indonesia, Iran, Japan, Kuwait, Malaysia, Nigeria, Philippines, Qatar, Sri Lanka, Taiwan, Thailand, Turkey, UAE, UK, Uzbekistan.

- **Conference Team**

Conference Administrator, Events/ Publication Director: Ms. Nuha Jahan, WBI, Australia

Marketing Director: Mr. Tanzil Hoque, WBI, Australia

Managing & Finance Director: Mrs. Khaleda Akhter, WBI, Australia

Technical Manager: Mr. Abdul Quddus Prodhan, WBI, Australia

Conference Program Outline

Registration Desk Located inside Room Emerald 2, 4th Floor

Presentation Room: Emerald 1 and Emerald 3, 4th Floor

Monday 25 August, 2014

| | |
|----------------------------|--|
| 7.15 AM - 5.00 PM | Conference Registration Inside Emerald 2, 4th Floor |
| 8.45 AM - 10.45 AM | Paper Presentations: Finance Track: Emerald 1 Management Track: Emerald 3 |
| 10.45 AM – 11.15 AM | Morning Tea Break Inside Emerald 2 |
| 11.15 AM – 1.00 PM | Paper Presentations: Economics Track: Emerald 1 Marketing Track: Emerald 3 |
| 1.00 PM - 2.00 PM | Lunch Bayview Café- 1st Floor |
| 2.00 PM – 4.00 PM | Paper Presentations: Banking Track: Emerald 1 Accounting and Finance Track: Emerald 3 |
| 4.00 PM – 4.15 PM | Afternoon Tea Break Inside Emerald 2 |
| 4.15 PM – 6.15 PM | Paper Presentations: Finance Track: Emerald 1 Management Track: Emerald 3 |

Conference Program Outline (cont...)

Registration Desk Located inside Room Emerald 2, 4th Floor

Presentation Room: Emerald 1 & 3, 4th Floor

Tuesday 26 August, 2014

| | |
|----------------------------|---|
| 8.00 AM – 4.00 PM | Conference Registration Inside Emerald 2, 4th Floor |
| 8.30 AM - 10.30 AM | Paper Presentations: Economics Track: Emerald 1 Management Track: Emerald 3 |
| 10.30 AM – 11.00 AM | Morning Tea Break Inside Emerald 2 |
| 11.00 AM – 1.00 PM | Paper Presentations: Finance Track: Emerald 1 Management & Marketing Track: Emerald 3 |
| 1.00 PM - 2.00 PM | Lunch Bayview Café- 1st Floor |
| 2.00 PM – 4.00 PM | Paper Presentations: Banking, Economics & Finance Track: Emerald 1 Management Track: Emerald 3 |
| 4.00 PM – 4.15 PM | Afternoon Tea Break Inside Emerald 2 |
| 4.15 PM – 6.15 PM | Paper Presentations: Finance Track: Emerald 1 |

~~~ End of Conference ~~~

Monday 25 August

8.45 AM – 10.45 AM

Room: Emerald 1

Session: Finance

Session Chair: Prof. William Lim, York University, Canada

312: Time-series Properties of Earnings: First Evidence from the Georgian Stock Exchange: Erekle Pirveli and Jochen Zimmermann, University of Bremen, Germany.

325: The Impacts of Off-Balance Sheet Types and Investment Positions on Investors' Judgments: Huda Wongyim, Chulalongkorn University, Thailand.

336: Corporate Governance Disclosure- A Comparative Analysis of Countries at Different Stages of Economic Development: Shaheen Sultana, Curtin University, Australia.

309: Japanese Candlestick Technical Trading Strategies in Indonesia Capital Market: Kevin Alvoti and Deddy P. Koesindartoto, Institut Teknologi Bandung, Indonesia.

311: Investment Decision Based on Financial Performance Analysis and Market Approach Valuation of Indonesian Estate Crops Industry: Annisa Putri Distya and Ana Noveria, Institut Teknologi Bandung, Indonesia.

308: Pecking Order Theory of Non-Financial Firms in Indonesia Included at LQ-45 Index: Aditya Dharma Andriano and Anggoro Budi Nugroho, Institut Teknologi Bandung, Indonesia.

Monday 25 August

8.45 AM – 10.45 AM

Room: Emerald 3

Session: Management

Session Chair: Dr. Izzal Asnira Zolkepli, Universiti Sains Malaysia, Malaysia

453: A Survey of Social Media Use by Travellers Visiting Thailand: Voraphan Raungpaka, Mahidol University, Thailand and Thanachart Ritbumroong, King Mongkut's University of Technology Thonburi, Thailand.

434: A Study on the Management Styles among MSME Owners in the City of Manila: Leonardo F. Cada, Far Eastern University, Philippines.

442: Assessing the Hierarchical Construct Model for Social Media Utilization from the Perspective of Psychological Gratification: Izzal Asnira Zolkepli, Universiti Sains Malaysia & Yusniza Kamarulzaman, University of Malaya, Malaysia.

427: Work-Life Balance: 'Family Life' or 'Personal Life': Khairuddin Naim Mohd Zain, Sharmila Jayasingam, Andri Zainal and Lee Su Teng, University of Malaya, Malaysia.

455: Key factors Influencing Purchasing Behavior in Gold Ornament: Navarwan Chaisuriyathavikun and Prattana Punnakitikashem, Mahidol University, Thailand.

Monday 25 August

10.45 AM – 11.15 AM

Emerald 2

“Morning Tea Break”

Monday 25 August

11.15 AM – 1.00 PM

Room: Emerald 1

Session: Economics

Session Chair: Dr. Harsh Pathak, Supreme Court of India, India

209: Analysis of Financial Performance of Plastic Industry of Gujarat for the Comparison among the Years of Selected Period: Harshad Tandel, Veer Narmad South Gujarat University, India.

220: Uncertainties in Wind Power Production Estimates: Asror Nigmonov, Management Development Institute of Singapore in Tashkent, Uzbekistan.

224: Big Data Processing Using Map Reduce Foreign Exchange (EUR/USD Currency Pair): Say Er Lim, Hui Kim Law, Saeed Aghabozorgi, University of Malaya, Malaysia and Ying Wah The.

229: Double Tax Avoidance Agreements – Consequential Taxability: Harsh Pathak, Advocate Supreme Court of India, India.

230: Cocoa Bean Prices Forecasting Using GARCH Model for Long Term Strategic Production and Hedging Strategies: Adrianus Agassi and Ana Noveria, Institut Teknologi Bandung, Indonesia.

Monday 25 August

11.15 AM – 1.00 PM

Room: Emerald 3

Session: Marketing

Session Chair: Dr. Nor Hazlina Hashim, Universitii Sains Malaysia, Malaysia

510: Niche Marketing Study: Determine a Potential Target Market for Lokananta Studio: Steven Bunjamin, Institut Teknologi Bandung, Indonesia.

513: The Effect of Mobile Advertising Message Content on Consumer Purchase Intention: Nor Hazlina Hashim and Izzal Asnira Zolkepli, MalaysiaUniversiti Sains Malaysia, Malaysia.

516: The Cognitive-Affective-Conative Model of Restaurant Image: Chih-Peng Chu, Cedric Hsi-Jui Wu and Yu-Ling Su, National Dong Hwa University, Taiwan.

519: A Study on the Social Influence Process of a Virtual Community: Cedric Hsi-Jui Wu and Hsiao-Chun Liao, National Dong Hwa University, Taiwan.

514: Consumers' Attitude Toward Shopping through Instagram Social Media: Pingkan Putri Dariswan and Mia Tantri Diah Indriani, Institut Teknologi Bandung, Indonesia.

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| Monday 25 August | 1.00 PM – 2.00 PM | Bayview Café – 1st Floor |
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“Lunch Break”

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| Monday 25 August | 2.00 PM – 4.00 PM | Room: Emerald 1 |
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Session: Banking

Session Chair: Prof. Dr. Mohammad Hoque, World Business Institute, Australia

607: Understanding Capital Position of Indian Banks with reference to Basel III Guidelines: Giri Seshadri R, Institute for Financial Management and Research, India.

609: Bank Lending Operations in the SME Market – A Case Study from Singapore: Keith Pond, Loughborough University, UK.

610: Analyzing Determinants of Bank Performance in Indonesia-Case Study: 19 Big Banks Period 2008-2013: Nita Nofita R and Achmad Herlanto Anggono, Institut Teknologi Bandung, Indonesia.

612: Macroeconomic Stress Testing for Banking Sector in Indonesia: Noor Irsalina and Ir. Budhi Arta Surya, Institut Teknologi Bandung, Indonesia.

613: Forecasting 2015 Indonesian Central Bank Interest Rate: Sabila Maharani and Sudarso Kaderi Wiryono, Institut Teknologi Bandung, Indonesia.

614: Detecting Early Indicators of SMEs Failure: Survival Analysis Techniques: Asma Marouani and Annie Bellier, Cergy-Pontoise University, France.

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| Monday 25 August | 2.00 PM – 4.00 PM | Room: Emerald 3 |
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Session: Accounting and Finance

Session Chair: Mr. Asror Nigmonov, Management Development Institute of Singapore in Tashkent, Uzbekistan

103: Auditors' Perception of the Adoption and Use of Electronic Work Papers Systems in Thailand's Audit Firms: Nongnuch Laomaneeerattanaporn and Prachit Hawat, Chulalongkorn University, Thailand.

313: The Relationship of Financial Performance and Macro Economic on Stock Return in Indonesia: Karin Natasyah and Ana Noveria, Institut Teknologi Bandung, Indonesia.

316: Capital Structure and Leverage Adjustment in Indonesian State Owned Enterprise: M. Ali Bazthomy Wakhidi and Subiakto Sukarno, Institut Teknologi Bandung, Indonesia.

318: Risk Mitigation of Bali Toll Road: Nadia Nurul Miladia and Sudarso Kaderi Wiryono, Institut Teknologi Bandung, Indonesia.

324: Optimal Dividend Policy Analysis in Large Scale Indonesia Company: Hans Reinaldi and Anggoro B. Nugroho, Institut Teknologi Bandung, Indonesia.

334: Analysis of Blood Bag Inventory Management: A Case Study of a Red Cross in Indonesia: Tifarie Luesas and Gatot Yudoko, Institut Teknologi Bandung, Indonesia.

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| Monday 25 August | 4.00 PM – 4.15 PM | Emerald 2 |
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“Afternoon Tea Break”

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| Monday 25 August | 4.15 PM – 6.15 PM | Room: Emerald 1 |
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Session: Finance

Session Chair: Mr. Erekle Pirveli, University of Bremen, Germany

328: The Effect of Foreign Company Acquisition by Pt Semen Indonesia (Persero) Tbk in Financial Performance: Muhammad Rahman L.W. and Sudarso K.Wiryono, Institut Teknologi Bandung, Indonesia.

333: Dynamic Capital Structure Adjustment towards Target Optimal Capital Structure Evidence from Indonesia: Ridho Bakti and Subiakto Soekarno, Institut Teknologi Bandung, Indonesia.

337: Testing Static Trade-off Theory in Indonesian Listed Firms: A Case Study, Period 1995 – 2012: Tiffany Chrisy Monika Sitompul and Ir. Subiakto Soekarno, Institut Teknologi Bandung, Indonesia.

341: Determinants of Capital Adequacy Requirements (CAR) for Credit Risk Weighted Assets on 19 Conventional Banks in Indonesia Period Year 2008-2013: Yohanna Karina and Achmad Herlanto Anggono, Institut Teknologi Bandung, Indonesia.

339: Financial Literacy Assessment in Record Keeping among Women Micro-entrepreneurs: Basis for Literacy Enhancement Program: Ma. Cedocia N. Oco, Partido State University, Philippines.

322: The influence of ROE, NPM, EPS, PER and PBV toward Stock Return of LQ45 Index during 2004-2013: Dhika Febrianov and Anggoro Budi Nugroho, Institut Teknologi Bandung, Indonesia.

Monday 25 August

4.15 PM – 6.15 PM

Room: Emerald 3

Session: Management

Session Chair: Miss. Asma Marouani, Cergy-Pontoise University, France

405: Application of Leadership and Personal Competencies for Augmented Managerial Performance: Empirical Evidence from Indian Manufacturing Units: Sambedna Jena and Chandan Kumar Sahoo, National Institute of Technology, India.

448: The Relationship of Learning Organization, Knowledge Management and the Performance of Rajabhat Universities' Hotel Business in Thailand: Supanchalee Onchaiya, Uttaradit Rajabhat University, Thailand.

451: Organizational Commitment, It Infrastructure and Accounting Information System's Quality: Rini Indahwati and Nunuy Nur Afiah, Padjajaran University, Indonesia.

452: Sustainability of E-Business through Effective Risk Management: Authentication of the Risk Driven E-Transformation Model: Kasuni Weerasinghe, University of Colombo, Sri Lanka.

445: Analyzing Factors That Affect Musician to Enter the Music Industry in Indonesia: Faisal Dhiqsan Abdurrachman, Institut Teknologi Bandung, Indonesia.

Tuesday 26 August

8.30 AM – 10.30 AM

Room: Emerald 1

Session: Economics

Session Chair: Dr. Ahmed Mehrez, Qatar University, Qatar

202: Firm Productivity and Mode of Foreign Expansion: Evidence from Taiwanese Manufacturing Firms: Judy Hsu, Feng Chia University, Taiwan.

203: Forecasting the Semiconductor Industry Growth: A Bayesian Model Averaging Approach: Wen-Hsien Liu and Shu-Shih Weng, National Chung Cheng University, Taiwan.

204: Expectations Hypothesis of Interest Rates in the Euro Area: New Evidence from a Nonlinear Approach: Ayşen ARAÇ and Ayşegül GÜLLÜ, Hacettepe University, Turkey.

216: Expenditure Tendencies of Pet Owner: Influence of Pet Utilities: Shui Lien Chen and Chung Hui Tu, Tamkang University, Taiwan.

226: Forecasting The Demand for PT Telkom's Internet Service Using Time Series Analysis: Ahza Rasyid and Akbar Adhiutama, Institut Teknologi Bandung, Indonesia.

215: Asymmetric Response between Costs and Sales for Companies in the UAE: Fernando Zanella, Peter Oyelere and MD Shahadut Hossain, United Arab Emirates University, United Arab Emirates.

Tuesday 26 August

8.30 AM – 10.30 AM

Room: Emerald 3

Session: Management

Session Chair: Prof. Dr. Mohammad Hoque, World Business Institute, Australia

444: Criteria for Evaluation of e-Governance Toolkit: Ahmed Al Arabi and K. Vizaya Kumar, Ahlia University, Kingdom of Bahrain.

407: Is Substantial Family Influence a Good Measure of Family Involvement? Evidence from the Czech Republic: Ondřej Machek and Jiří Hnilica, University of Economics, Czech Republic.

418: Cost Analysis in European House Furnishing Project 2014 for Waterproofing on Metal Roof by PT XYZ: Rena Gracia and Ir. Drs. H. Arson Aliludin, Institut Teknologi Bandung, Indonesia.

438: Implication of Product Portfolio in Strategic Approach for Small Business: Welisha Firdausi Drieno and Mia Tantri Diah Indriani, Institut Teknologi Bandung, Indonesia.

441: The Influence of Psychological Types towards Employee Engagement Driver: Fawziani Inggrita Agniputri and Aurik Gustomo, Institut Teknologi Bandung, Indonesia.

421: Relationship between Way of Life and Identity of Ethnic Groups in Supporting Social Enterprise Entrepreneurs in Maehongson Province, Thailand: Chutimun Sasong and Boonthawan Wingwon, Lampang Rajabhat University, Thailand.

Tuesday 26 August

10.30 AM – 11.00 AM

Emerald 2

“Morning Tea Break”

Tuesday 26 August

11.00 AM – 1.00 PM

Room: Emerald 1

Session: Finance

Session Chair: Dr. Istianingsih Sastro Diharjo, Mercubuana University, Indonesia

332: Frequent-Pattern Tree Algorithm Application to S&P and Equity Indexes: E. Younsi, H. Andriamboavonjy, A. David, S. Dokou and B. Lemrabet, ECE Paris School of Engineering, France.

330: Analysis of Macro-Economic Variables on the Equity Funds Performance in 2008 until 2013: Rizky Fitriani Junaedi and Sylviana Maya Damayanti, Bandung Institute of Technology, Indonesia.

317: Determinants of Dividend Payout Ratio in Indonesia Mining Sector: Daniel Budisatrio Martua and Isrochmani Murtaqi, Institut Teknologi Bandung, Indonesia.

342: Research Proposal: Implementing New Leasing Services in Uzbek Leasing Market: Allayar Mambetkarimov and Ulugbek Nizamov, Management Development Institute of Singapore at Tashkent, Uzbekistan.

340: The Effects of Board Structure on Strategy In Japanese Corporations: Takahiro Nishi, Meiji University, Japan.

326: The Role of Good Corporate Governance in Reducing The Asymmetry of Information Through The Disclosure of Intellectual Capital: Istianingsih Sastrodiharjo, University of Mercu Buana, Indonesia.

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| Tuesday 26 August | 11.00 AM – 1.00 PM | Room: Emerald 3 |
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Session: Management and Marketing

Session Chair: Mrs. Raumporn Mala, Lampang Rajabhat University, Thailand

431: Effects of Participation of Community and Way of Life toward the Development of Small Enterprises: Case Study of Processed Woods Entrepreneurs, Hangchat District, Lampang Province, Thailand: Boonthawan Wingwon, Thanakorn Noithonglek, Mayuree Promthep and Atchara Meksuwan, Lampang Rajabhat University, Thailand.

420: Influence of Integrated Strategic Resources toward Competitive Advantage of Lanna Enterprises Cluster in Thailand: Ardchawin Jaikaew, Boonthawan Wingwon, Lampang Rajabhat University, Thailand and Pichaphob Panphae, Payap University, Thailand.

509: Prospect Analysis of PT Tiga Pilar Sejahtera Food Tbk : Study of Indonesian Fast Manufacturing Consumer Good Company: Agnes Maria Thea Phandu and Subiakto Soekarno, Institut Teknologi Bandung, Indonesia.

511: Is Adaptation Significant in Education?: Umidakhon Narimanova, Management Development Institute of Singapore in Tashkent, Uzbekistan.

512: The Provision of Trustworthy Online Dispute Resolution for Business to Consumer Electronic Disputes: Fahimeh Abedi and John Zeleznikow, Victoria University, Australia.

518: Study of Post-Churn Impacts on Brand Image in Telecommunication Sector: Mustafid Aumar, Institut Teknologi Bandung, Indonesia. [PROXY]

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| Tuesday 26 August | 1.00 PM – 2.00 PM | Bayview Café – 1 st Floor |
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“Lunch Break”

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| Tuesday 26 August | 2.00 PM – 4.00 PM | Room: Emerald 1 |
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Session: Banking, Economics and Finance

Session Chair: Miss. Qandeel Baloch, Assumption University Bangkok, Thailand

601: Training and Development in Banks: Two exploratory cases from Qatar: Ahmed Mehrez, Qatar University, Qatar.

611: A Study of Influencing Factors towards Customer Loyalty: A Case Study of Islamic Bank of Thailand: Qandeel Baloch and Sirion Chaipoopirutana, Assumption University, Thailand.

206: A New Network Data Envelopment Analysis Model by Balanced Scorecard Approach for Projects Efficiency Evaluation: Morteza Shafiee, Islamic Azad University, Shiraz Branch, Iran.

221: Do Real Exchange Rate and Exchange Rate Volatility Derives FDI Inwards? Panel Data Evidence: Mohammad I. Elian, Gulf University for Science and Technology, Kuwait.

310: Closing Price Manipulation in Indonesia Stock Exchange: An Empirical Evidence during Financial Crisis 2008-2009: Steven Gunawan and Deddy P. Koesindartoto, Institut Teknologi Bandung, Indonesia.

314: Optimal Capital Structure Analysis for Energy Companies Listed in Indonesia Stock Exchange: Nadhila Qamarani, Institut Teknologi Bandung, Indonesia.

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| Tuesday 26 August | 2.00 PM – 4.00 PM | Room: Emerald 3 |
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Session: Management

Session Chair: Prof. Vizaya Kumar Karumanchi, Ahlia University, Bahrain

412: The Impact of Executive Compensation on the Financial Performance of Quoted Banks in Nigeria: Sani Kabiru Saidu, Bayero University Kano, Nigeria.

423: The Effect of Human Resource Management and Creative Corporate Culture on Small- and Medium-Sized Export Enterprises in Upper Northern Thailand: Kritsada Maneechettha, Boonthawan Wingwon, Lampang Rajabhat University, Thailand and Pichaphob Panphae, Payap University, Thailand.

424: Research Title: The Key Success of Product Innovation in Four to Five Star of the local entrepreneur, One Tambon (Sub-District) One Product (OTOP) in the Northern of Thailand: Raumporn Mala and Boonthawan Wingwon, Lampang Rajabhat University, Thailand.

425: Correlation Between Bankruptcy Score and Market Performance: Developing Altman's Z-score Model: Rifa Intania and Anggoro Budi Nugroho, Institut Teknologi Bandung, Indonesia.

446: Organizational Performance through Transformational Leadership and Organizational Learning of Exporting Gems and Jewelry Business in Thailand: Pasiri Khetpiyarat, Uttaradit Rajabhat university, Thailand.

410: Knowledge Sharing: The Influence of Organizational Citizenship Behavior: Muhammad Aamir and Faiza Aamir, University of the Punjab, Pakistan and Talat Islam, Universiti Teknologi Malaysia, Malaysia.

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| Tuesday 26 August | 4.00 PM – 4.15 PM | Emerald 2 |
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“Afternoon Tea Break”

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| Tuesday 26 August | 4.15 PM – 6.15 PM | Room: Emerald 1 |
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Session: Finance

Session Chair: Prof. William Lim, York University, Canada

315: Determining Optimal Dividend Policy for State-Owned Company and Private-Owned Company: Admiraldi Raditya Wardhana and Anggoro B. Nugroho, Institut Teknologi Bandung, Indonesia.

319: Volatility Analysis International Crude Palm Oil Price 2004 – 2014: Philbertha Genta Pramana and Achmad Herlanto Anggono, Institut Teknologi Bandung, Indonesia.

320: Financial Performance Assessment of PT Astra Agro Lestari Tbk Compared With Other Palm Oil Companies: Sovi Savira Miftah and Sylviana Maya Damayanti, Institut Teknologi Bandung, Indonesia.

329: Advantages of Investing in Sharia Financial Instruments Using Modern Portfolio Theory Approach: Muhammad Rizki Ramadhan and Anggoro Budi Nugroho, Institut Teknologi Bandung, Indonesia.

331: Analysis of Inventory Management for Perishable Materials: Case Study of Warung Pasta Restaurant Bandung: Sahinaz Sesiovira and Akbar Adhiutama, Institut Teknologi Bandung, Indonesia.

343: Investigating the Correlation between Google Trend Data with Stocks Movement of Five Commercial Banks in Indonesia: Zahra Azhalia, Institut Teknologi Bandung, Indonesia.

~~~ End of Conference ~~~

List of Participants

| Paper No. | Author Name | University | Country |
|------------------|---------------------------------------|--|----------------|
| 336 | Ms. Shaheen Sultana | Curtin University | Australia |
| 512 | Miss. Fahimeh Abedi | Victoria University | Australia |
| 444 | Prof. Vizaya Kumar Karumanchi | Ahlia University | Bahrain |
| observer | Mr. Jemnoel Assis de Oliveira | Petrobras Transporte S.A.- Transpetro | Brazil |
| observer | Dr. Rubens Teixeira da Silva | Petrobras Transporte S.A.- Transpetro | Brazil |
| observer | Mr. Augusto Werckmaister | Petrobras Transporte S.A.- Transpetro | Brazil |
| 407 | Mr. Ondrej Machek | University of Economics, Prague | Czech Republic |
| 332 | Mr. Enis Younsi | ECE Paris School of Engineering | France |
| 430 | Miss. Asma Marouani | Cergy-Pontoise University | France |
| 312 | Mr. Erekle Pirveli | University of Bremen | Germany |
| 607 | Mr. Giri Seshadri Ravi | Institute for Financial Management and Research | India |
| 209 | Dr. Harshad Tandel | Veer Narmad South Gujarat University | India |
| 229 | Dr. Harsh Pathak | Supreme Court of India | India |
| 405 | Miss. Sambedna Jena | National Institute of Technology | India |
| 610 | Ms. Nita Nofita Rahmat | Institut Teknologi Bandung | Indonesia |
| 612 | Ms. Noor Irsalina | Institut Teknologi Bandung | Indonesia |
| 613 | Mrs. Sabila Maharani | Institut Teknologi Bandung | Indonesia |
| 230 | Mr. Adrianus Agassi Rusli | Institut Teknologi Bandung | Indonesia |
| 226 | Mr. Ahza Rasyid Riyanto | Institut Teknologi Bandung | Indonesia |
| 311 | Ms. Annisa Putri Distya | Institut Teknologi Bandung | Indonesia |
| 309 | Mr. Kevin Alvoti | Institut Teknologi Bandung | Indonesia |
| 316 | Mr. Muhammad Ali Bazthomy Wakhidi | Institut Teknologi Bandung | Indonesia |
| 328 | Mr. Muhammad Rahman Listiyo Wibowo | Institut Teknologi Bandung | Indonesia |
| 341 | Dr. Yohanna Karina | Institut Teknologi Bandung | Indonesia |
| 330 | Miss. Rizky Fitriani Junaedi | Institut Teknologi Bandung | Indonesia |
| 317 | Mr. Daniel Budisatrio Martua | Institut Teknologi Bandung | Indonesia |
| 331 | Ms. Sahinaz Sesiovira | Bandung Institute of Technology | Indonesia |
| 315 | Mr. Admiraldi Raditya Wardhana | Institut Teknologi Bandung | Indonesia |
| 310 | Mr. Steven Gunawan | Bandung Institute of Technology | Indonesia |
| 314 | Miss. Nadhila Qamarani | Institut Teknologi Bandung | Indonesia |
| 320 | Miss. Sovi Savira Miftah | Institut Teknologi Bandung | Indonesia |

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|-----|--|---|-------------|
| 329 | Mr. Muhammad Rizki Ramadhan | Institut Teknologi Bandung | Indonesia |
| 319 | Mr. Philbertha Genta Pramana | Institut Teknologi Bandung | Indonesia |
| 343 | Ms. Zahra Azhalia | Institut Teknologi Bandung | Indonesia |
| 322 | Mr. Dhika Febrianov | Institut Teknologi Bandung | Indonesia |
| 334 | Miss. Tifarie Luesas | Institut Teknologi Bandung | Indonesia |
| 308 | Mr. Aditya Dharma Andriano | Institut Teknologi Bandung | Indonesia |
| 324 | Mr. Hans Reinaldi | Bandung Institute of Technology | Indonesia |
| 333 | Mr. Ridho Bakti | Institut Teknologi Bandung | Indonesia |
| 318 | Miss. Nadia Nurul Miladia | Institut Teknologi Bandung | Indonesia |
| 337 | Ms. Tiffany Chrisy Monika Sitompul | Institut Teknologi Bandung | Indonesia |
| 418 | Miss. Rena Gracia | Institut Teknologi Bandung | Indonesia |
| 438 | Dr. Welisha Firdausi Drieno | Bandung Technology of Institute | Indonesia |
| 441 | Miss. Fawziani Inggrita Agniputri | Institut Teknologi Bandung | Indonesia |
| 445 | Mr. Faisal Dhiqsan Abdurrachman | Institut Teknologi Bandung | Indonesia |
| 425 | Miss. Rifa Intania | Institut Teknologi Bandung | Indonesia |
| 451 | Mrs. Rini Indahwati | Padjajaran University | Indonesia |
| 510 | Mr. Steven Bunjamin | Institut Teknologi Bandung | Indonesia |
| 518 | Mr. Mustafid Aufar | Bandung Institute of Technology | Indonesia |
| 514 | Dr. Pingkan Putri Dariswan | Bandung Institute of Technology | Indonesia |
| 509 | Ms. Agnes Maria Thea Phandu | Institut Teknologi Bandung | Indonesia |
| 313 | Ms. Karin Natasyah | Institut Teknologi Bandung | Indonesia |
| 326 | Dr. Istianingsih Sastro Diharjo | Mercubuana University | Indonesia |
| 206 | Dr. Morteza Shafiee | Islamic Azad University, Shiraz Branch | Iran |
| 340 | Dr. Takahiro Nishi | Meiji University | Japan |
| 221 | Dr. Mohammad Elian | Gulf University of Science and Technology | Kuwait |
| 224 | Dr. Saeed Reza Aghabozorgi Sahaf Yazdi | University of Malaya | Malaysia |
| 442 | Dr. Izzal Asnira Zolkepli | Universiti Sains Malaysia | Malaysia |
| 427 | Mr. Khairuddin Naim Mohd Zain | University of Malaya | Malaysia |
| 513 | Dr. Nor Hazlina Hashim | Universiti Sains Malaysia | Malaysia |
| 412 | Mr. Sani Kabiru Saidu | Bayero University | Nigeria |
| 410 | Mr. Muhammad Aamir | University of the Punjab | Pakistan |
| 434 | Dr. Leonardo Jr. Cada | Far Eastern University- Institute of Accounts, Business and Finance | Philippines |
| 339 | Mrs. Ma. Cedocia Oco | Partido State University | Philippines |
| 601 | Dr. Ahmed Mehrez | Qatar University | Qatar |
| 452 | Mrs. Kasuni Weerasinghe | University of Colombo | Sri Lanka |
| 516 | Miss. Yu-Ling Su | Taiwan Hospitality & Tourism College | Taiwan |

| | | | |
|----------|--|--|------------|
| 519 | Miss. Hsiao-Chun Liao | National Dong Hwa University | Taiwan |
| 203 | Prof. Wen-Hsien (Lewis) Liu | National Chung Cheng University | Taiwan |
| 202 | Prof. Yu-Pei (Judy) Hsu | Feng Chia University | Taiwan |
| 216 | Miss. Shui Lien Chen | Tamkang University | Taiwan |
| 103 | Miss. Nongnuch Laomaneerattanaorn | Chulalongkorn University | Thailand |
| 325 | Mrs. Huda Wongyim | Chulalongkorn University | Thailand |
| 455 | Miss. Navarwan Chaisuriyathavikun | Mahidol University | Thailand |
| 453 | Mrs. Voraphan Raungpaka | Mahidol University | Thailand |
| Observer | Miss Maichamapon Chaisuriyathavikun | Mahidol University | Thailand |
| 448 | Miss. Supanchalee Onchaiya | Uttradit Rajabhat University | Thailand |
| 446 | Miss. Pasiri Khetpiyarat | Uttradit Rajabhat University | Thailand |
| 421 | Mrs. Chutimun Sasong | Lampang Rajabhat University | Thailand |
| 424 | Mrs. Raumporn Mala | Lampang Rajabhat University | Thailand |
| 423 | Mr. Kritsada Maneechettha | Lampang Rajabhat University | Thailand |
| 420 | Mr. Ardchawin Jaikaewon | Lampang Rajabhat University | Thailand |
| 431 | Miss Atchara Meksuwan | Lampang Rajabhat University | Thailand |
| 611 | Miss. Qandeel Baloch | Assumption University Bangkok | Thailand |
| 204 | Dr. Aysen Arac | Hacettepe University | Turkey |
| observer | Miss. Aysegul Gullu | Hacettepe University | Turkey |
| 215 | Dr. Fernando Zanella | United Arab Emirates University | UAE |
| 609 | Dr. Keith Pond | Loughborough University | UK |
| 220 | Mr. Asror Nigmonov | Management Development Institute of Singapore in Tashkent | Uzbekistan |
| 342 | Mr. Allayar Mambetkarimov | Management Development Institute of Singapore at Tashkent | Uzbekistan |
| 342 | Mr. ..Ulugbek Nizamov | Management Development Institute of Singapore at Tashkent | Uzbekistan |
| 511 | Miss. Umidakhon Narimanova | Management Development Institute of Singapore in Tashkent | Uzbekistan |

附件二 會議論文

Forecasting the Semiconductor Industry Growth: A Bayesian Model Averaging Approach

Wen-Hsien Liu*

Shu-Shih Weng[†]

ABSTRACT

It is estimated that a new semiconductor fabrication plant may cost US\$5 billion today, as the semiconductor industry has experienced huge fluctuations, ranging from a positive 70% to a negative 40% annual growth during the past 40 years. Hence, how to precisely forecast the semiconductor industry growth in order to secure the enormous investment turns out to be a concern and a challenge in the industry. By incorporating 70 potential predictors in our model, we utilize the Bayesian Model Averaging (BMA) approach to tackle this research question. It is found that the BMA model proposed in this study outperforms the random walk model and the best-fitting univariate ARMA model in the long-term prediction and can be a useful tool on forecasting the semiconductor industry growth.

Keywords: Bayesian model averaging; semiconductor; industry cycle

JEL Classification: C11, C53, L16, L63

* Corresponding author: Department of Economics and Institute of International Economics, National Chung Cheng University, Min-Hsiung, Chiayi 62102, Taiwan; E-mail: whl@ccu.edu.tw; Tel: +886-5-2720411, ext. 34124; Fax: +886-5-2720816.

[†] Institute of International Economics, National Chung Cheng University, Taiwan; E-mail: mrcom4343@hotmail.com.

1. INTRODUCTION

As a new semiconductor fabrication plant (fab) costs more than US\$5 billion nowadays, the semiconductor industry has exhibited a noteworthy cyclical pattern, ranging from a positive 70% to a negative 40% annual growth during the past few decades. Therefore, how to accurately predict the semiconductor industry growth so as to secure the enormous investment have become a public concern and a challenge for the industry practitioners. Recently, this issue has garnered much attention of academic researchers (Liu, 2005, 2007; Liu and Chyi, 2006; Chow and Choy, 2006; Tan and Mathews, 2010a, 2010b; Liu et al. 2013; Aubry and Renou-Maissant, 2013, 2014). Although various econometric methods¹ were proposed to improve the predictive accuracy in previous studies, the essential question remains unsolved: when there are many potential explanatory variables, how do we know which variables should be included in the model and how important are they?

In this study, we adopt a new methodology, the Bayesian Model Averaging (BMA) approach, to tackle this research question and evaluate it in an out-of-sample forecasting exercise. BMA addresses the model uncertainty in a regression problem and has recently received considerable attention in both the statistics and econometrics literature. The theory of BMA is originally inspired by Leamer's (1978) pioneering work. As Leamer (1983) later suggest using the extreme bounds analysis (EBA) to reduce the model uncertainty, Levine and Renelt (1992) and Sala-I-Martin (1997) further improve the methodology of EBA and effectively reduce the calculation complexity. Besides, Madigan and Raftery (1994) use the Ocam's window algorithm to help calculating the posterior model probability and make the application

¹ These methodologies used in previous studies include the vector autoregressive (VAR) model in Liu (2005, 2007), the Markov regime-switching model in Liu and Chyi (2006) and Liu et al. (2013), the discrete Fourier transform in Tan and Mathews (2010a), the Bayesian vector autoregressive (BVAR) model in Chow and Choy (2006) and Aubry and Renou-Maissant (2014) and the vector error-correction model (VECM) in Aubry and Renou-Maissant (2013).

of the BMA methodology afterwards more efficient. In addition to being widely applied in the statistics field, BMA has also been utilized in various applied econometric studies, such as output growth forecasting (Min and Zellner, 1993), cross-country growth regressions (Fernandez et al., 2001b), exchange rate forecasting (Wright, 2008), inflation rate forecasting (Jacobson and Karlsson, 2004; Wright, 2009). However, none has tried to apply it to the prediction of the industry growth and this reveals the potential contribution of our study in the literature.

In our BMA setup, the predictor set contains 70 macroeconomic, financial and industry-level potential indicators. We begin with a prior that each predictor is equally likely to be useful in the forecast of the semiconductor industry growth. The posterior weight assigned to each predictor (i.e. the importance of the variable) in period t is then based on a Bayesian updating scheme that uses only the information available at time t . The results from our out-of-sample forecasts indicate that the gains in the mean absolute prediction error (MAPE) and the mean square prediction error (MSPE) relative to the random walk model and a best-fitting univariate ARMA model are statistically significant in long-term.

The remainder of the paper is organized as follows. Section 2 briefly outlines the econometric methodology used to combine forecasts by BMA. In Section 3, we introduce the variables used in our BMA framework. The forecasting setup is then explained in Section 4. In Section 5, we compare the performance of BMA forecasts with the competing models. And lastly, Section 6 concludes.

2. BAYESIAN MODEL AVERAGING

Let us consider a set of n models M_1, M_2, \dots, M_n . Suppose the γ^{th} model is indexed by a parameter vector θ_γ . We know that one of these models is the correct model, but do not know which one. We also have prior knowledge about the probability that the γ^{th}

model is the correct model as $P(M_\gamma)$, observes data D , and updates our knowledge to compute the posterior model probability (PMP) that the γ^{th} model is the correct model:

$$P(M_\gamma|D) = \frac{P(D|M_\gamma)P(M_\gamma)}{\sum_{j=1}^n P(D|M_j)P(M_j)} ,$$

where

$$P(D|M_\gamma) = \int P(D|\theta_\gamma, M_\gamma)P(\theta_\gamma|M_\gamma)d\theta_\gamma ,$$

is the marginal likelihood of the γ^{th} model, $P(\theta_\gamma|M_\gamma)$ is the prior density of the parameter vector in this model and $P(D|\theta_\gamma, M_\gamma)$ is the likelihood. If each model represents a forecast, our overall forecast gives a particular weight to each of these forecasts by the posterior probability for that model. We only need to specify the set of models, the model priors, $P(M_\gamma)$, and the parameter priors, $P(\theta_\gamma|M_\gamma)$. Assume that the models are linear regression models. The γ^{th} model then specifies that

$$G = \alpha_\gamma + X_\gamma\beta_\gamma + \varepsilon$$

where G is a $T \times 1$ vector of observations on a variable (e.g. the semiconductor industry growth in this study) that we like to forecast, α_γ is the constant term, X_γ is a $T \times q_\gamma$ matrix of strictly exogenous predictors, β_γ is a $q_\gamma \times 1$ parameter vector, ε is the disturbance vector. The disturbances are i.i.d. with mean zero and variance σ^2 , and $\theta_\gamma = (\beta_\gamma' \sigma^2)'$.

Following the suggestion of Fernandez et al. (2001b), we assume that the probability of being the correct model for every model is the same to represent a lack of prior knowledge, so that $P(M_\gamma) = 1/n$. For the parameter priors, we follow the general trend of the BMA literature in specifying that the prior for α_γ and σ^2 , denoted by $p(\alpha_\gamma, \sigma)$ is uninformative and is proportional to $1/\sigma$, while using the g -prior specification of Zellner (1986) for β_γ , $\beta_\gamma|\sigma, \alpha_\gamma, M_\gamma \sim N(0, \sigma^2 g(X_\gamma' X_\gamma)')$, where g is the shrinkage hyperparameter and measures the strength of the prior. Here we follow the popular fixed g -prior setup of Fernandez et al. (2001a) and assume $g = 1/\max\{T, k^2\}$,

where T is the total number of observations and k is the total number of potential predictors.

3. DATA

In this study, we collect the monthly data of the semiconductor world market billings (WMB) to calculate the semiconductor industry annual growth rate (G_t), which is defined as

$$G_t = \text{dln}WMB_t = \ln WMB_t - \ln WMB_{t-12}.$$

In addition, 70 macroeconomic, financial and industry-level variables are used as its potential predictors. These predictors based on the suggestions of previous studies contain the Federal Funds Rate (FF), the Composite Leading Index (CLI) from OECD, the U.S. Industrial Production Index (IP), the Consumer Sentiment Index (CS) provided by the University of Michigan, three U.S. stock market indexes, including Dow Jones Industrial Average Index (DJ), NASDAQ Composite Index (NDQ) and the Philadelphia Semiconductor Index (SOX). In addition, several industry-level variables, such as capacity, capacity utilization ratio, bookings and billings, inventories, new orders, producer price index, value of shipments, of the semiconductor and its related up-stream and down-stream industries are included. The beginning of the sample period 1994:05-2012:10 is constrained by the availability of the Philadelphia Semiconductor Index.

We first take natural logarithm for series with large values to solve numbers extending from very big to very small in a more refined manner. Then, we perform the unit root test for all series to see if they are stationary series. If not, then the first difference will be taken to convert a series from I(1) into I(0). The detailed predictor description, data coverage, data source with basic summary statistics (including mean and standard deviation) are given in Table 1. Table 2 provides the summary of

data transformations of these variables.

4. THE FORECASTING SETUP

To gauge the forecasting ability of the competing models, we split our data into two parts. The first consists of the period from 1995:05 to 2009:02 and is utilized for the preliminary estimation of the model, while the 44 data points left behind, i.e., from 2009:03 to 2012:10, are employed for out-of-sample forecasting. Here we adopt a recursive rolling-window procedure, i.e. re-estimating the model whenever adding a new data point by holding the starting period (1995:05) fixed and letting the window grows. With the intention to meet the various forecasting demand from practitioners, policy makers and investors, we consider forecast horizons of 0, 3, 6, 9, 12, 18, and 24 months, in which 0-month-ahead forecast representing a momentary horizon, 3- and 6-month-ahead forecasts being a short horizon, 9- and 12-month-ahead forecasts standing for a medium horizon, and 18- and 24-month-ahead forecasts corresponding to a long horizon. We assume at time t only data up to time $t-1$ is available for the forecast for time $t+h$, so this can be regarded as a real-time forecast. The criterion of forecasting ability we provide in this paper for the competing models are the MAPE and the MSPE. For each month from 2009:03 on, the out-of-sample MAPE and MSPE of the BMA model were computed. All the predictors in Table 1 are used.

In addition, two time series models are considered for comparisons, the random walk (hereafter RW) model and a best-fitting univariate ARMA model (hereafter ARMA). The h -month-ahead RW forecast is based on the naive guess and defined as

$$\hat{G}_{t+h}^{RW} = G_{t-1},$$

i.e., the best h -month-ahead forecast for the semiconductor industry growth at time t is its growth rate at time $t-1$. The forecast error of the RW model is

$$\hat{\varepsilon}_{t+h}^{RW} = G_{t+h} - \varepsilon_{t+h}^{RW}.$$

On the other hand, the selection of the best-fitting ARMA is based on several criteria, such as sum of squared residuals (SSR), Akaike Information Criterion (AIC), Schwartz Bayesian Criterion (SBC) and Ljung-Box Q -statistics reported in Table 3, after visual examining the autocorrelation and partial autocorrelation functions of G_t . We begin our search with the simplest AR(1) and MA(1) models and then expand the candidates to the more complicated ARMA (p, q) models. At the end, we find that an ARMA (3, 1) model with a seasonal autoregressive (SAR) term of 12 months adequately capture the seasonal pattern and is the best-fitting ARMA model (with a R^2 of 0.98). The ARMA forecast is therefore defined as

$$\hat{G}_{t+h}^{ARMA} = \alpha_1 + \beta_1 G_{t-1} + \beta_2 G_{t-2} + \beta_3 G_{t-3} + \beta_4 G_{t-12} + \tau_1 \varepsilon_{t-1},$$

and its forecast error is

$$\hat{\varepsilon}_{t+h}^{ARMA} = G_{t+h} - \hat{G}_{t+h}^{ARMA}.$$

The prior means for α_1 , β_i and τ_1 are estimated over the pre-sample period 1995:05-2009:02 and their coefficients are reported in Table 4.

5. RESULTS

The forecast results are reported in Table 5. This table includes the out-of-sample MAPE and MSPE from the RW model, and the relative MAPE/MSPE of the ARMA and the BMA models as comparisons. Namely, we calculate the ratio of these models' prediction errors to those of the RW model at every forecast horizon. When the ratio for a competing mode is smaller than one, it indicates that the particular model may outperform the RW model in terms of forecasting ability.

From comparison of the out-of-sample MAPEs and MSPEs from the above models, a number of points emerge. First, the ARMA model represents a consistent improvement over the RW model across different forecast horizons, corresponding to

a reduction in MAPE of 16-69% or in MSPE of 31-89%. Second, the BMA model performs worst in the 0-month-ahead forecast and corresponds to an increase in MAPE of 38% or in MSPE of 78% compared to the RW model. However, there are considerable improvements over other forecast horizons, corresponding to a reduction in MAPE of 31-89% or in MSPE of 78-95%. Third, overall speaking, the ARMA model performs best in the 0-month-ahead forecast, while the BMA model dominates the ARMA model in other horizons by larger reduction in either MAPE or MSPE. It implies that the inclusion of information from the selected variables in Table 1 clearly leads to remarkable improvements in the predictive accuracy of the BMA model over the ARMA model.

To further confirm if the differences in predictive accuracy found in Table 5 are statistically significant, we conduct the Diebold and Mariano (1995) (DM) test. Given an actual series and two competing predictions, one may apply a loss criterion (such as MAPE or MSPE) and then calculate a number of measures of predictive accuracy that allow the null hypothesis of equal accuracy to be tested. Table 6 reports the DM statistics for the pairwise tests. Two essential observations are made based on the DM tests. First, it is found that the BMA model ties with the RW model in the 0-month-ahead forecast and barely beats the RW model in the 3-month-ahead forecast at the 10% significance level. Beside those two horizons, the BMA model provides consistent improvement in predictive accuracy over the RW model. Second, the DM statistics also indicate that the ARMA model performs better than the BMA model in the 0-month-ahead forecast and ties with the BMA model in the 12-month-ahead forecast. The latter finding of tie in the 12-month-ahead forecast may possibly be attributed to the inclusion of SAR(12) term (which captures the potential seasonal

effects) in the ARMA model.²

The two above-mentioned observations from the DM tests further confirm that the BMA model have a trivial edge over either the RW model or the ARMA model in the momentary and the short (0- and 3-month-ahead) forecast horizons. However, in the medium and the long horizons, the differences in the predictive accuracy are mostly verified at the 5% significance level, except for the 12-month-ahead forecast.

6. CONCLUSIONS

Forecasting the semiconductor industry growth is critical for the industry practitioners and investors given the huge capital and R&D investments each semiconductor company spends every year. However, it is difficult to decide which variables should be included in the regression and how important they are. Different from the previous studies selecting predictors subjectively, this paper shows how the BMA approach can be used to help selecting predictors objectively from a large number of potential variables. By using 70 potential predictors and giving them different posterior inclusion probabilities, we find that BMA generally gives more accurate out-of-sample forecasts than the RW model or the best-fitting univariate ARMA model. This superior performance is consistent across different forecast horizons, except for the very short horizons (0- and 3-month-ahead forecasts). All in all, we conclude that the BMA approach can be a useful tool in the future on the long-term forecast of the semiconductor industry growth.

² We also try to add G_{t-1} , G_{t-2} , G_{t-3} and G_{t-12} into our BMA model at the same time as the potential predictors, but the forecast results (in terms of MAPEs and MSPEs) are quite similar with those without the lagged variables. In addition, we also try to replace the Uniform model prior by Binomial or Beta-Binomial model priors and receive similar results.

Table 1 Variable descriptions and summary statistics

| Series | Description | Data coverage | Source | Mean | Standard deviation |
|---|---|----------------|--------|------------------------|-----------------------|
| WMB | Semiconductor world market billings | 1976:3-2012:10 | SIA | 17436×10^6 | 5092×10^6 |
| (a) Macroeconomic variables | | | | | |
| FF | Federal Funds Rate | 1954:7-2012:11 | FR | 2.89% | 2.24% |
| CLI | Composite Leading Index | 1955:1-2012:10 | OECD | 99.87 | 1.52 |
| IP | US Industrial production index | 1919:1-2012:11 | FR | 91.41 (y2007=100) | 5.25 |
| CS | Consumer Sentiment Index | 1978:1-2012:11 | UM | 86.97 (y1966=100) | 14.82 |
| (b) Financial variables | | | | | |
| SOX | Philadelphia Semiconductor Index | 1994:5-2012:11 | YF | 435.57 | 174 |
| NDQ | NASDAQ Composite Index | 1993:3-2012:11 | YF | 2238.68 | 634.89 |
| DJ | Dow Jones Industrial Average Index | 1896:5-2012.11 | YF | 10402.19 | 1652.16 |
| (c) Semiconductor industry-level variables | | | | | |
| CAP | capacity | 1971:1-2012:11 | FR | 90.64 (y2007=100) | 63.3 |
| SIP | industrial production index | 1972:1-2012:11 | FR | 69.09 (y2007=100) | 47.27 |
| UTL | capacity utilization ratio | 1972:1-2012:11 | FR | 77.65% | 8.56% |
| ISR | inventory to shipment ratio (computer and electronic products) | 1992:1-2012:10 | CB | 1.47% | 0.12 |
| NO | new orders (computer and electronic products) | 1992:2-2012:10 | CB | 26752.71×10^6 | 4429.94×10^6 |
| FGI | finished goods inventory (computer and electronic products) | 1992:1-2012:10 | CB | 11380.89×10^6 | 1857.29×10^6 |
| MSI | materials and supplies inventory (computer and electronic products) | 1992:1-2012:10 | CB | 17977.04×10^6 | 2971.29×10^6 |
| VS | value of shipments (computer and electronic products) | 1992:1-2012:10 | CB | 32592.51×10^6 | 4516.29×10^6 |

| | | | | | |
|--|---|-----------------|------|--------------------------|-------------------------|
| TI | total inventories (computer and electronic products) | 1992:1-2012:10 | CB | 47886.77×10 ⁶ | 6485.38×10 ⁶ |
| BB | book-to-bill ratio for semiconductor manufacturing equipment | 1992:1-2012:10 | SEMI | 0.96 | 0.19 |
| Book | bookings for semiconductor manufacturing equipment | 1992:1-2012:10 | SEMI | 1247.71×10 ⁶ | 528.23×10 ⁶ |
| Bill | billings for semiconductor manufacturing equipment | 1991:1-2012:10 | SEMI | 1281.27×10 ⁶ | 416.04×10 ⁶ |
| PPI | producer price index (electronic components and accessories) | 1965:12-2012:11 | BLS | 87.02 (y1982=100) | 10.54×10 ⁶ |
| ES | retail sales for electronics and appliance stores | 1992:1-2012:10 | CB | 7637.04×10 ⁶ | 1063.36×10 ⁶ |
| ESA | wholesale sales for electrical and electronic goods | 1992:1-2012:10 | CB | 23579.75×10 ⁶ | 5125.87×10 ⁶ |
| EIN | wholesale inventories for electrical and electronic goods | 1992:1-2012:10 | CB | 31468.99×10 ⁶ | 5906.87×10 ⁶ |
| (d) Related producer price index for | | | | | |
| PPI1 | integrated microcircuits (including microprocessors and MOS memories) | 1975:12-2012:11 | BLS | 67.68 (y1998=100) | 25.9 |
| PPI2 | microprocessors (including microcontrollers) | 1981:6-2012:11 | BLS | 7983.98 (y2007=100) | 21306.72 |
| PPI3 | other semiconductor devices (parts such as chips, wafers, and heat sinks) | 1976:4-2012:11 | BLS | 77.57 (y1981=100) | 12.01 |
| (e) Related industrial production index for | | | | | |
| IP1 | computer and electronic product | 1972:1-2012:11 | FR | 73.34 (y2007=100) | 28.48 |
| IP2 | computer and peripheral equipment | 1972:1-2012:11 | FR | 68.15 (y2007=100) | 25.14 |
| IP3 | communications equipment | 1972:1-2012:11 | FR | 83.37 (y2007=100) | 15.13 |
| IP4 | audio and video equipment | 1972:1-2012:11 | FR | 89.56 (y2007=100) | 31.38 |
| IP6 | electrical equipment, appliance, and component | 1972:1-2012:11 | FR | 95.36 (y2007=100) | 10.62 |
| IP7 | battery | 1972:1-2012:11 | FR | 99.9 (y2007=100) | 11.68 |
| IP8 | communication and energy wire and cable | 1972:1-2012:11 | FR | 119.78 (y2007=100) | 36.26 |

(f) Related new orders for

| | | | | | |
|------|--|----------------|----|-------------------------|-------------------------|
| NO2 | computer storage device manufacturing | 1992:2-2012:10 | CB | 2530.82×10 ⁶ | 1163.61×10 ⁶ |
| NO7 | other electronic component manufacturing | 1992:2-2012:10 | CB | 4284.5×10 ⁶ | 996.34×10 ⁶ |
| NO9 | household appliance manufacturing | 1992:2-2012:10 | CB | 1814.5×10 ⁶ | 212.8×10 ⁶ |
| NO11 | computers and related products | 1992:2-2012:10 | CB | 6064.59×10 ⁶ | 2244.43×10 ⁶ |
| NO12 | communication equipment | 1992:2-2012:10 | CB | 5768.2×10 ⁶ | 2168.7×10 ⁶ |
| NO14 | electrical equipment manufacturing | 1992:2-2012:10 | CB | 2999.32×10 ⁶ | 373.11×10 ⁶ |
| NO15 | search and navigation equipment | 1992:2-2012:10 | CB | 1019.44×10 ⁶ | 339.23×10 ⁶ |

(g) Related total inventories for

| | | | | | |
|------|---|----------------|----|--------------------------|-------------------------|
| TI1 | farm machinery and equipment manufacturing | 1992:2-2012:10 | CB | 2465.95×10 ⁶ | 491.74×10 ⁶ |
| TI2 | construction machinery manufacturing | 1992:2-2012:10 | CB | 4101.25×10 ⁶ | 820.96×10 ⁶ |
| TI3 | computer storage device manufacturing | 1992:2-2012:10 | CB | 1380.15×10 ⁶ | 305.23×10 ⁶ |
| TI4 | other computer peripheral equipment manufacturing | 1992:2-2012:10 | CB | 2249.15×10 ⁶ | 694.46×10 ⁶ |
| TI5 | communications equipment manufacturing (nondefense) | 1992:2-2012:10 | CB | 9369.28×10 ⁶ | 2814.6×10 ⁶ |
| TI6 | audio and video equipment | 1992:2-2012:10 | CB | 849.84×10 ⁶ | 160.01×10 ⁶ |
| TI7 | other electronic component manufacturing | 1992:2-2012:10 | CB | 7507.25×10 ⁶ | 1471.73×10 ⁶ |
| TI8 | electrical equipment, appliances and components | 1992:2-2012:10 | CB | 13988.66×10 ⁶ | 1181.48×10 ⁶ |
| TI9 | household appliance manufacturing | 1992:2-2012:10 | CB | 2028.38×10 ⁶ | 242.68×10 ⁶ |
| TI10 | battery manufacturing | 1992:2-2012:10 | CB | 809.49×10 ⁶ | 190.11×10 ⁶ |
| TI11 | computers and related products | 1992:2-2012:10 | CB | 6064.2×10 ⁶ | 2236.67×10 ⁶ |
| TI12 | communication equipment | 1992:2-2012:10 | CB | 10571.29×10 ⁶ | 2533.09×10 ⁶ |
| TI13 | information technology industries | 1992:2-2012:10 | CB | 40888.79×10 ⁶ | 5067.3×10 ⁶ |
| TI14 | electrical equipment manufacturing | 1992:2-2012:10 | CB | 4467.3×10 ⁶ | 402.21×10 ⁶ |

| | | | | | |
|---|---|----------------|----|--------------------------|-------------------------|
| TI15 | search and navigation equipment | 1992:2-2012:10 | CB | 2741.27×10 ⁶ | 366.84×10 ⁶ |
| (h) Related value of shipments for | | | | | |
| VS1 | farm machinery and equipment manufacturing | 1992:2-2012:10 | CB | 1614.76×10 ⁶ | 453.99×10 ⁶ |
| VS2 | construction machinery manufacturing | 1992:2-2012:10 | CB | 2438.65×10 ⁶ | 841.25×10 ⁶ |
| VS3 | computer storage device manufacturing | 1992:2-2012:10 | CB | 872.54×10 ⁶ | 333.03×10 ⁶ |
| VS4 | other computer peripheral equipment manufacturing | 1992:2-2012:10 | CB | 1434.87×10 ⁶ | 553.99×10 ⁶ |
| VS5 | communications equipment manufacturing (nondefense) | 1992:2-2012:10 | CB | 5319.64×10 ⁶ | 2018.04×10 ⁶ |
| VS6 | audio and video equipment | 1992.2-2012.10 | CB | 607.83×10 ⁶ | 227.91×10 ⁶ |
| VS7 | other electronic component manufacturing | 1992.2-2012.10 | CB | 4265.37×10 ⁶ | 851×10 ⁶ |
| VS8 | electrical equipment, appliances and components | 1992.2-2012.10 | CB | 9561.81×10 ⁶ | 775.86×10 ⁶ |
| VS9 | household appliance manufacturing | 1992:2-2012:10 | CB | 1814.25×10 ⁶ | 186.46×10 ⁶ |
| VS10 | battery manufacturing | 1992:2-2012:10 | CB | 670.43×10 ⁶ | 155.11×10 ⁶ |
| VS11 | computers and related products | 1992:2-2012:10 | CB | 6109.91×10 ⁶ | 2237.11×10 ⁶ |
| VS12 | communication equipment | 1992:2-2012:10 | CB | 5714.07×10 ⁶ | 1945.18×10 ⁶ |
| VS13 | information technology industries | 1992:2-2012:10 | CB | 26080.83×10 ⁶ | 3688.69×10 ⁶ |
| VS14 | electrical equipment manufacturing | 1992:2-2012:10 | CB | 2986.84×10 ⁶ | 299.13×10 ⁶ |
| VS15 | search and navigation equipment | 1992:2-2012:10 | CB | 974.51×10 ⁶ | 177.59×10 ⁶ |

Note: BLS: Bureau of Labor Statistics; CB: Bureau of Census; FR: Federal Reserve; OECD: Organization for Economic Co-operation and Development; SEMI: Semiconductor Equipment and Materials International; SIA: Semiconductor Industry Association; UM: University of Michigan; YF: Yahoo! Finance.

Table 2 Data transformations

| Series | Transformation | Series | Transformation | Series | Transformation |
|--------|----------------|--------|----------------|--------|----------------|
| WMB | dln | PPI3 | level | TI12 | dln |
| FF | dln | IP1 | dln | TI13 | dln |
| CLI | level | IP2 | dln | TI14 | dln |
| IP | dln | IP3 | dln | TI15 | dln |
| CS | level | IP4 | dln | VS1 | dln |
| SOX | dln | IP6 | dln | VS2 | dln |
| NDQ | dln | IP7 | dln | VS3 | dln |
| DJ | dln | IP8 | dln | VS4 | dln |
| CAP | dln | NO2 | dln | VS5 | dln |
| SIP | dln | NO7 | dln | VS6 | dln |
| UTL | level | NO9 | dln | VS7 | dln |
| ISR | level | NO11 | dln | VS8 | dln |
| NO | dln | NO12 | dln | VS9 | dln |
| FGI | dln | NO14 | dln | VS10 | dln |
| MSI | dln | NO15 | dln | VS11 | dln |
| VS | dln | TI1 | dln | VS12 | dln |
| TI | dln | TI2 | dln | VS13 | dln |
| BB | level | TI3 | dln | VS14 | dln |
| Book | level | TI4 | dln | VS15 | dln |
| Bill | level | TI5 | dln | | |
| PPI | level | TI6 | dln | | |
| ES | dln | TI7 | dln | | |
| ESA | dln | TI8 | dln | | |
| EIN | dln | TI9 | dln | | |
| PPI1 | level | TI10 | dln | | |
| PPI2 | level | TI11 | dln | | |

Table 3 Selection of the best-fitting ARMA models

| Model Selection Criteria | AR(1) | MA(1) | ARMA(1,1) | ARMA(2,1) | ARMA(3,1) | ARMA(4,1) | ARMA(3,1) +SAR(12) | ARMA(4,1) +SAR(12) |
|-----------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------------------|-----------------------|-----------------------|
| SSR | 0.323 | 1.996 | 0.201 | 0.100 | 0.090 | 0.089 | 0.063 | 0.062 |
| AIC | -3.368 | -1.553 | -3.832 | -4.513 | -4.600 | -4.590 | -4.875 | -4.873 |
| SBC | -3.330 | -1.515 | -3.775 | -4.437 | -4.504 | -4.47 | -4.774 | -4.752 |
| Q(12) | 342.74 (0.000) | 496.11 (0.000) | 192.93 (0.000) | 61.85 (0.000) | 39.25 (0.000) | 39.34 (0.000) | 9.12 (0.244) | 8.10 (0.231) |
| Q(24) | 425.59 (0.000) | 683.31 (0.000) | 251.11 (0.000) | 92.18 (0.000) | 45.44 (0.001) | 44.59 (0.001) | 24.798 (0.160) | 26.569 (0.087) |
| Q(36) | 442.58 (0.000) | 780.72 (0.000) | 269.79 (0.000) | 111.52 (0.000) | 54.788 (0.007) | 52.33 (0.010) | 30.279 (0.503) | 32.385 (0.350) |

Note: 1. SSR is the sum of squared residuals. 2. $Q(n)$ reports the Ljung-Box Q -statistic for the autocorrelations of the n residuals of the estimated model. Significance levels are in parentheses.

Table 4 Estimation of the best-fitting ARMA model

| Variable | Coefficient | Standard error | t -Statistic | P -value |
|----------------------|-------------|----------------|----------------|------------|
| Constant, α_1 | 0.035 | 0.043 | 0.809 | 0.420 |
| AR(1), β_1 | 1.021 | 0.104 | 9.852 | 0.000 |
| AR(2), β_2 | 0.699 | 0.164 | 4.259 | 0.000 |
| AR(3), β_3 | -0.761 | 0.081 | -9.436 | 0.000 |
| SAR(12), β_4 | -0.556 | 0.077 | -7.182 | 0.000 |
| MA(1), τ_1 | 0.615 | 0.134 | 4.587 | 0.000 |

Table 5 Forecast performance of competing models

| Forecast horizon (months) | RW | | Relative MAPE | | Relative MSPE | |
|------------------------------|--------|--------|---------------|------|---------------|------|
| | MAPE | MSPE | ARMA | BMA | ARMA | BMA |
| 0 | 0.0355 | 0.0024 | 0.73 | 1.38 | 0.51 | 1.78 |
| 3 | 0.1276 | 0.0302 | 0.84 | 0.46 | 0.69 | 0.22 |
| 6 | 0.21 | 0.0728 | 0.66 | 0.39 | 0.40 | 0.15 |
| 9 | 0.2678 | 0.1138 | 0.46 | 0.24 | 0.19 | 0.06 |
| 12 | 0.2959 | 0.1332 | 0.31 | 0.21 | 0.11 | 0.05 |
| 18 | 0.3068 | 0.1178 | 0.52 | 0.29 | 0.37 | 0.10 |
| 24 | 0.2838 | 0.0979 | 0.59 | 0.36 | 0.37 | 0.16 |

Note: Relative errors are the ratios of the respective models' MAPE or MSPE to those of the random walk model.

Table 6 Diebold-Mariano (DM) test

| Forecast horizon (months) | Criteria | BMA vs. RW | BMA vs. ARMA |
|------------------------------|----------|------------|--------------|
| 0 | MAPE | 0.0134 | 0.0227*** |
| | MSPE | 0.0019 | 0.0031* |
| 3 | MAPE | -0.0687* | -0.0488** |
| | MSPE | -0.0237 | -0.0142* |
| 6 | MAPE | -0.1281*** | -0.0563*** |
| | MSPE | -0.0617** | -0.0177** |
| 9 | MAPE | -0.2022*** | -0.564*** |
| | MSPE | -0.1065** | -0.0140** |
| 12 | MAPE | -0.2326*** | -0.0272 |
| | MSPE | -0.1268** | -0.0084 |
| 18 | MAPE | -0.2194*** | -0.0723* |
| | MSPE | -0.1056*** | -0.0314* |
| 24 | MAPE | -0.1803*** | -0.0631*** |
| | MSPE | -0.0825*** | -0.0211*** |

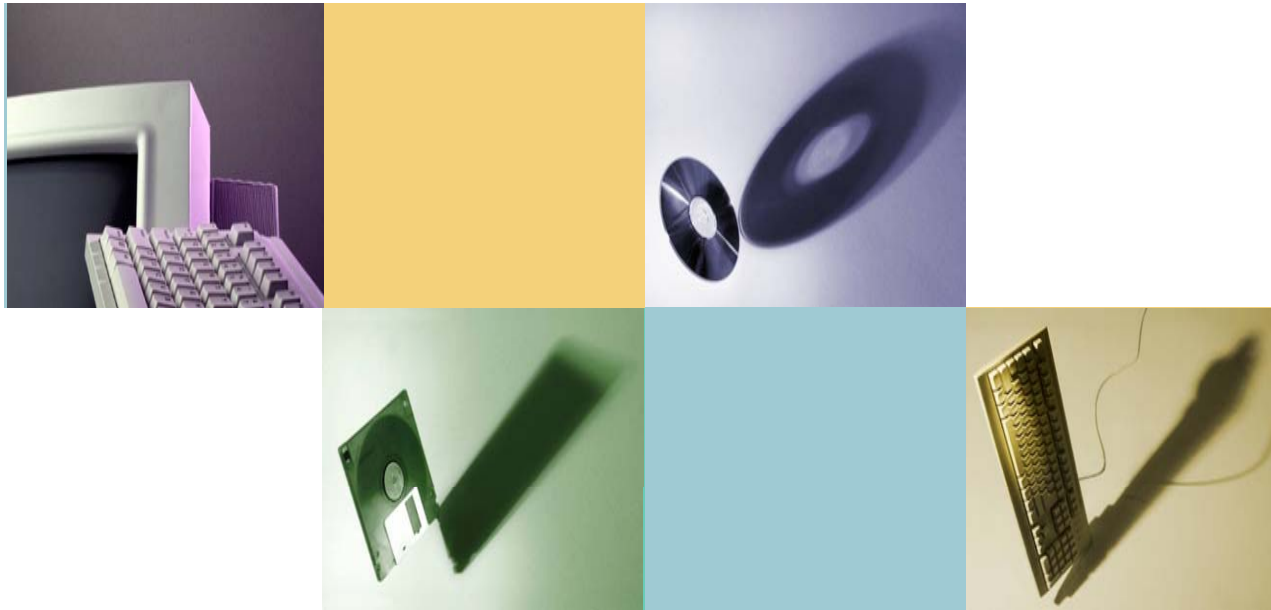
Note: * denotes significance at the 10% level; ** denotes significance at the 5% level; *** denotes significance at the 1% level.

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附件三 **Power Point** 報告檔

Forecasting the Semiconductor Industry Growth: A Bayesian Model Averaging Approach



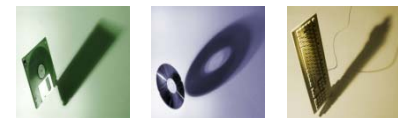
Wen-Hsien Liu Shu-Shih Weng

Institute of International Economics
National Chung Cheng University

The 7th Asia-Pacific Business Research Conference, August 25-26, 2014, Singapore

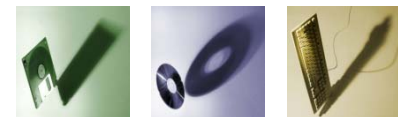
Introduction

- It is estimated that a new semiconductor fabrication plant may cost US\$5 billion today, as the semiconductor industry has experienced huge fluctuations, ranging from a positive 70% to a negative 40% annual growth during the past 40 years.
- Hence, how to precisely forecast the semiconductor industry growth in order to secure the enormous investment turns out to be a concern and a challenge in the industry.
- By incorporating 70 potential predictors in our model, we utilize the Bayesian Model Averaging (BMA) approach to tackle this research question. It is found that the BMA model proposed in this study outperforms the random walk model and the best-fitting univariate ARMA model in the long-term prediction and can be a useful tool on forecasting the semiconductor industry growth.



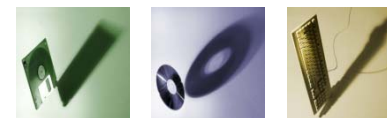
Literature Review

- The methodologies used in previous studies include
 - the vector autoregressive (VAR) model: Liu (2005, 2007)
 - the Markov regime-switching model: Liu and Chyi (2006) and Liu et al. (2013)
 - the discrete Fourier transform: Tan and Mathews (2010a)
 - the Bayesian vector autoregressive (BVAR) model: Chow and Choy (2006) and Aubry and Renou-Maissant (2014)
 - the vector error-correction model (VECM): Aubry and Renou-Maissant (2013).
- However, the essential questions remain unsolved when there are many potential explanatory variables:
 - Which variables should be included in the model?
 - How important are they?



Bayesian Model Averaging

- Inspired by Leamer's (1978) and improved by Leamer (1983, Levine and Renelt (1992), Sala-I-Martin (1997) and Madigan and Raftery (1994).
- Addressing the model uncertainty in a regression problem
- Has recently received considerable attention in both the statistics and econometrics literature
- Examples of applications in econometrics
 - output growth forecasting: Min and Zellner (1993)
 - cross-country growth regressions (Fernandez et al., 2001b), exchange rate forecasting (Wright, 2008)
 - inflation rate forecasting (Jacobson and Karlsson, 2004; Wright, 2009)



Data

- Monthly data of the semiconductor world market billings (WMB) is used to calculate the semiconductor industry annual growth rate (G_t), which is defined as

$$G_t = \ln WMB_t - \ln WMB_{t-12}$$

- 70 potential predictors: macroeconomic, financial and industry-level (see Table 1).
 - Take logs and convert I(1) to I(0) if necessary (see Table 2)
- 1994:05-2012:10 → 1995:05-2012:10 after taking annual growth rate
 - Pre-sample estimation: 1995:05-2009:02
 - Out-of-sample forecast: 2009:03-2012:10 (44 data points)

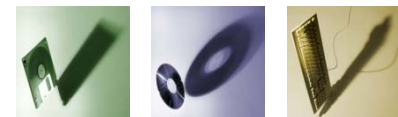


Table 1 Variable descriptions and summary statistics

| Series | Description | Data coverage | Source | Mean | Standard deviation |
|---|---|----------------|--------|--------------------------|-------------------------|
| WMB | Semiconductor world market billings | 1976:3-2012:10 | SIA | 17436×10 ⁶ | 5092×10 ⁶ |
| (a) Macroeconomic variables | | | | | |
| FF | Federal Funds Rate | 1954:7-2012:11 | FR | 2.89% | 2.24% |
| CLI | Composite Leading Index | 1955:1-2012:10 | OECD | 99.87 | 1.52 |
| IP | US Industrial production index | 1919:1-2012:11 | FR | 91.41 (y2007=100) | 5.25 |
| CS | Consumer Sentiment Index | 1978:1-2012:11 | UM | 86.97 (y1986=100) | 14.82 |
| (b) Financial variables | | | | | |
| SOX | Philadelphia Semiconductor Index | 1994:5-2012:11 | YF | 435.57 | 174 |
| NDQ | NASDAQ Composite Index | 1993:3-2012:11 | YF | 2238.88 | 634.89 |
| DJ | Dow Jones Industrial Average Index | 1896:5-2012:11 | YF | 10402.19 | 1652.16 |
| (c) Semiconductor industry-level variables | | | | | |
| CAP | capacity | 1971:1-2012:11 | FR | 90.64 (y2007=100) | 63.3 |
| SIP | industrial production index | 1972:1-2012:11 | FR | 69.09 (y2007=100) | 47.27 |
| UTL | capacity utilization ratio | 1972:1-2012:11 | FR | 77.65% | 8.56% |
| ISR | inventory to shipment ratio (computer and electronic products) | 1992:1-2012:10 | CB | 1.47% | 0.12 |
| NO | new orders (computer and electronic products) | 1992:2-2012:10 | CB | 26752.71×10 ⁶ | 4429.94×10 ⁶ |
| FGI | finished goods inventory (computer and electronic products) | 1992:1-2012:10 | CB | 11380.89×10 ⁶ | 1857.29×10 ⁶ |
| MSI | materials and supplies inventory (computer and electronic products) | 1992:1-2012:10 | CB | 17977.04×10 ⁶ | 2971.29×10 ⁶ |

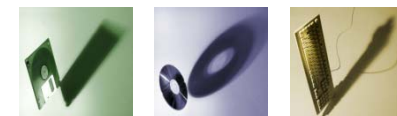


Table 1 (con't)

| | | | | | |
|--|---|-----------------|------|--------------------------|-------------------------|
| VS | value of shipments (computer and electronic products) | 1992:1-2012:10 | CB | 32592.51×10 ⁶ | 4516.29×10 ⁶ |
| TI | total inventories (computer and electronic products) | 1992:1-2012:10 | CB | 47886.77×10 ⁶ | 6485.38×10 ⁶ |
| BB | book-to-bill ratio for semiconductor manufacturing equipment | 1992:1-2012:10 | SEMI | 0.96 | 0.19 |
| Book | bookings for semiconductor manufacturing equipment | 1992:1-2012:10 | SEMI | 1247.71×10 ⁶ | 528.23×10 ⁶ |
| Bill | billings for semiconductor manufacturing equipment | 1991:1-2012:10 | SEMI | 1281.27×10 ⁶ | 416.04×10 ⁶ |
| PPI | producer price index (electronic components and accessories) | 1985:12-2012:11 | BLS | 87.02 (y1982=100) | 10.54×10 ⁶ |
| ES | retail sales for electronics and appliance stores | 1992:1-2012:10 | CB | 7637.04×10 ⁶ | 1063.36×10 ⁶ |
| ESA | wholesale sales for electrical and electronic goods | 1992:1-2012:10 | CB | 23579.75×10 ⁶ | 5125.87×10 ⁶ |
| EIN | wholesale inventories for electrical and electronic goods | 1992:1-2012:10 | CB | 31468.99×10 ⁶ | 5906.87×10 ⁶ |
| (d) Related producer price index for | | | | | |
| PPI1 | integrated microcircuits (including microprocessors and MOS memories) | 1975:12-2012:11 | BLS | 67.68 (y1998=100) | 25.9 |
| PPI2 | microprocessors (including microcontrollers) | 1981:6-2012:11 | BLS | 7983.98 (y2007=100) | 21306.72 |
| PPI3 | other semiconductor devices (parts such as chips, wafers, and heat sinks) | 1976:4-2012:11 | BLS | 77.57 (y1981=100) | 12.01 |
| (e) Related industrial production index for | | | | | |
| IP1 | computer and electronic product | 1972:1-2012:11 | FR | 73.34 (y2007=100) | 28.48 |
| IP2 | computer and peripheral equipment | 1972:1-2012:11 | FR | 68.15 (y2007=100) | 25.14 |
| IP3 | communications equipment | 1972:1-2012:11 | FR | 83.37 (y2007=100) | 15.13 |
| IP4 | audio and video equipment | 1972:1-2012:11 | FR | 89.56 (y2007=100) | 31.38 |
| IP6 | electrical equipment, appliance, and component | 1972:1-2012:11 | FR | 95.36 (y2007=100) | 10.62 |
| IP7 | battery | 1972:1-2012:11 | FR | 99.9 (y2007=100) | 11.68 |
| IP8 | communication and energy wire and cable | 1972:1-2012:11 | FR | 119.78 (y2007=100) | 36.26 |

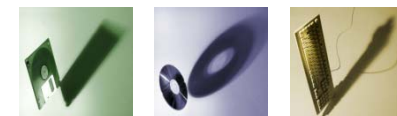


Table 1 (con't)

(f) Related new orders for

| | | | | | |
|------|--|----------------|----|-------------------------|-------------------------|
| NO2 | computer storage device manufacturing | 1992:2-2012:10 | CB | 2530.82×10 ⁶ | 1163.61×10 ⁶ |
| NO7 | other electronic component manufacturing | 1992:2-2012:10 | CB | 4284.5×10 ⁶ | 996.34×10 ⁶ |
| NO9 | household appliance manufacturing | 1992:2-2012:10 | CB | 1814.5×10 ⁶ | 212.8×10 ⁶ |
| NO11 | computers and related products | 1992:2-2012:10 | CB | 6064.59×10 ⁶ | 2244.43×10 ⁶ |
| NO12 | communication equipment | 1992:2-2012:10 | CB | 5768.2×10 ⁶ | 2168.7×10 ⁶ |
| NO14 | electrical equipment manufacturing | 1992:2-2012:10 | CB | 2999.32×10 ⁶ | 373.11×10 ⁶ |
| NO15 | search and navigation equipment | 1992:2-2012:10 | CB | 1019.44×10 ⁶ | 339.23×10 ⁶ |

(g) Related total inventories for

| | | | | | |
|------|---|----------------|----|--------------------------|-------------------------|
| TI1 | farm machinery and equipment manufacturing | 1992:2-2012:10 | CB | 2465.95×10 ⁶ | 491.74×10 ⁶ |
| TI2 | construction machinery manufacturing | 1992:2-2012:10 | CB | 4101.25×10 ⁶ | 820.96×10 ⁶ |
| TI3 | computer storage device manufacturing | 1992:2-2012:10 | CB | 1380.15×10 ⁶ | 305.23×10 ⁶ |
| TI4 | other computer peripheral equipment manufacturing | 1992:2-2012:10 | CB | 2249.15×10 ⁶ | 694.46×10 ⁶ |
| TI5 | communications equipment manufacturing (nondefense) | 1992:2-2012:10 | CB | 9369.28×10 ⁶ | 2814.6×10 ⁶ |
| TI6 | audio and video equipment | 1992:2-2012:10 | CB | 849.84×10 ⁶ | 160.01×10 ⁶ |
| TI7 | other electronic component manufacturing | 1992:2-2012:10 | CB | 7507.25×10 ⁶ | 1471.73×10 ⁶ |
| TI8 | electrical equipment, appliances and components | 1992:2-2012:10 | CB | 13988.66×10 ⁶ | 1181.48×10 ⁶ |
| TI9 | household appliance manufacturing | 1992:2-2012:10 | CB | 2028.38×10 ⁶ | 242.68×10 ⁶ |
| TI10 | battery manufacturing | 1992:2-2012:10 | CB | 809.49×10 ⁶ | 190.11×10 ⁶ |
| TI11 | computers and related products | 1992:2-2012:10 | CB | 6064.2×10 ⁶ | 2236.67×10 ⁶ |
| TI12 | communication equipment | 1992:2-2012:10 | CB | 10571.29×10 ⁶ | 2533.09×10 ⁶ |
| TI13 | information technology industries | 1992:2-2012:10 | CB | 40888.79×10 ⁶ | 5067.3×10 ⁶ |
| TI14 | electrical equipment manufacturing | 1992:2-2012:10 | CB | 4467.3×10 ⁶ | 402.21×10 ⁶ |

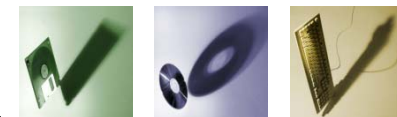


Table 1 (con't)

| | | | | | |
|---|---|----------------|----|--------------------------|-------------------------|
| TI15 | search and navigation equipment | 1992:2-2012:10 | CB | 2741.27×10 ⁶ | 366.84×10 ⁶ |
| (h) Related value of shipments for | | | | | |
| VS1 | farm machinery and equipment manufacturing | 1992:2-2012:10 | CB | 1614.76×10 ⁶ | 453.99×10 ⁶ |
| VS2 | construction machinery manufacturing | 1992:2-2012:10 | CB | 2438.65×10 ⁶ | 841.25×10 ⁶ |
| VS3 | computer storage device manufacturing | 1992:2-2012:10 | CB | 872.54×10 ⁶ | 333.03×10 ⁶ |
| VS4 | other computer peripheral equipment manufacturing | 1992:2-2012:10 | CB | 1434.87×10 ⁶ | 553.99×10 ⁶ |
| VS5 | communications equipment manufacturing (nondefense) | 1992:2-2012:10 | CB | 5319.64×10 ⁶ | 2018.04×10 ⁶ |
| VS6 | audio and video equipment | 1992:2-2012:10 | CB | 607.83×10 ⁶ | 227.91×10 ⁶ |
| VS7 | other electronic component manufacturing | 1992:2-2012:10 | CB | 4265.37×10 ⁶ | 851×10 ⁶ |
| VS8 | electrical equipment, appliances and components | 1992:2-2012:10 | CB | 9561.81×10 ⁶ | 775.86×10 ⁶ |
| VS9 | household appliance manufacturing | 1992:2-2012:10 | CB | 1814.25×10 ⁶ | 186.46×10 ⁶ |
| VS10 | battery manufacturing | 1992:2-2012:10 | CB | 670.43×10 ⁶ | 155.11×10 ⁶ |
| VS11 | computers and related products | 1992:2-2012:10 | CB | 6109.91×10 ⁶ | 2237.11×10 ⁶ |
| VS12 | communication equipment | 1992:2-2012:10 | CB | 5714.07×10 ⁶ | 1945.18×10 ⁶ |
| VS13 | information technology industries | 1992:2-2012:10 | CB | 26080.83×10 ⁶ | 3688.69×10 ⁶ |
| VS14 | electrical equipment manufacturing | 1992:2-2012:10 | CB | 2986.84×10 ⁶ | 299.13×10 ⁶ |
| VS15 | search and navigation equipment | 1992:2-2012:10 | CB | 974.51×10 ⁶ | 177.59×10 ⁶ |

Note: BLS: Bureau of Labor Statistics; CB: Bureau of Census; FR: Federal Reserve; OECD: Organization for Economic Co-operation and Development; SEMI: Semiconductor Equipment and Materials International; SIA: Semiconductor Industry Association; UM: University of Michigan; YF: Yahoo! Finance.

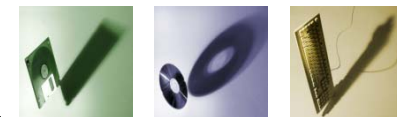
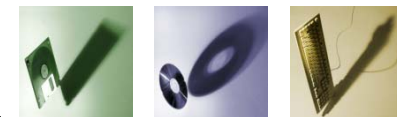


Table 2 Data transformations

| Series | Transformation | Series | Transformation | Series | Transformation |
|--------|----------------|--------|----------------|--------|----------------|
| WMB | dln | PPI3 | level | TI12 | dln |
| FF | dln | IP1 | dln | TI13 | dln |
| CLI | level | IP2 | dln | TI14 | dln |
| IP | dln | IP3 | dln | TI15 | dln |
| CS | level | IP4 | dln | VS1 | dln |
| SOX | dln | IP6 | dln | VS2 | dln |
| NDQ | dln | IP7 | dln | VS3 | dln |
| DJ | dln | IP8 | dln | VS4 | dln |
| CAP | dln | NO2 | dln | VS5 | dln |
| SIP | dln | NO7 | dln | VS6 | dln |
| UTL | level | NO9 | dln | VS7 | dln |
| ISR | level | NO11 | dln | VS8 | dln |
| NO | dln | NO12 | dln | VS9 | dln |
| FGI | dln | NO14 | dln | VS10 | dln |
| MSI | dln | NO15 | dln | VS11 | dln |
| VS | dln | TI1 | dln | VS12 | dln |
| TI | dln | TI2 | dln | VS13 | dln |
| BB | level | TI3 | dln | VS14 | dln |
| Book | level | TI4 | dln | VS15 | dln |
| Bill | level | TI5 | dln | | |
| PPI | level | TI6 | dln | | |
| ES | dln | TI7 | dln | | |
| ESA | dln | TI8 | dln | | |
| EIN | dln | TI9 | dln | | |
| PPI1 | level | TI10 | dln | | |
| PPI2 | level | TI11 | dln | | |



Forecast Setup

- Real time forecast
 - In period t , only data up to $t-1$ is available
- Forecast horizons:
 - Momentary-term: 0-month-ahead
 - Short-term: 3- and 6-month-ahead
 - Medium-term: 9- and 12-month-ahead
 - Long-term: 18- and 24-month-ahead
- BMA: using the recursive rolling-window procedure
 - Re-estimating the model whenever adding a new data point by holding the starting period (1995:05) fixed and letting the window grows
- Competing models:
 - Random Walk (RW) $\hat{G}_{t+h}^{RW} = G_{t-1}$ $\hat{\varepsilon}_{t+h}^{RW} = G_{t+h} - \hat{\varepsilon}_{t+h}^{RW}$
 - The best-fitting univariate ARMA model (see Tables 3 and 4)

•



Table 3 Selection of the best-fitting ARMA models

| Selection Criteria \ Model | Model | | | | | | | ARMA (3,1) +SAR (12) | ARMA (4,1) +SAR (12) |
|----------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------------------|-------------------|-------------------------|-------------------------|
| | AR(1) | MA(1) | ARMA (1,1) | ARMA (2,1) | ARMA (3,1) | ARMA (4,1) | | | |
| SSR | 0.323 | 1.996 | 0.201 | 0.100 | 0.090 | 0.089 | 0.063 | 0.062 | |
| AIC | -3.368 | -1.553 | -3.832 | -4.513 | -4.600 | -4.590 | -4.875 | -4.873 | |
| SBC | -3.330 | -1.515 | -3.775 | -4.437 | -4.504 | -4.47 | -4.774 | -4.752 | |
| Q(12) | 342.74 (0.000) | 496.11 (0.000) | 192.93 (0.000) | 61.85 (0.000) | 39.25 (0.000) | 39.34 (0.000) | 9.12 (0.244) | 8.10 (0.231) | |
| Q(24) | 425.59 (0.000) | 683.31 (0.000) | 251.11 (0.000) | 92.18 (0.000) | 45.44 (0.001) | 44.59 (0.001) | 24.798 (0.160) | 26.569 (0.087) | |
| Q(36) | 442.58 (0.000) | 780.72 (0.000) | 269.79 (0.000) | 111.52 (0.000) | 54.788 (0.007) | 52.33 (0.010) | 30.279 (0.503) | 32.385 (0.350) | |

Note: $Q(n)$ reports the Ljung-Box Q-statistic for the autocorrelations of the n residuals of the estimated model. Significance levels are in parentheses.

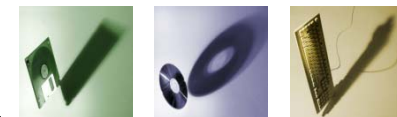


Table 4 Estimation of the best-fitting ARMA model

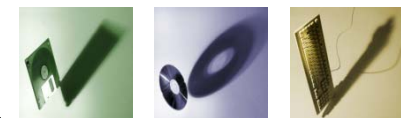
| Variable | Coefficient | Standard error | <i>t</i> -Statistic | <i>P</i> -value |
|----------------------|-------------|----------------|---------------------|-----------------|
| Constant, α_1 | 0.035 | 0.043 | 0.809 | 0.420 |
| AR(1), β_1 | 1.021 | 0.104 | 9.852 | 0.000 |
| AR(2), β_2 | 0.699 | 0.164 | 4.259 | 0.000 |
| AR(3), β_3 | -0.761 | 0.081 | -9.436 | 0.000 |
| SAR(12), β_4 | -0.556 | 0.077 | -7.182 | 0.000 |
| MA(1), τ_1 | 0.615 | 0.134 | 4.587 | 0.000 |

$R^2 = 0.98$ for pre-sample period

Also using the recursive rolling-window procedure

$$\hat{G}_{t+h}^{ARMA} = \alpha_1 + \beta_1 G_{t-1} + \beta_2 G_{t-2} + \beta_3 G_{t-3} + \beta_4 G_{t-12} + \tau_1 \varepsilon_{t-1}$$

$$\hat{\varepsilon}_{t+h}^{ARMA} = G_{t+h} - \hat{G}_{t+h}^{ARMA}$$



Results

1. ARMA model beats the RW model, corresponding to a reduction in MAPE of 16-69% or in MSPE of 31-89%.
2. BMA model
 - performs worst in the 0-month-ahead forecast
 - beats RW by considerable improvements over other horizons, corresponding to a reduction in MAPE of 31-89% or in MSPE of 78-95%.
3. Overall, ARMA performs best in the 0-month-ahead forecast, while the BMA model dominates ARMA in other horizons
 - The inclusion of potential predictors in Table 1 clearly leads to remarkable improvements in the predictive accuracy.
4. The DM tests further confirm that BMA has a trivial edge over either the RW or ARMA in the momentary- or the short-term (0- or 3-month-ahead) horizons. However, in the medium-term or the long-term horizons, the differences in the predictive accuracy are mostly verified at the 5% significance level, except for the 12-month-ahead forecast.

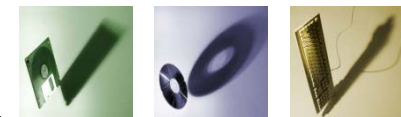


Table 5 Forecast performance of competing models

| Forecast horizon (months) | RW | | Relative MAPE | | Relative MSPE | |
|---------------------------|--------|--------|---------------|------|---------------|------|
| | MAPE | MSPE | ARMA | BMA | ARMA | BMA |
| 0 | 0.0355 | 0.0024 | 0.73 | 1.38 | 0.51 | 1.78 |
| 3 | 0.1276 | 0.0302 | 0.84 | 0.46 | 0.69 | 0.22 |
| 6 | 0.21 | 0.0728 | 0.66 | 0.39 | 0.40 | 0.15 |
| 9 | 0.2678 | 0.1138 | 0.46 | 0.24 | 0.19 | 0.06 |
| 12 | 0.2959 | 0.1332 | 0.31 | 0.21 | 0.11 | 0.05 |
| 18 | 0.3068 | 0.1178 | 0.52 | 0.29 | 0.37 | 0.10 |
| 24 | 0.2838 | 0.0979 | 0.59 | 0.36 | 0.37 | 0.16 |

Note: Relative errors are the ratios of the respective models' MAPE or MSPE to those of the random walk model.

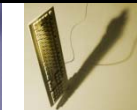


Table 6 Diebold-Mariano (DM) test

| Forecast horizon (months) | Criteria | BMA vs. RW | BMA vs. ARMA |
|---------------------------|----------|------------|--------------|
| 0 | MAPE | 0.0134 | 0.0227*** |
| | MSPE | 0.0019 | 0.0031* |
| 3 | MAPE | -0.0687* | -0.0488** |
| | MSPE | -0.0237 | -0.0142* |
| 6 | MAPE | -0.1281*** | -0.0563*** |
| | MSPE | -0.0617** | -0.0177** |
| 9 | MAPE | -0.2022*** | -0.564*** |
| | MSPE | -0.1065** | -0.0140** |
| 12 | MAPE | -0.2326*** | -0.0272 |
| | MSPE | -0.1268** | -0.0084 |
| 18 | MAPE | -0.2194*** | -0.0723* |
| | MSPE | -0.1056*** | -0.0314* |
| 24 | MAPE | -0.1803*** | -0.0631*** |
| | MSPE | -0.0825*** | -0.0211*** |

RW ties with BMA

ARMA beats BMA

ARMA ties with BMA

BMA beats ARMA

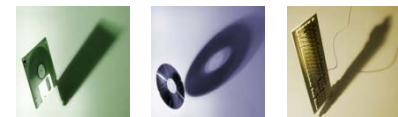
BMA beats RW

Note: * denotes significance at the 10% level; ** denotes significance at the 5% level; *** denotes significance at the 1% level.



Conclusions

- BMA generally gives more accurate out-of-sample forecasts than the RW model or the best-fitting univariate ARMA model.
- This superior performance is consistent across different forecast horizons, except for the very short horizons (0- and 3-month-ahead forecasts).
- Overall, BMA can be a useful tool in the future on the long-term forecast of the semiconductor industry growth.



Thank you for your participation.

Comments are welcome!

