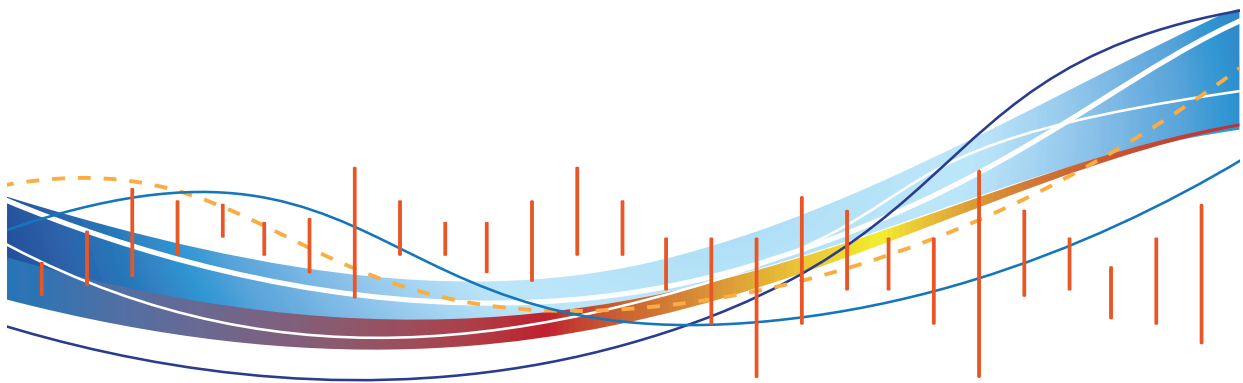


# National Statistics Conference (MyStats 2013) Proceedings



Promoting Innovation in Economic and  
Financial Statistics to Support Policy  
Making in a Dynamic Environment

18 November 2013, Sasana Kijang

Organised by



**BANK NEGARA MALAYSIA**  
CENTRAL BANK OF MALAYSIA



Jabatan Perangkaan  
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OF STATISTICS

# Contents

<b>Foreword</b> .....	5
<b>Conference Summary</b> .....	7
<b>Opening Remarks</b>	
Datuk Dr. Haji Abdul Rahman Hasan .....	17
<b>Keynote Address</b>	
Senator Dato' Sri Abdul Wahid Omar .....	21
<b>Papers</b>	
<b>Session 1: New Statistics for Better Surveillance and Policy Action</b>	
Global Financial and Economic Crises: Lag in Statistics or Slow in Policy Actions? Per Nymand-Andersen .....	27
Statistics after the Financial Crisis: Response to New Data Demands and Data Gaps Dr. He Qi .....	37
Strengthening Statistical Compilation and Usage of Relevant Statistics in Malaysia Abd. Latib Talib, Nur Hidaah Mahamad Rappek, Siti Rahmah Seh Omar and Nurul Naqiah Mansor .....	47
<b>Session 2(A): Innovation in Analysis and Statistics</b>	
Compilation and Management of Labour Market Statistics for Macroeconomic Analysis at the U.S Bureau of Labor Statistics Kenneth W. Robertson and Dr. John L. Eltinge .....	59
Domestic Demand-Driven Growth: Analysis Perspective and Statistics Needed Dr. Yeah Kim Leng .....	75
Core Inflation: The Malaysian Case Mohd Helmi Ramlee and Muhamad Shukri Abdul Rani .....	101
<b>Session 2(B): Leveraging on Statistical Methods and Scientific Approaches for Better Analysis</b>	
An Overview on the Statistical Methods for Economic Research and Risk Assessment Dr. Lau Wee Yeap .....	127
Aggregate Financing to the Real Economy Dr. Sheng Songcheng .....	133

Measurement and Contribution of Total Factor Productivity to Economic Growth Dr. Rahmah Ismail and Dr. Noorasiah Sulaiman .....	139
Estimating Malaysia's Output Gap: Have We Closed the Gap? Dr. Chuah Lay Lian and Dr. Nur Ain Shahrier.....	153
<b>Session 3(A): New Horizon for Financial and Economic Statistics</b>	
Transcending the Traditional Approach through Satellite Accounts Zubaidah Ismail, Mazreha Ya'akub and K Megala Kumarran.....	179
Monitoring Shadow Banking and its Challenges: The Malaysian Experience Muhamad Amar Mohd Farid .....	191
<b>Session 3(B): Application of Technology in Transforming Malaysia's Statistical Landscape</b>	
Leveraging on Business Intelligence Tools for Micro- and Macro-Data Analysis and Research Tai Yoon Foong and Muhamad Kamal Firdaus Muhmad Foudzi.....	213
Addressing Statistical Gaps in a Dynamic Payment Environment Yee Chee May and Ravinder Kaur .....	221
Location Based Statistics: Knowing Your Place Wan Razali Matsah.....	233





## Foreword

On 18 November 2013, Bank Negara Malaysia, in collaboration with the Department of Statistics, Malaysia and Institut Statistik Malaysia, hosted the Second National Statistics Conference, MyStats 2013, at Sasana Kijang, Bank Negara Malaysia. The theme of the conference was “Promoting Innovation in Economic and Financial Statistics to Support Policy Making in a Dynamic Environment”. MyStats 2013, in comparison with the first conference held in 2012, has attracted a larger number and wider range of participants, which include statistical compilers, statisticians, analysts, economists, policy makers and academicians in Malaysia.

The key objective of MyStats is to provide a platform for compilers and users of statistics to share, discuss and highlight statistical issues in analysis and policy formulation as well as challenges in the compilation and communication of statistics. It also aims to achieve greater collaboration between the compilers and users of statistics, particularly in improving the compilation, communication

and usage of statistics. The topics discussed during MyStats 2013 include: (i) New Statistics for Better Surveillance and Policy Action; (ii) Innovation in Analysis and Statistics; (iii) Leveraging on Statistical Methods and Scientific Approaches for Better Analysis; (iv) New Horizon for Financial and Economic Statistics; (v) Application of Technology in Transforming Malaysia’s Statistical Landscape; and (vi) Innovation in Statistics and Analysis for Responsive Policy Action.

Nineteen papers were presented and more than three hundred participants took part in the conference. The Opening Remarks was delivered by Y.Bhg. Datuk Dr. Haji Abdul Rahman Hasan, Chief Statistician, Department of Statistics, Malaysia and the Keynote Address was provided by YB Senator Dato’ Sri Abdul Wahid Omar, Minister in the Prime Minister’s Department, Malaysia. This conference volume is a collection of the conference summary, Opening Remarks, Keynote Address and the fifteen papers presented during the conference.



## Conference Summary

The theme of the Second National Statistics Conference (MyStats 2013), “Promoting Innovation in Economic and Financial Statistics to Support Policy Making in a Dynamic Environment” is highly relevant in light of global developments in the past five years. The lessons learned from every crisis prompt a rethink of current approaches to policy-making, and crucially, a re-evaluation of the statistics used as the basis for policy decisions. The 19 presentations, which were organised in five sessions and one panel session, focused on six main areas:

1. New Statistics for Better Surveillance and Policy Action;
2. Innovation in Analysis and Statistics;
3. Leveraging on Statistical Methods and Scientific Approaches for Better Analysis;
4. New Horizon for Financial and Economic Statistics;
5. Application of Technology in Transforming Malaysia’s Statistical Landscape; and
6. Innovation in Statistics and Analysis for Responsive Policy Action.

### Session 1: New Statistics for Better Surveillance and Policy Action

The first session of the conference, entitled “New Statistics for Better Surveillance and Policy Action”, provided opportunity for participants to discuss the current challenges faced by global and domestic economy and needs for new statistics and innovation in compilation to support analysis, surveillance and policy responses. The Chairperson of this session, Marzunisham Omar (Bank Negara Malaysia), provided a policymaker’s perspective with regard to the lessons learnt from the recent global financial crisis. He highlighted three key lessons: First, the crisis demonstrated that financial imbalances such as asset price bubbles can accumulate in an environment of stable inflation. Hence, the pre-emptive detection and mitigation of financial

imbalances is crucial. Second, the focus on stability of individual institution is insufficient, given the extensive interconnectedness of the financial system. As such, greater attention should be given towards preserving overall financial stability. Finally, the crisis underlined the international aspect of financial vulnerabilities and the risk of spillovers in the current interconnected financial environment. Arising from these observations, he highlighted that statistics must be improved along four key dimensions: 1) coverage; 2) granularity; 3) cross-country comparability; and 4) timeliness.

Given the significant implications arising from the interconnectedness between countries, Per Nymand-Andersen (European Central Bank), in his paper “Global Financial and Economic Crises: Lag in Statistics or Slow in Policy Actions?” emphasised the need for greater information sharing between countries. The financial crisis has revealed the need to re-assess the conceptual approach to risk and the statistics required from the financial sector, by taking a complete economic and financial system-wide perspective. He emphasised the new challenges in managing systemic risks, focusing on the macro- and micro-level statistics and the conceptual framework needed to ensure high quality, timely and representative statistics. He presented the comprehensive response that Europe has undertaken to safeguard the European financial system and the roadmap for establishing the European Banking Union. Although lag in statistics was not the cause of the global financial crisis, he pointed out that good quality and independently produced statistics are crucial to ensure an accurate representation of current developments. In this, he highlighted that continuous efforts are needed to safeguard statistics from electoral pressures and political cycles.

Acknowledging that the recent crisis has revealed information gaps and brought with



it demands for more information, Dr. He Qi (International Monetary Fund) and Abd. Latib Talib (Department of Statistics Malaysia, or DOSM) focused their discussions on the need for the implementation of new statistical initiatives and improvements in the compilation, dissemination and usage of statistics to close these data gaps and improve the quality of statistics. Dr. He Qi in her presentation “Statistics after the Financial Crisis: Response to New Data Demands and Data Gaps” highlighted data gaps which have impeded the understanding of key issues such as the build-up of risks in the financial sector, cross-border financial linkages, vulnerability of domestic economies to shocks and effective communication of statistics. In addition, she discussed the twenty recommendations identified by the International Monetary Fund (IMF)/Financial Stability Board (FSB) G-20 Data Gaps Initiative (DGI) to address these data gaps. While the DGI has made good progress in closing several data gaps, she also recognised that further work will be required to address the remaining data gaps.

Abd. Latib Talib, in presenting the paper “Strengthening Statistical Compilation and Usage of Relevant Statistics in Malaysia”, co-authored with Nur Hidaah Mahamad Rappek, Siti Rahmah Seh Omar and Nurul Naqiah Mansor, discussed the measures which DOSM has implemented to provide internationally comparable, timely and accurate statistics. This includes continuously improving statistical methodologies used and enhancing existing statistics. It also involves compiling new statistics such as the Business Cycle Clock and Early Warning Signals.

The discussant, ‘Allauddin Haji Anuar (Economic Planning Unit) acknowledged that this discussion topic has shed light on the challenges faced by global economies in terms of the availability of timely, granular and comparable statistics for policy formulation. For Malaysia, he suggested that there is a need to: 1) balance the needs of data users and compilers, in terms of data accuracy, quality, timeliness, consistency, sensitivity, frequency and coverage; 2) promote data collection in the areas of labour force, wages and productivity; 3) effectively communicate and educate the

public on the published statistics; and 4) gather inputs from private sector on statistical compilation. He also stressed that high quality and timely data is crucial for policymakers and regulators in making effective policy decisions.

In the discussion, a question was raised on the actions taken by the European authorities to regain public confidence in the credibility of official statistics in the aftermath of the sovereign debt crisis. Per Nymand-Andersen shared that among the measures needed to safeguard the integrity and quality of statistics is through ensuring the independence of the statistical agency and ensuring transparent communication of statistics.

Elaborating further on the impact of the global financial crisis on the compilation of statistics, Dr. He Qi mentioned that as the recommended improvements to data sources and categories are implemented, the compilation of distributional information such as income, consumption and wealth are needed alongside with aggregate figures, to measure the social cost of the crisis at different income levels. Given this, the Interagency Group on Economic and Financial Statistics (IAG) is encouraged to promote the production and dissemination of these data in a more frequent and timely manner. The OECD is also encouraged to continue with its efforts to link national accounts data with distributional information.

The Chair concluded the session from policy maker’s standpoint, by emphasising the need for users of statistics to “look beyond the headline figures” given that crises usually involve human costs which are often not reflected in the headline figures. One example is the impact of unemployment on families – it affects families’ basic needs such as access to education and medical amenities. Given the significant impact of crises on peoples’ lives, he stressed on the need for robust surveillance to avoid the occurrence of future crisis.

#### [Session 2A: Innovation in Analysis and Statistics](#)

Session 2A, entitled “Innovation in Analysis and Statistics” and chaired by Dr. Sivabalasingam a/l Veerasingam (Institut

Tadbiran Awam Negara), discussed new analytical perspectives and the relevant statistics needed to facilitate a comprehensive understanding of the state of economy and identification of relevant policy measures for economic development and sustainable growth. Dr. John L. Eltinge (U.S. Bureau of Labor Statistics) in discussing a paper co-written with Kenneth W. Robertson on "Compilation and Management of Labour Market Statistics for Macroeconomic Analysis at the U.S. Bureau of Labor Statistics", provided a brief overview of the compilation and management of labour market statistics at the Bureau of Labor Statistics (BLS). He stressed that the publication of economic data by a federal statistical agency should be factual, consistent and unbiased. While analyses will change as different elements of the economy change, the approach to analysis should remain as consistent as possible to mitigate the appearance of political influence in the production and analysis of data. He also emphasised on the importance of transparency, highlighting that the BLS regularly publishes articles about the theoretical and applied aspects of BLS procedures and maintains a press office as one of several points of contact for the media and the public.

Providing a Malaysian perspective on innovation in analysis and statistics, Ku Kok Peng (The Performance Management and Delivery Unit, or PEMANDU) in his presentation on "Economic Transformation Programme: KPI-Centric Approach of Result Delivery", pointed out the effectiveness of a Key Performance Indicator (KPI)-centric approach to ensure that Malaysia's Economic Transformation Programme (ETP) progresses on schedule. He noted that the KPI-setting process promotes collaboration between implementing ministries PEMANDU, and private sector. It also guides ministries towards timely implementation. He emphasised that in promoting greater transparency, ETP outcomes are made available to the public via annual reports.

Delving further into the use of statistics in the Malaysian context, Dr. Yeah Kim Leng (RAM Holdings Berhad), suggested in his paper

entitled "Domestic Demand-Driven Growth: Analysis Perspective and Statistics Needed", that domestic demand-driven growth is feasible and sustainable for Malaysia given the under-consumption and under-investment situation which has prevailed since the 1998 Asian Financial Crisis. Moreover, this approach has helped to offset the weak external demand during the last decade and, more importantly, during the period after the global financial crisis. Nevertheless, he acknowledged that this growth strategy is subjected to several constraints. He highlighted that a domestic demand-driven growth strategy can only contribute to a partial decoupling from external demand due to the country's large export capacity and small domestic market size. Furthermore, rising indebtedness and leverage will limit debt-funded consumption and investment. For a domestic demand-driven growth strategy to be sustainable, it will need to tap into all the sources and factors of growth as well as create the necessary conditions that catalyse or support economic growth. He ended his presentation by bringing to attention the different types of data required to facilitate the analysis of domestic-driven demand growth. Among the information required include household assets and liabilities by income groups, investment by technology classification, business formations, consumption of services by foreigners, high value agricultural activities, R&D intensity and innovation and micro-finance activities.

With price stability as one of the primary goals of central banks, Mohd Helmi Ramlee (Bank Negara Malaysia) in discussing the paper entitled "Core Inflation: The Malaysian Case" highlighted the importance of core inflation as one of the more important indicators to assess demand pressures on inflation. The paper, co-authored with Muhamad Shukri Abdul Rani (Bank Negara Malaysia), derived the estimates of core inflation for Malaysia and evaluated the performance of each measure of core inflation (statistical-based measurements, model-based approach and hybrid model). Mohd Helmi concluded that each measurement performs differently when used to forecast headline inflation, alluding to the possibility that some measures of core inflation could act as good predictors of future inflation, while others are

best at describing current development. He argued that no single measure of core inflation is superior to the other and reiterated the need for policy makers to support their analysis with an array of other economic indicators as well as anecdotal evidence in order to maximise the usefulness of these underlying measures of inflation in corroborating their policy analysis.

Sia Ket Ee (Hong Leong Investment Bank Berhad), as the discussant for this session, highlighted the need for greater collaboration between the Ministry of Human Resources, PEMANDU and DOSM to streamline labour statistics. He also highlighted the need for the Malaysian Education Blueprint to take into consideration the skill sets and knowledge required by Malaysia's labour force in its effort to reform the Malaysian education system. He then pointed out that in the current environment, the challenges for central banks lie in the limited number of monetary policy tools they can utilise and in communicating their policy decisions. He concluded his remarks by recognising MyStats as an appropriate platform to stimulate discussions among data compilers, users and policymakers.

A useful point highlighted by a participant during the discussion was on the lessons learnt from the recent crisis – that most statistics are lagging indicators. This gives rise to the need for the compilation of more leading indicators, such as indicator on inflation expectations.

#### [Session 2B: Leveraging on Statistical Methods and Scientific Approaches for Better Analysis](#)

Chaired by Dr. Kwek Kian Teng (Universiti Malaya), Session 2B discussed the statistical methods and scientific approaches that could be adopted by analysts, economists and policymakers in assessing economic and financial conditions as well as the associated risks. It began with a presentation by Dr. Lau Wee Yeap (Universiti Malaya) titled "An Overview on the Statistical Methods for Economic Research and Risk Assessment". He provided an introduction to descriptive statistics, statistical inferences, regression and models, and discussed volatility and market

risk models. He highlighted that widely used volatility models include the autoregressive conditionally heteroskedasticity (ARCH) model introduced by Engle (1982), and the generalised autoregressive conditional heteroskedasticity (GARCH) model extended by Bollerslev (1986). In discussing market risk models, he noted that the value-at-risk (VAR) model is among the most often used model to measure market risk. Since it was first developed in 1994, the VAR model has been established as the industry and regulatory standard in measuring market risk.

In the following presentation, Dr. Sheng Songcheng (People's Bank of China) deliberated on the new statistical framework developed by the People's Bank of China – the Aggregate Financing to the Real Economy (AFRE) approach to analyse the overall financing to the real economy. He began by introducing that the AFRE framework analyses the total financing from the financial system to the real economy during a certain period (a month, a quarter or a year). Then, he explained the two guiding principles coming from the Monetary and Financial Statistics Manual of the IMF, which are consolidation and accrual. After reviewing related theories on monetary transmission mechanism, he highlighted that the key feature of AFRE is its focus on the asset side of both financial institutions and issuers in the financial markets given that items on the asset side, such as loans, contain useful information. This complements the use of monetary aggregates which focuses only on the liabilities of financial institutions. As such, AFRE serves as an aggregated indicator comprehensively depicting the financial resources channelled through the financial sector to the real economy. He concluded by emphasising the usefulness of AFRE as a leading or lagging indicator of economic activity, pointing out that in China, the correlation between AFRE and other economic indicators is higher than that between the M2 monetary aggregate and other economic indicators. He ended by mentioning that AFRE is used by both national authorities for macro-prudential management and international economists for analysing China's economy situation.

In providing a Malaysian context to the discussion on the use of statistical methods and scientific approaches for better analysis, Dr. Noorasiah Sulaiman (Universiti Kebangsaan Malaysia) spoke about the use of Total Factor Productivity (TFP) to understand the composition of Malaysia's economic growth. In the discussion on her paper titled "Measurement and Contribution of Total Factor Productivity to Economic Growth", co-authored by Dr. Rahmah Ismail, she noted that during the study period of 1971 to 2007, growth of the Malaysian economy in the early years was driven by capital, labour and raw materials. Nevertheless, the country's economic growth strategy has evolved from an input-driven growth to one driven by productivity and knowledge. Of significance, growth in Malaysia's TFP between 1971 and 2007 was mainly due to technological progress. She pointed out that although TFP is an increasingly important contributor to Malaysia's economic growth, it is still much less influential relative to labour and capital. As such, there is still a need for Malaysia to augment TFP growth to increase its contribution to overall GDP growth.

Also exploring within the subject of economic growth, Dr. Nur Ain Shahrier (Bank Negara Malaysia) shared the various techniques that can be used in estimating Malaysia's output gap. Her paper entitled "Estimating Malaysia's Output Gap: Have We Closed the Gap?", jointly written with Dr. Chuah Lay Lian (Bank Negara Malaysia), outlined these techniques ranging from univariate to multivariate and structural methods. From this broad range of models, they found that Malaysia's output gap is closing. Dr. Nur Ain noted that an assessment of the output gap is necessary for the formulation of macro policies as the output gap contains information on how much more the economy can produce and how many more jobs it can create without exerting pressures on prices. However, she also acknowledged that the output gap measure is an unobserved component, and therefore, its measurement is subjected to estimation problems. In the assessment of various output gap estimation models, ranging from univariate to multivariate and structural methods, she concluded that the estimation of the output

gap from the various methods remain useful in the formulation of fiscal and monetary policies.

Discussant, Alan Tan Chew Leong (Affin Investment Bank Berhad), in addressing the issue of Malaysia's output gap suggested that the narrowing of the output gap can be attributed to the implementation of the ETP. The ETP has successfully increased the country's private investment growth. The rapid growth in private investment provides a partial explanation to the issue raised by Dr. Noorasiah that relative to the TFP, capital input plays a greater role in driving Malaysia's economic growth. He also commended China's effort to promote the use of AFRE. In addition to promoting greater transparency for the financial sector, AFRE also serves as a useful analysis tool to prevent excessive financing in the economy.

### Session 3A: New Horizon for Financial and Economic Statistics

The discussion in Session 3A, entitled "New Horizon for Financial and Economic Statistics", with Dr. Mohd Gazali Abas (Economic Planning Unit) as a Chairperson, was geared toward new statistical developments and potential for compilation of non-conventional data to better understand financial and economic conditions in a dynamic and challenging environment. Dr. Dahlia Rosly (Ministry of Urban Wellbeing, Housing and Local Government), shared her perspectives on "Going Beyond GDP: Social Wellbeing and Happiness Indicators". A relatively new concept for Malaysia, she explained that the need for a Happiness Index for the country was proposed in the Tenth Malaysia Plan. She acknowledged that social wellbeing and happiness can be measured using different indicators such as the spiritual, physical and social health of the people and the quality of the environment. She concluded that the Happiness Index can be an effective monitoring tool to assist local authorities in identifying urban wellbeing gaps.

Acknowledging the limitations of traditional indicators in providing a holistic understanding of the state of the economy, Zubaidah Ismail (Department of Statistics Malaysia, or DOSM)

and her co-authors, Mazreha Ya'akub and K. Megala Kumarran, discussed the use of Satellite Accounts to complement Gross Domestic Product as a measure for economic activity in the paper titled "Transcending the Traditional Approach through Satellite Accounts". She emphasised that the key benefit of Satellite Accounts is their ability to provide detailed information on the flow of goods and services from both the demand and supply perspectives. DOSM has successfully developed two satellite accounts – the Tourism Satellite Account (TSA) and the Information and Communication Technology Satellite Account. Focusing her discussion on the TSA, she explained that the TSA comprises main indicators to measure the contribution of tourism expenditure to the economy and employment generated by the tourism industry. In her conclusion, she highlighted that these Satellite Accounts were developed in accordance with international standards, and thus could facilitate international comparisons.

Bob Chua (Pulse Group PLC) in his presentation titled "Big Data Analytics: The Next Frontier for Economic and Financial Analysis", provided an overview of big data and its potential due to the availability of data and information on the internet. Big data, as he described, refers to high amount, often terabytes to petabytes, of data (volume), which come in many forms (variety), fast-moving (velocity) with a lot of uncertainties (veracity). Discussing the growing importance of big data analysis in the financial industry, he shared that finding ways to take advantage of new, unstructured data is the key for financial services providers to gain competitive advantages. Financial services providers can leverage on big data in improving their consumer insight, dealing with risk, generating customer centric financial offerings, meeting regulatory challenges and improving operational efficiency.

The role in which the shadow banking system played in precipitating the recent global financial crisis brought renewed focus on non-bank financial institutions (NBFIs) that act like banks but are not regulated and supervised like

banks. Muhamad Amar Mohd Farid (Bank Negara Malaysia) shared his views on the topic "Monitoring Shadow Banking and Its Challenges: The Malaysian Experience". Despite the growing importance of shadow banking in the Malaysian financial system, he noted that banking institutions remain the backbone of the Malaysian financial system, accounting for almost 60% of total assets within the domestic financial system. Notwithstanding this, he stressed that adequate supervision of NBFIs is important due to their interconnectedness with the banking system. While there are challenges, the accordance of power to collect relevant information from non-regulated NBFIs under the Central Bank of Malaysia Act 2009 has enabled the Bank to undertake rigorous assessments on the systemic implications of the Malaysian shadow banking system to the financial system and the overall economy.

Discussant for this session, Dr. Santha Vaithilingam (Monash University) acknowledged that the papers presented are relevant and timely given Malaysia's aspiration to achieve the status of a high-income economy. Of importance, she emphasised on the need of having micro measures and proper weightage for each variables in measuring happiness. She also discussed the impact of soon-to-be introduced Goods and Services Tax on the tourism industry, which should subsequently be reflected in the Tourism Satellite Account. She highlighted the potential of big data in unleashing underlying tacit information and the need for proper usage of existing data and methodology for shadow banking analysis.

### [Session 3B: Application of Technology in Transforming Malaysia's Statistical Landscape](#)

Recognising technology as a catalyst of change, Session 3B entitled "Application of Technology in Transforming Malaysia's Statistical Landscape" chaired by Sabri Omar (Department of Statistics Malaysia), provided an opportunity for compilers and users to discuss and share knowledge on the adoption and application of technology for data sourcing and processing. The session also discussed ways to improve data management and provision of statistical services via IT facilities and tools.

Dr. Qing Wu (Google Inc.) in discussing the first topic for this session “Going Beyond the Traditional Mode of Business: Statistics from Internet”, shared two Google tools which researchers can use to access *search* data collected by Google - Google Trends and Google Correlate. With Google Trends, a topic can be keyed in to retrieve a series of its *search* frequency, whereas Google Correlate is Google Trends in reverse, of which, targeted *search* data series are keyed in to retrieve topics whose frequency follows a similar pattern. He explained that these tools facilitate nowcasting analyses of economics series such as auto sales and consumer confidence. He also shared the findings of an analysis conducted using Google *search* data on the impact of weather to web traffic.

Tai Yoon Foong (Bank Negara Malaysia) shared her views on business intelligence (BI) through her paper entitled “Leveraging on Business Intelligence Tools for Micro- and Macro-data Analysis and Research”, written jointly with Muhamad Kamal Firdaus Muhmad Foudzi (Bank Negara Malaysia). She began by explaining the data management framework adopted at Bank Negara Malaysia which consists of three main components – data collection, data warehousing and the application of business intelligence tools to analyse large volumes of data. Focusing her discussion on Bank Negara Malaysia’s experience, she elaborated in details the usage of BI tools by different groups of users namely compilers, regulators, analysts and researchers. BI tools are extensively used for data quality checking by compilers; and in the production of key indicators and quantitative analyses by regulators, analysts and researchers for the purpose of surveillance, risk assessment and policy development and implementation.

Speaking on the topic “Addressing Statistical Gaps in a Dynamic Payment Environment” in her paper written jointly with Ravinder Kaur, Yee Chee May (Bank Negara Malaysia) started by providing some background information on the current landscape of payment statistics in Malaysia. She explained that payment statistics in Malaysia are jointly compiled by the Payment Systems Policy Department and the Statistical Services Department of

Bank Negara Malaysia. The statistics, which is made available in Bank Negara Malaysia website and published in the Financial Stability and Payment Systems Report, is mainly used to support policy development and to perform oversight functions. She stressed that payment statistics are also important for Bank Negara Malaysia in monitoring the progress of the country’s agenda of migration to e-payments. In view of the importance of payment statistics, financial institutions and payment system operators should play their parts in meeting the rising data requirement. Commitment from all parties is necessary to understand the current data requirement and definitions, which is crucial in ensuring data accuracy, comprehensiveness and timeliness.

Delivering the final presentation for the session, Wan Razali Matsah (Telekom Malaysia Berhad, or TM) highlighted the importance of location based statistics. Through his paper titled “Location Based Statistics: Knowing Your Place”, he emphasised that most data collected for purposes such as the opening a new branch, targeted marketing campaigns, delivery planning and survey, are location based data. He stressed that quality control and quality assurance must be applied to the collected data to reduce errors and increase data reliability. Accuracy of data is crucial to ensure planners make the right decisions and avoid costly mistakes. He also highlighted that designing and developing an IT system to store location based data for fast retrieval and easy maintenance is another major component in having a location based data facility. He concluded by pointing out that TM Map and location based statistics are now widely used in TM, from the planning of TM Point, to determining the best location for marketing campaigns, demarcation of TM’s sales team, up until the operation of installing and restoration services to homes or offices.

#### [Panel Discussion: Innovation in Statistics and Analysis for Responsive Policy Action](#)

The panel session on “Innovation in Statistics and Analysis for Responsive Policy Action”, was chaired by Dato’ Dr. Abdul Halim Mohd Nawawi (Universiti Teknologi MARA). Well represented by a diverse

group of stakeholders including researchers, practitioners, industry professionals and policymakers, the session discussed and called for the compilation of relevant and representative new data to meet users' needs for analysis and policy formulation.

Dr. Mohd Uzir Mahidin (Department of Statistics Malaysia, or DOSM) as the first panellist, briefly described the recent initiatives undertaken by DOSM to provide easy access to official statistics and to maintain public trust and confidence in the integrity and quality of data provided by DOSM. He explained that among the initiatives undertaken by DOSM to achieve these goals include the use of e-Survey and e-Services, data warehousing, the implementation of the National Enterprise-Wide Statistical System (NEWSS) and the collection of new indicators. He also highlighted the existence of the Main User Committee, established and led by DOSM to deliberate and assess new data requests from various parties.

The second panellist, Suhaimi Ilias (Maybank Investment Bank Berhad) began by first recognising the effectiveness of MyStats in providing a platform to facilitate collaboration between policymakers, data compilers, public and private sectors. He suggested four catalysts for innovation in statistics and analysis. First, is the new normal – the prevailing financial conditions following the global financial crisis. The new financial landscape is a catalyst for innovation because it requires the stretching of monetary policy boundaries through the use of non-conventional measures in formulating policy actions such as quantitative easing. The second driver for innovation in statistics and analysis is the financialisation of the modern economy. With the financial sector now playing a broader role beyond its basic intermediation role in the economy, key decision makers are required to have a better understanding of concepts related to finance and accounting in addition to having a good understanding of economics. Third, is the need to incorporate behavioural conditions and tendencies of market participants into economic analysis and forecasting. This

gives rise to the need for high frequency survey-based statistics that may provide indicative signals on market reactions such as fear, panic, optimism, pessimism and euphoria. Finally, he discussed the growing need for microeconomics data. Developments in the Malaysian economy such as the implementation of the Goods and Services Tax and subsidy rationalisation gives rise to the need for micro statistics to facilitate effective policy formulation and evaluation.

Dr. Zakariah Abdul Rashid (Malaysian Institute of Economic Research, or MIER), the third panellist, emphasised on the need to generate public confidence and trust in statistics produced. Key highlights of his presentation included the current positive trends of data sharing by multilateral agencies which can be adopted by national data compilers. He encouraged more research collaboration and data sharing with national and regional institutions with MIER, similar to what have been achieved with DOSM and the Economic Research Institute for ASEAN and East Asia (ERIA). Dr. Zakariah also pointed out several gaps in data compilation such as the lack of regional data and the need for more detailed data to facilitate better analysis.

The last panellist, Dr. Norhana Endut (Bank Negara Malaysia) provided her thoughts on the current economic and financial landscape facing policymakers and its implications on policy analysis and statistical requirements. She pointed out three key observations: 1) Monetary stability and financial stability are interlinked, thus, the calibration of monetary policy and other policies requires assessment of business and financial cycle; 2) Increased global interconnectedness resulting in periods of heightened volatility and contagion risk; and 3) Tepid global growth and accommodative monetary policy for more than five years with a prolonged conditions of weak recovery and high liquidity has led to structural changes in the global economy. She then shared on the statistical needs to facilitate pre-emptive policy formulation. Firstly, the excessiveness and threshold models which are critical ingredients for policy analysis require ability to pin down unobservable variables. Secondly, the

effective surveillance and monitoring of risks require greater data granularity and coverage, and timeliness of information. Thirdly, cross border analysis of risks requires expansion in scope, enhancement in frequency and standardisation of data across countries. Finally, forecasting and scenario analysis have to be complemented with survey- and indicator-based analysis. She ended her presentation by emphasising that data users must acquire the ability and skills to interpret and make the available data and information useful for policy analysis.

The Chair concluded that the strategic issues and next steps identified during the one-day conference revolve around data needs and requirements, challenges in maintaining data quality, and disclosure, openness and communication between data compilers and users.

During the discussion, there was interest to understand from the panellists on the future and usefulness of social media as a source of information to compile official statistics. Dr. Mohd Uzir, sharing from the perspective of an official compiler, is of the view that data from any source has to be fit-for-purpose and compiled based on the accepted statistical standards and requirements. Another question raised was on managing the volatility in high frequency data to ensure that the data is reliable and representative. Suhaimi acknowledged that high frequency data may provide understanding about the past, but has very limited ability in predicting the future. Given the dynamic changes in the economic and financial condition, users shall not depend on the standard long-term statistics but have to be more creative and innovative in interpreting and analysing the available statistics.





## Opening Remarks

Datuk Dr. Haji Abdul Rahman Hasan<sup>1</sup>

Assalamualaikum dan selamat pagi. YB. Senator Dato' Sri Abdul Wahid Omar, Menteri di Jabatan Perdana Menteri, para penceramah dan peserta yang dihormati sekalian.

Saya berbesar hati untuk mengalu-alukan YB. Menteri dan semua yang hadir dalam persidangan MyStats 2013. Kejayaan persidangan kali kedua ini adalah hasil kerjasama erat tiga organisasi, iaitu Bank Negara Malaysia, Jabatan Perangkaan Malaysia dan Institut Statistik Malaysia. Kami amat berbangga dengan kehadiran YB. Menteri bagi menyampaikan Ucaptama dan seterusnya menyempurnakan majlis perasmian. Kami juga amat gembira dengan sokongan yang ditunjukkan oleh para peserta dan pembentang kertas kerja. Peserta persidangan kali ini meningkat kepada 350 orang, yang terdiri daripada sektor swasta dan awam, perangkawan serta ahli-ahli akademik. Saya yakin persidangan ini boleh menjadi platform yang berkesan untuk kita berkongsi pandangan, pengalaman dan pengetahuan berkaitan domain statistik yang sentiasa berkembang merentasi masa dan perubahan sejagat. Perbincangan yang kondusif selama kita berseminar ini pastinya juga akan mencernakan idea-idea baru bagi manfaat bersama.

I am pleased to welcome the Honourable Dato' Sri Abdul Wahid Omar, Minister in the Prime Minister's Department and all participants and speakers to the Second National Statistics Conference (MyStats 2013). I am also very encouraged by the strong support from all of you present here today. This is the second conference after the successful inaugural MyStats 2012. The Conference this year is a collaborative effort among Bank Negara Malaysia (BNM), Department of Statistics, Malaysia (DOSM) and Malaysia Institute of Statistics (ISM).

The key objective of MyStats 2013 is to facilitate greater discussion and collaboration between statisticians, compilers and users of statistics, such as economists, analysts, academicians and policy makers, in improving data compilation, communication and usage of statistics. It also provides an avenue for the participants to discuss new ways and innovative approaches in the compilation and usage of statistics to support analysis, surveillance and policy measures in the increasingly dynamic environment.

This year, the Conference is held in conjunction with the International Year of Statistics (IYOS) 2013, which was initiated by the International Statistical Institute (ISI) and American Statistical Association (ASA). More than 123 countries and 2,250 statistics-related organisations celebrated IYOS 2013 around the globe. We are grateful that the President of ISI, Prof. Dr. Vijayan N. Nair is also here today to share with us the latest activities undertaken by the ISI.

Ladies and Gentlemen,  
The theme of MyStats 2013 is "Promoting Innovation in Economic and Financial Statistics to Support Policy Making in a Dynamic Environment". Among the topics of discussion include: (i) New Statistics for Better Surveillance and Policy Action; (ii) Innovation in Analysis and Statistics; (iii) New Horizon for Financial and Economic Statistics; (iv) Leveraging on Statistical Methods and Scientific Approaches for Better Analysis; (v) Application of Technology in Transforming Malaysia's Statistical Landscape; and (vi) Innovation in Statistics and Analysis for Responsive Policy Action.

This year, the Conference is introducing parallel sessions and it is hoped that the sessions will give more opportunity for us to cover broad areas of interest.

<sup>1</sup> Chief Statistician, Department of Statistics, Malaysia

### The Statistical System and Guiding Frameworks

Ladies and Gentlemen,  
Let me briefly share about official Statistical Framework in Malaysia. Every country has its statistical system and the country's statistical system is designed based on the country's requirements. Appropriate national statistical system ensures the efficiency and effectiveness in compiling official statistics. Official statistics are statistics produced by the national statistical office and other government agencies, which using basic framework provided by The United Nations Fundamental Principles of Official Statistics.

Malaysia adopts a centralised statistical system whereby the process of collection, compilation and dissemination of national statistics is governed by the Statistics Act 1965 (Revised - 1989). The centralised statistical system allows DOSM to coordinate and integrate the national statistics through standardised definition, concept, methodology and classification. This also provides a platform in integrating the entire process of data collection, interpretation and dissemination under one roof in order to produce sound statistics.

### Dynamism of Statistical Service

Ladies and Gentlemen,  
The borderless economy and the rapid structural changes have resulted in high expectations and the need for a more diverse spectrum of statistics. This entails a new set of indicators and more short term statistics to monitor and identify the changes. One of the new sets of indicators developed by DOSM was the statistics on Small Medium Enterprises (SMEs). Since 2005, DOSM has compiled statistics on SMEs to examine the role of SMEs as the next engine of economic growth. Using these statistics, the SME Master Plan was formulated with the goal of stimulating the SMEs' contribution to the economy.

In 2012, DOSM continued to develop new products and among the new products produced include Tourism Satellite Accounts, Information and Communication Technology

Satellite Accounts (ICTSA), indicators for Economic Transformation Programme (ETP) such as Gross National Income by 11 NKEAs, Foreign Direct Investment (FDI) in Malaysia by Sector and Country, Statistics on Direct Investment Abroad by Sector and Country, Index of Distributive Trade and others. The reports on Economic Census 2011 were released last year and a special report on Small and Medium Enterprise was launched in September 2012.

The development of new products will be continued in a few areas which include the Index of Services, Services Production Price Index and Job Creation statistics. Other statistics such as small area statistics will also be compiled as an input for micro planning purpose and investment programme under the ETP.

### ICT as an Enabler and a Tool for Moving Forward

Ladies and Gentlemen,  
Innovation and creativity in DOSM are being fostered through various activities whereby the activities undertaken have created many new ideas in improving the services provided by DOSM. The uses of technology and innovation as well as creativity in routine work activities are also being optimised. E-Survey was first implemented for the Monthly Manufacturing Survey and followed by the International Trade in Services and recently extended to the Quarterly Survey of Services.

Moving forward in terms of modernisation of data collection, the use of Personal Digital Assistant (PDA) and Computer Assisted Telephone Interview (CATI) are currently being tested in our Household based surveys.

In tandem with its ICT Strategic Plan, DOSM undertakes continuous enhancement in various aspects of the Generic Statistical Business Process Model (GSBPM). DOSM has undertaken several new initiatives to integrate individual systems and applications; and streamlined the statistical workflow through a computerised system known as National Enterprise Wide Statistical System (NEWSS).

### On Challenges

Ladies and Gentlemen,  
Lack of awareness on the importance of statistics is said to contribute to poor cooperation in terms of incomplete surveys questionnaires and the delay in submitting them within the stipulated time frame. To overcome this, DOSM has undertaken continuous engagement and awareness programmes. One of the strategic directions outlined in DOSM's Strategic Plan 2010 - 2014 is the strategy 'to expand networking with data providers and users'. In line with that, DOSM has moved towards intensifying data tapping on secondary and administrative data from other agencies instead of solely relying on the primary data to cater for the increasing demand for new statistics. This is vital in order to avoid duplication of efforts and to reduce respondents' burden as well as to use the resources more effectively.

Prior to data tapping, it is important that respective agencies accommodate DOSM's data requirements. In addition, full understanding of the usage of the codes, classifications and concepts by the respective agencies is a must to ensure standardisation and compliance to international recommendations.

Data requirements and needs have never ceased but continue to increase, thus giving rise to the need for data prioritisation. The current focus of DOSM is to fulfil the requirements of statistics for the preparation of the 11th Malaysian Plan which is scheduled to be tabled to the parliament by the Prime Minister in June 2015.

### On Data Quality and Integrity

Ladies and Gentlemen,  
DOSM is rigorous with respect to the standards for data collection, methods of data processing and the derivation of results. The staffs are instilled with an ethos of quality to promote the achievement of such high standards. In this way, the sense that what are produced are the result of quality inputs, as well as quality methods of production and control, is constantly reinforced.

DOSM also gives priority to standardisation of definitions, codes and classifications. These codes and classifications are regularly updated in tandem with the development of the related

manuals and standards. An Inter-Agency Technical Committee was set up in 2007 to promote and coordinate uses of standard codes and classifications and is scheduled to meet twice a year.

In terms of timeliness, DOSM complies with the Special Data Dissemination Standard (SDDS). According to the IMF Annual Observance Report of the Special Data Dissemination Standard for 2011, DOSM supersedes the SDDS in terms of timeliness requirements for national accounts, labour market, balance of payments, merchandise trade and international investment position statistics. For example, recognising the urgency of obtaining quarterly GDP and BOP data by stakeholders, DOSM managed to improve the timeliness of releasing these indicators from 9 weeks to less than 7 weeks.

### On Data Dissemination

DOSM's portal will continue to be used strategically for data dissemination and communication. Improvement of website contents will be continuously undertaken. E-Services that include free download services have been expanded to include all publications by DOSM and as to date, more than 100 publications are available for free on-line download. The portal, being the medium of information dissemination, will continue to provide informative and user-oriented services.

Ladies and Gentlemen,  
The need to fulfil comprehensive economic and financial statistics cannot be materialised if it is not supported by efficient delivery system, adequate regulatory and surveillance framework. Hence, the innovation and modernisation of the statistical delivery system is certainly a paramount effort in DOSM to support dynamic economic policy making.

To conclude, I would like to take this opportunity to extend my deepest gratitude to all who have contributed to the preparation of this conference. My special thanks to YB. Senator Dato' Sri Abdul Wahid Omar, Minister in the Prime Minister's Department for being with us today. My appreciation also goes to our co-organisers, BNM and ISM for the valuable cooperation in making this conference a success.



## Keynote Address

Senator Dato' Sri Abdul Wahid Omar<sup>1</sup>

First of all, I would like to thank the organisers, Bank Negara Malaysia (BNM), the Department of Statistics, Malaysia (DOSM) and Institut Statistik Malaysia (ISM) for inviting me to deliver the keynote address in this conference. It is indeed a great pleasure and an honour for me to be here this morning and to present the keynote address in the Second National Statistics Conference, MyStats 2013, held in conjunction with the celebration of the International Year of Statistics 2013.

During the past decades, the Malaysian economy has experienced rapid structural changes. In the early years after independence, the economy mainly dominated by the agriculture and mining sectors, with both sectors contributing 45 percent of GDP and 66 percent of employment. Since then, the landscape of Malaysia's economy has evolved from an agriculture and commodity based economy to an industrial economy and then to a service economy with higher value added and technology driven industries.

The structure and growth of the Malaysian economy have been largely moulded through the implementation of national development blueprints. Malaysia's economic development plans (Malaysia Plans) provided the main thrusts for the country's socio-economic policy and are used as a base for development planning, policy formulation and implementation. The country's first five-year plan, 1956-1960, which was implemented on the eve of independence, focused on economic expansion to absorb the growing labour force and on the provision of basic needs and facilities such as education, health, sanitation, water supply and electricity. Thereafter, the plans incorporated numerous deliberation strategies intended to bring about balanced development to the country

and ultimately improve the quality of life for the people. The nation is now at the mid-period of the 10th Malaysia Plan (2011-2015) where the country's sustainable development strategy has been incorporated.

The success of the country's development which was complemented by relevant statistics has generated vibrant economic activity. As a result, the Malaysian economy has moved from a resource-based economy to an industrial economy. The manufacturing sector grew from 14.6 percent of GDP in 1970 to 24.9 percent in 2012. During the same period, the share of agriculture declined from 28.8 percent of GDP (1970) to 7.3 percent of GDP (2012).

The rapid growth of manufactured exports since 1980 was a commendable achievement of the industrialisation era. The government's decision to pursue an outward-looking development strategy was the key to the path of sustained and vigorous growth of its economy. The external sector continues to be a major contributor to the country's revenue, contributing to the largest share of the annual foreign exchange earnings over the decades.

Malaysia's international merchandise trade has grown remarkably over the past decades. Particularly, in the ten year period of 2000 to 2010, Malaysia's exports increased significantly from RM373.3 billion (2000) to RM638.8 billion (2010) and last year (2012) amounted to RM702.6 billion. These figures can be attributed to the initiatives taken by the government to support the export oriented industries by creating an investment friendly environment through various incentives and maintaining close ties between the government and private businesses.

<sup>1</sup> Minister in the Prime Minister's Department, Malaysia

## Focusing on Services Sector to Accelerate the Growth

Ladies and Gentlemen,

To bring the country to new heights and for Malaysia to become a developed nation by 2020, new sources of growth need to be identified and the government has targeted the services sector to drive future growth. The sector which contributed only 42.6 percent to GDP in 1970 is targeted to grow to 67.3 percent by 2020. This target is in line with the experience of developed economies, where the services sector is usually the largest contributor to GDP (e.g. for the last year: the US: 77%, Japan: 74%, Germany: 71%, Singapore: 63%, Hong Kong: 92%). Thus, to support the services sector, the government anticipates that the growth will take place across the board, especially in oil and gas, construction, business and professional services, education and training, ICT, healthcare and tourism sectors.

In order to accelerate the growth of the services sector, the government has opened up a number of important services sub-sectors to foreign participation. In April 2009, a total of 27 services sub-sectors were liberalised and an additional of 18 services sub-sectors were liberalised last year. The liberalisation measures taken by the government is part of Malaysia's obligations in accordance with the various trade agreements signed under the World Trade Organisation (Malaysia joined the WTO in 1995). The liberalisation is also an effort to meet our commitment towards the ASEAN Economic Community by 2015.

On the potential of financial and banking sector in the economy, Malaysia's model of Islamic finance and halal trade has been well accepted globally. There has been an increasing trend on the number of consumers and businesses using Islamic finance in their financing programmes. During the first World Islamic Forum outside the Muslim world in London in October this year, the United Kingdom's Prime Minister announced that he wanted London to stand alongside Dubai and Kuala Lumpur as one of the great capitals of Islamic finance in the world. With the enthusiasm towards Islamic finance and the strong effort by the government, Malaysia will

continue to lead as the international Islamic finance hub in the world and this will certainly contribute to the expansion of the services sector.

Although the country's foreign exchange earnings has traditionally been heavily dependent on merchandise trade, the export potential of the services sector will be strengthened and given specific focus by policy makers. Last year, the country's services sector exports amounted to RM117.0 billion. Among the significant contributors are Tourism (RM62.5 billion); Business Services (RM23.8 billion); and Transportation (RM13.7 billion). To keep the momentum, the various government agencies will continue to formulate strategies to assist businesses to establish business links overseas. The government has in place various initiatives to accelerate the pace of development of services sector and the details can be tracked in the Economic Transformation Program (ETP) and the Government Transformation Program (GTP).

Ladies and Gentlemen,

On the overall performance, the country has achieved a substantial increase in GNI from RM11.6 billion in 1970 to RM771.0 billion (2010) and RM905.2 billion (2012). At present, relative to other countries in the world, Malaysia is ranked as an upper middle-income country. The country's FDI has also increased steadily. In 2000, Malaysia's FDI recorded RM14.4 billion and had increased to RM29.2 billion (2010) and RM31.1 billion (2012). Despite the government's push on the external sectors, the country's domestic economic activities are also strengthened as sources of growth. As we are moving towards a high income per capita country, our economy will also gradually shift from being heavily dependent on the external sector to a consumption based economy.

To put this into perspective, back in the year 1970, only 26.8 percent of the country's population reside in urban areas and based on the latest Population Census 2010, the number had increased to 70.9 percent. Meanwhile, the people's life expectancy has also improved, from 61.6 years for males in 1970 to 72.3 years in 2012 and for the

females, from 65.6 years in 1970 to 77.2 years in 2012. Furthermore, the largest share of the population are the youth and teenagers. These snap-shots of demographic statistics give us the indication that the consumption and desires of people is on the rise which certainly will propel demand on the domestic sector.

#### Current Economic Scenario and Challenges Ahead

Ladies and Gentlemen,  
As we stand on the threshold of a vulnerable economic environment, with the world economy expecting expected to grow at a slower pace of 2.9 percent in 2013, coupled with issues on debt and twin deficits, balance of payments and government budget deficits daunting most countries. Despite this global uncertainty, the government has continuously implemented prudent economic development policies and has managed to shield the country economy from recurring recessions.

In the Prime Minister's 2014 Budget speech on 25 October 2013, it was highlighted that the government has outlined various new measures to support the growth momentum. There are 100 touch points covered in the 2014's Budget, which manifest into 5 main thrusts, namely:

- Invigorating economic activity;
- Strengthening fiscal management;
- Inculcating excellence in human capital;
- Intensifying urban and rural development; and
- Ensuring well-being of the people.

The 2014 Budget focuses on sustainability, strengthening economic resilience and accelerating transformation of the country into developed nation. The government has taken various strategies and made bold decisions towards strengthening the country's fiscal ability and commitment for future development. Various new mechanisms of fiscal policies have been formulated such as restructuring government revenue through Goods and Services Taxes (GST) and rationalisation of subsidies, ultimately for the prosperity of the nation and its people. The government's principle is to ensure the country's economic growth and at the

same time, not lose sight of our economic responsibility to reduce the budget deficit and achieve a balanced budget by 2020.

Ladies and Gentlemen,  
The economy is expected to grow at a rate of between 4.5 to 5.0 percent for this year and 5.0 to 5.5 percent next year. The government is also projected to have a surplus of RM25 billion in the balance of payments account this year. Meanwhile, the government's budget deficit is targeted to improve to 4.0 percent in 2013 and 3.5 percent in 2014. Thereafter, the government will keep reducing the fiscal deficit until we reach a balanced budget by 2020. The unemployment rate is expected to remain at a moderate level of 3.1 percent and inflation rates hovering at 2.0 to 3.0 percent in 2014.

Malaysia's GDP in the third quarter of 2013 which was announced last week has continued to expand by 5.0 percent annually and the Current Account surplus surged to RM9.8 billion. Given these recent statistics, the performance of the country remained viable and competitive and above all better than the other industrialised economies. The decent growth guides the country on a right path to become a full developed nation by 2020 where the country's income per capita is targeted to increase from USD9,928 (RM30,667) in 2012 to USD15,000 in 2020.

#### On Country Competitiveness

Ladies and Gentlemen,  
The Institute for Management Development (IMD), a business school in Lausanne, Switzerland has over the years assessed countries according to three main competitiveness factors namely economic performance, government efficiency and infrastructure to measure how well countries manage their economy and human resources in increasing their prosperity.

According to the latest World Competitiveness Yearbook 2013 released by the Institute, Malaysia was ranked 15th out of 60 economies. At this position, Malaysia continues to be ahead of Australia (16th), United Kingdom (18th), China (21st), South Korea (22nd) and Japan (24th). Malaysia also registered significant improvements in



economic performance with its ranking rising from tenth to seventh position while business efficiency rose to fourth place from sixth in the previous year. The major contributing factors to Malaysia's competitiveness performance include Management Practices, International Trade, Labour Market, Finance and Prices.

Meanwhile, according to the "Doing Business 2014" report released by the World Bank and the International Finance Corporation, Malaysia jumped from twelfth to sixth place among business friendly economies. The rankings were based on 10 indicators and covered 189 economies. The report puts Malaysia ahead of other countries in this region except Singapore. With our collective effort i.e. the government and private sector and an improved delivery system, I believe that our "Doing Business" ranking can be upgraded further to be among the top 5 in the years ahead.

To ensure that competitiveness is further enhanced, Malaysia will strive to achieve fiscal balance for economic sustainability. This will be achieved through reducing budget deficit, intensifying regulatory review initiatives to modernise the business environment, leveraging on flexible skills and talent development for higher productivity and to meet market needs, better management commitment towards sustainable development and better quality of life, and strengthening the innovation eco-system as well as intensifying commercialisation of research and development and technological capabilities.

Ladies and Gentlemen,  
"Promoting Innovation in Economic and Financial Statistics to Support Policy Making in a Dynamic Environment" has been chosen as the theme of this conference. The theme is

highly relevant as the recent financial crisis and economic uncertainty has set new challenges to statisticians to ensure availability of relevant statistics and also challenges to users on the importance of the right diagnosis and timely policy responses based on statistical evidences. The conference will facilitate greater discussion and collaboration among statisticians, compilers, researchers and users of statistics in many areas including on the latest methodology and statistical processing, new methods on data compilation and new statistical economic indicators.

Malaysia has achieved remarkable progress in its economic and social development through a series of five year development plans and various national blueprints. All the plans incorporate statistics produced by the DOSM, BNM, Ministry of Finance, Ministry of International Trade and Industry and other government agencies to support development planning, policy formulation and implementation. Essentially, all the measures and initiatives put forward by policy makers must be strongly supported by a broad spectrum of economic and financial statistics. Thus, the Government will continue to have high expectations from professional statisticians and economists who play a key role in developing the nation into achieving a high income nation status.

Finally, I believe that this conference will be beneficial to the speakers as well as the participants. Again, let me thank the organising committee in making this conference such a successful event.

Ladies and Gentlemen,  
With the lafaz Bismillahirrahmanirrahim, I now declare this Second National Statistics Conference, MyStats 2013 open.





# GLOBAL FINANCIAL AND ECONOMIC CRISES: LAG IN STATISTICS OR SLOW POLICY ACTIONS?

Per Nymand-Andersen<sup>1</sup>

*"Small waves are not to be ignored"*

## Abstract

The financial crisis has revealed the need to re-assess the conceptual approach to risk and the statistics required from the financial sector, by taking a complete economic and financial system-wide perspective. This paper highlights the new challenges in managing systemic risks, focusing on the macro- and micro-level statistics required and the conceptual framework needed to ensure high quality, timely and representative statistics are available to describe the structures and dynamics of financial systems and assess their impact on the real economy. Although statistics are not the cause of the financial crisis, there are significant statistical challenges in supporting prudent economic and financial analyses in their ability to predict the magnitude and contagion effects of financial risks and to support timely corrective policy actions.

## Does the Value of a Number Increase in Times of Economic and Financial Crisis?

Statistics are the snapshots and radar screens reflecting the structure and dynamics of our democracies. These snapshots need to be continuously adjusted to capture new patterns within our society, which has led to new economic theories, new conceptual frameworks and new policy needs. In a global and highly interconnected economy, the world of statistics is continually challenged by its responsibility to reflect and explain complex financial and economic phenomena, as well as their relative importance in, and impact on, the real economy. The persisting financial crisis has had a significant impact on the field of national and international statistics.

Although it is clear that statistics did not cause the financial crisis, it cannot be completely ruled out that certain reported statistics may have contributed to – or even amplified – the financial turmoil and adversely affected the timeliness of corrective policy responses. The financial crisis emerged as a banking (and financial insurance) crisis and swiftly spilled over (as a derivative) into a sovereign debt crisis, as national governments stepped in to rescue the national banking sectors from spillover effects and contagion risks from other domestic banks and from banks abroad. For instance, financial market statistical indicators – such as spreads between sovereign bond yields, associated credit default swap rates, certain volatility measures – started to signal increases in the risk premia for holding certain sovereign securities. These increasing risk premia reflected market sentiments questioning the ability of some sovereign borrowers to manage their national fiscal policies and to live up to their obligations in a prudent and sustainable manner.

As official national statistics are used to measure these debt levels, these core statistics are of paramount importance for assessing, among others, national governments' debt levels, obligations, revenues, finance and expenditures. However, it cannot be ruled out that sudden questioning of the quality of and trust in these statistics alongside the systematic under reporting of debt levels, may have contributed to – or even exacerbated – the financial turmoil.

Statistics are becoming increasingly important. They are now part of the solution in the safeguarding of financial stability. They are also used for the supervision of financial agents and governments' fiscal discipline as well as for triggering corrective policy actions in compliance with supra-national and international obligations.<sup>2</sup>

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<sup>2</sup> The new framework for European Union (EU) policy coordination includes the implementation of the macroeconomic imbalance procedure as part of the economic governance reform. This reform aims to strengthen economic surveillance within the EU and the euro area in order to ensure that Member States conduct policies that prevent the emergence of harmful macroeconomic imbalances and to correct such imbalances where they become excessive.

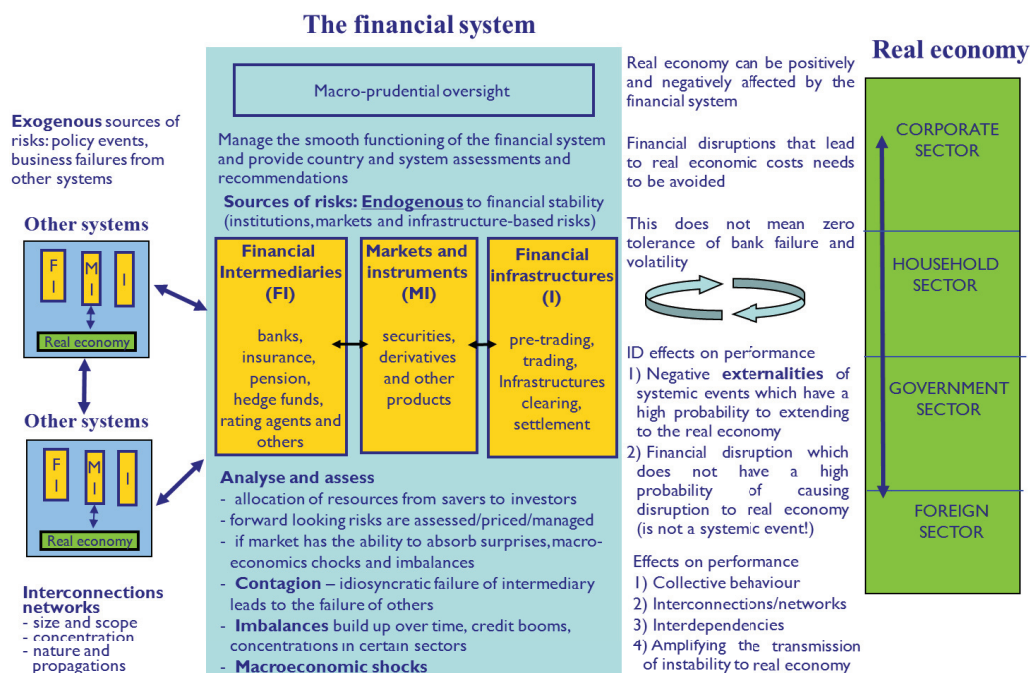
What is certain, however, is the long-term reputational risk to statistics, if the quality of and trust in statistics are questioned. This reputational risk goes far beyond the national agents involved in providing national statistics – it causes collective cross border damage to other statistics agents, including international statistics organisations and to the statistics profession as a field of science attracting young and bright graduates. This is where the collective governance of the statistical function needs to take effect in order to develop, present and safeguard the quality and reputation of statistics. It is not the first time in modern democracies that a tendency towards increased political pressure on statistics is observed during periods of political distress.

If citizens cannot trust official statistics, who can they rely on to provide the information needed to ensure sustainable policy decisions for an optimal allocation of resources?

There are two elements to this question: what is needed within our modern democracies to continuously shield statistics from short-term

electoral and political cycles, and how can the statistics profession be assured that it has the ability to provide and guard good quality statistics? There are clear indications that independently produced statistics are the best pre-condition for the provision of a factual representation of the structure and dynamics of our economy and for the safeguarding of our democracies.<sup>3</sup>

Of course, the real losers of wrong policies are the citizens of individual countries who have to pay for the medium to long-term damage caused by manipulated and unsound policy decisions. The costs are real and high for these citizens, who have to pay higher taxes, work longer, face a reduction in pension payments and deal with job losses, without an equivalent increase in public services. This is combined with a significant decrease in public expenditure, impacting the level of public services, health-care systems and the field of statistics. The cost is indeed significant in the field of statistics also, as the demand for and importance of statistics is ever increasing.



Source: Detken, C. and Nymand-Andersen, P. (2013), "The new financial stability framework in Europe", in Fouque, J-P. and Langsam, J.A. (eds.), Handbook on systemic risk, Cambridge University Press, Chapter 26.

<sup>3</sup> Schubert and Nymand-Anderson (2013).

Let us first turn to the new policy solutions for safeguarding financial stability to ensure that a similar financial crisis will not occur in the future.

### [The New Financial Architecture - On the Road to a Banking Union with Common Rules](#)

The financial crisis has many mutually reinforcing causes. Promoting financial stability requires an in-depth understanding of the functioning of the financial system, consisting of (i) markets, (ii) financial intermediaries and (iii) infrastructures, and of how the financial system interacts with the real economy.

In open market economies where financial intermediaries can operate across various jurisdictions and geographical areas and where financial flows take place easily across borders, safeguarding financial stability requires an international approach followed by implementation at the national level. This requires policymakers to think internationally and act nationally. Well-known challenges emerging from the incentive structure within the financial system; the associated asymmetric information and moral hazard problems were not addressed sufficiently at the international level, and neither was the issue of ensuring a level playing field. It is now well recognised by policy authorities at all levels that safeguarding financial stability is a necessary precondition for maintaining macroeconomic and monetary stability to ensure economic growth and welfare.

Several international fora under the patronage of the Bank for International Settlements (BIS), the Financial Stability Board (FSB), the International Monetary Fund (IMF) and G20 have now developed common approaches, guidelines and recommendations for coordinating financial stability initiatives across various economic territories and countries.

At the European<sup>4</sup> level, the far-reaching responses to the need for retaining financial stability are without historical precedence, comprising the creation of a new supervisory architecture for financial supervision, based on the recommendations of the “De Larosière report”<sup>5</sup> and the Presidents of the European Council, European Commission, European Central Bank and Eurogroup<sup>6</sup>. This is supplemented by a new roadmap for a European banking union to build an integrated financial framework to safeguard financial stability and to minimise the cost of bank failures. The roadmap for the banking union includes the following three building blocks.

- The establishment of a single supervisory mechanism (SSM) for which the European Central Bank (ECB) will be responsible, and the implementation of a single rulebook for financial services<sup>7</sup>.
- The establishment of a single resolution mechanism, and the possibility of direct recapitalisation of banks via European funds and the European Stability Mechanism as a fiscal backstop.
- The harmonising of Member States’ deposit guarantee schemes and the establishment of a common European system of deposit protection.

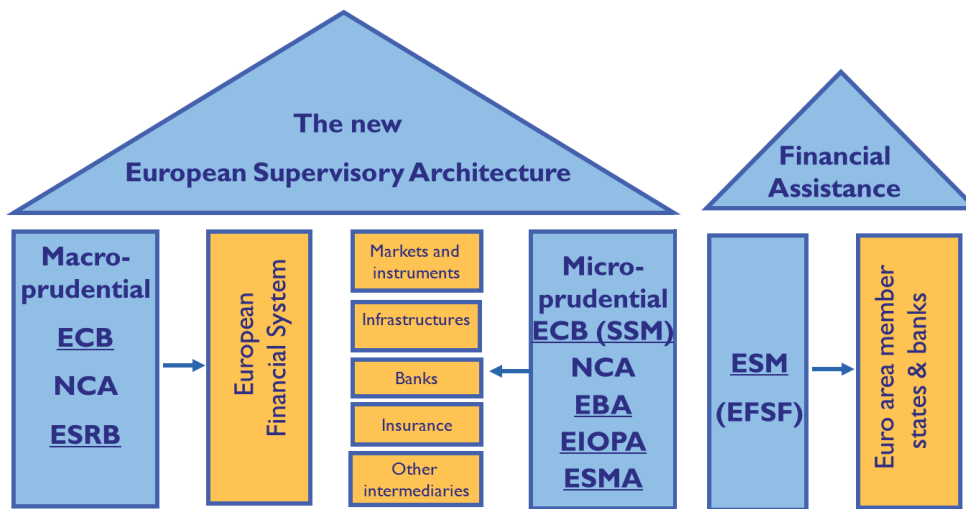
<sup>4</sup> The term Europe in this paper refers to the 28 Member States of the European Union as of 1st January 2014.

<sup>5</sup> The report of the High-Level Group on Financial Supervision in the EU, chaired by Jacques de Larosière, published on 25 February 2009.

<sup>6</sup> Van Rompuy, Herman, Towards a genuine Economic and Monetary Union, European Council, Brussels, 5 December 2012. Final report by the President of the European Council in close collaboration with the Presidents of the European Commission, European Central Bank and Eurogroup.

<sup>7</sup> Council Regulation (EU) No 1024/2013 of 15 October 2013 (the ‘SSM Regulation’).

## The new European landscape - New ECB tasks



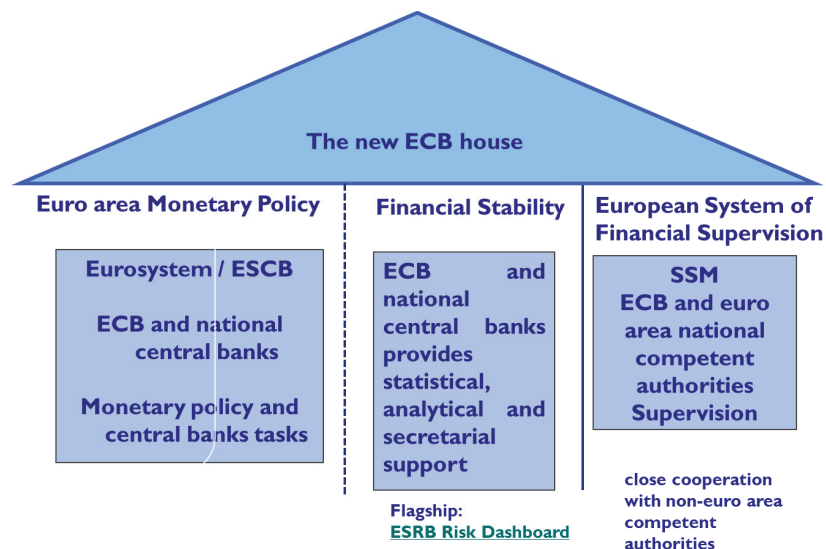
Source: Detken, C. and Nyman-Andersen, P. (2013), "The new financial stability framework in Europe", in Fouque, J-P. and Langsam, J.A. (eds.), Handbook on systemic risk, Cambridge University Press, Chapter 26. New European agencies or new tasks for existing institutions are underlined.

Europe is on the right path towards a banking union, building upon a macro-prudential and a micro-prudential pillar and a financial assistance scheme. The macro-prudential pillar consists of the ECB and the new European Systemic Risk Board (ESRB), the secretariat, statistics and analytical support of which is ensured by the ECB. The new micro-prudential pillar consists of the ECB – with the SSM and the national competent authorities (NCAs), and three new European supervisory authorities: the European Banking Authority (EBA), the European Securities and Markets Authority (ESMA), and the European Insurance and Occupational Pensions Authority (EIOPA).

The financial assistance scheme consists of the new European Stability Mechanism

(ESM), which is the permanent financial assistance fund in the euro area with the purpose of providing financial assistance to euro area Member States in difficulties. The ESM has EUR80 billion of paid-up capital and EUR620 billion of callable capital, against which it issues bonds and lends the proceeds to euro area Member States. The transfer of supervisory powers to the supranational level, together with the ESM, is necessary as part of the SSM, in support of the Economic and Monetary Union (EMU).

The new European solutions for safeguarding the financial system are far-reaching and significant progress has been made, with further consolidation to come on the road to a banking union. The European Central Bank's mandate has been extended.



These solutions, however, require an all-inclusive statistics approach as part of supplying meaningful and comparable statistics that serve the new financial architecture as part of the 'new ECB house'.

#### The Increasing Role of Statistics in National and International Policy Making

The provision of statistics and financial data is essential for supporting the analytical tools and models employed in the analysis and assessment of the financial system. The ECB's Directorate General Statistics predominantly collects data and statistics for euro area monetary policy purposes and has

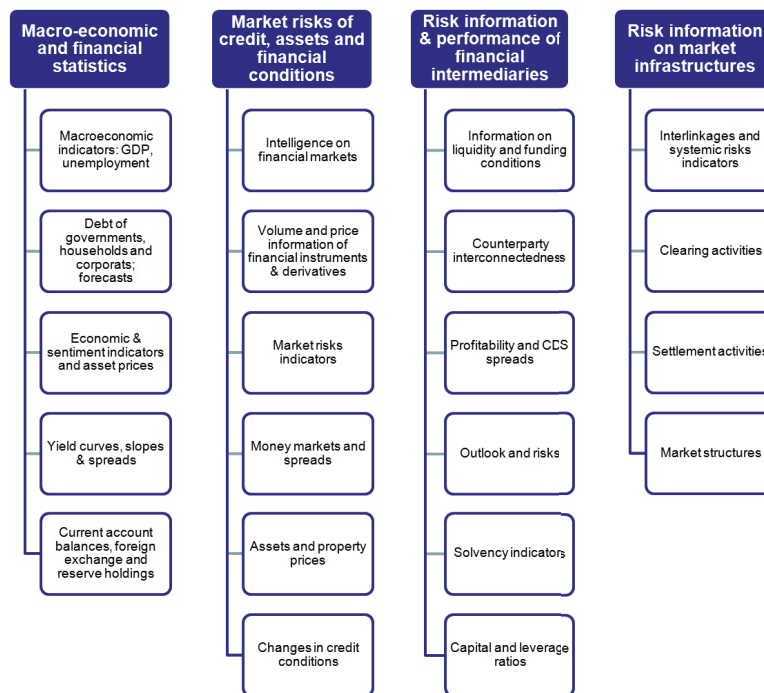
been mandated to collect new and enhanced statistics to fully support the EU-wide macro-prudential and micro-prudential analysis frameworks. A particular challenge will be to expand the coverage from the euro area (18 Member States<sup>8</sup>) to all 28 Member States of the EU.

There are four main statistical indicator groups identified for the purposes of macro-prudential analysis: (i) macroeconomic and financial statistics; (ii) market risks relating to credit, assets and financial conditions; (iii) risk information on and performance of financial intermediaries; and (iv) risk information on market infrastructures.

<sup>8</sup> As of 1 January 2014.



### Four main financial statistical indicators and risk information groups



Source: Nymand-Andersen, P., Antoniou, N., Burkart, O. and Kure, J. (2013), "Financial data and risk information needed for the European System of Financial Supervision", in Brose, M.S., Flood, M.D. and Krishna, D. (eds.), Handbook of Financial Data and Risk Information, Cambridge University Press, Chapter x.

It is apparent that financial crises pose their own challenges for statistics and that statistics have increased in importance as part of the new financial architecture.

The focus has shifted towards more timely credit statistics for monetary and economic analysis. In fragmented markets, monitoring the transmission channel within countries has become of the utmost importance. The trend is a policy shift from looking at total aggregates to focusing on more detailed and disaggregated statistics at national and regional levels. Users require an in-depth understanding of how the national financial system interacts with the real economy and the ability to compare national financial structures across countries, economic regions and beyond. For example, users require timely statistics on country and regional loan developments, with more detailed information on sectors, size of firms and industry activity of counterparties, and the ability to analyse banks' (monetary financial institutions') interest rate statistics on loans

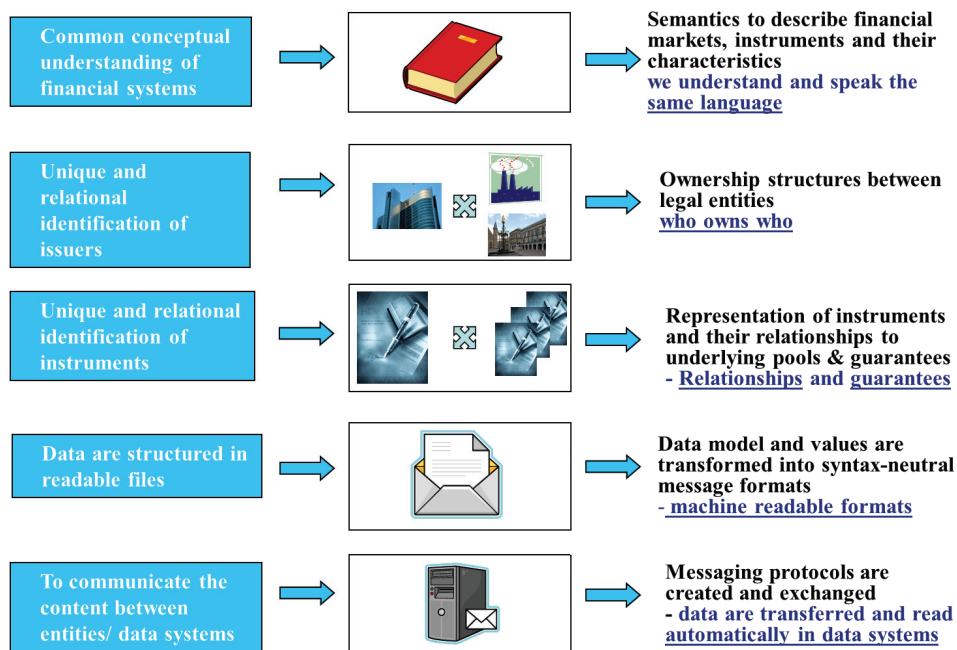
and deposits, size and maturity class and the financing needs/barriers of, in particular, small and medium sized corporates.

A similar trend is foreseen in the use of micro-level data and the need for granular statistics. This means a shift from the traditional collection of aggregated sector-level statistics to institution-specific and individual-level data. A risk orientation concept replaces the macroeconomic perspective. The provision of micro-level information is significantly more demanding in terms of ensuring the quality and accuracy of the statistics compared with the provision of aggregated statistics. The focus will be on cross-institutional comparisons and on linking different information sources for one institution to an overall risk assessment. These are major changes. At the same time, there are many potential synergies between the current and new statistical methods, collection processes and supervisory data. Several central banks are already performing this function today.

This challenges the traditional statistical collection and production concept, and the new mission cannot be achieved without substantial political and statistical support. The challenge is two-fold. First, to obtain and maintain the political trust and support for sharing (giving access to) detailed information among national, supranational and international authorities, since – to a large extent – the pool of required statistics and data are already available within the overall system, fully respecting and preserving the strict confidentiality of individual data. The latter should however not be used as a barrier to progress, as several methods exist for preserving statistics information and today's IT capacities and IT developments are by no means a barrier to sharing nor to handling large and complex amounts of timely data. Second, substantial political and statistical

supports are required for the standardisation of concepts and values, which is a cumbersome process of obtaining agreements, and for ensuring timely implementation. For instance, five building blocks of standardisation are necessary for collecting and sharing relevant statistics and risk data among national and international authorities:

- (i) a common conceptual understanding of financial instruments and their specific data characteristics;
- (ii) a unique identification of issuers such as financial institutions;
- (iii) the identification of instruments and their structures;
- (iv) a standardised data model and data structure; and
- (v) a mechanism to transmit and exchange statistics and data.



Source: Nymand-Andersen, P., Antoniou, N., Burkart, O. and Kure, J. (2013). "Financial data and risk information needed for the European System of Financial Supervision", in Brose, M.S., Flood, M.D. and Krishna, D. (eds.), Handbook of Financial Data and Risk Information, Cambridge University Press, Chapter x.

Furthermore, to complete the snap shot picture of the financial systems, there is an increasing need for very timely ad hoc data collection to cover phenomena which are new or potentially growing in relevance, while the standardisation work and implementation are yet to be fixed. These temporary measures can take the form of direct surveys to gauge the importance of the phenomena and detect shifts in patterns. Furthermore, statisticians should not shy away from using private (unofficial) sources to fill in the missing pieces to complete the complex picture of the puzzle, as long as the source and methodologies are transparent. This could include statistics and data from institutional and commercial data vendors, private credit registers and pre-trading, trading and post-trading agents.

#### Conclusion - Lag in Statistics or Slow Policy Actions?

The on-going financial crisis has had a significant impact on the field of national and international statistics. Statistics are part of the solution for safeguarding the financial systems and are increasing in importance. The financial crisis has revealed the need to reassess the conceptual framework for identifying and managing risk and this has a significant impact on the field of statistics as supplier of information. This paper highlights the new statistics challenge of providing the macro- and micro-level statistics required to describe the structures and dynamics of our financial systems and their impact on the real economy.

Statistics are not the cause of the financial crisis. However, it cannot be completely ruled out that certain reported statistics may have contributed to – or even amplified – the financial turmoil and adversely affected the timeliness of corrective policy responses. Statistics and their quality can therefore not be taken for granted and continuous efforts are needed to safeguard statistics from the pressure of elections and political cycles, which seems to increase during periods of

political distress. There are indications that independently produced statistics are the best pre-condition for the provision of a factual representation of the structure and dynamics of economies and for the safeguarding of democracies.

Yet, there are significant statistical challenges in supporting the newly established institutions with their new conceptual frameworks for identifying and mitigating risks within the financial system. At least in Europe, the response has been comprehensive and wide-ranging as part of safeguarding the European financial system and preventing a repetition of the financial crisis.

- A new micro-economic financial stability architecture has been established by the creation of three new European-level supervisory authorities (EBA, EIOPA and ESMA) for (i) banking sector; (ii) the insurance and pension sector; and (iii) financial markets and instruments. Furthermore the ECB has taken on new supervisory tasks in the context of the single supervisory mechanism (SSM).
- The European Systemic Risk Board (ESRB) was established with the responsibility for macro-prudential oversight of the European financial system together with the ECB, as part of contributing to the prevention and mitigation of systemic risks within the financial system.
- A new European Stability Mechanism (ESM) forms a permanent and significant financial assistance package where temporary financial assistance can be directed to assist euro area Member States.

The new single supervisory mechanism is moving Europe forward on the road to a banking union, ensuring one single prudential supervision policy and rulebook for all financial services operating in Europe. The next steps are to establish a common resolution authority and a common Europe-wide deposit guarantee scheme as part of protecting consumers.

The statistics challenges are in providing and supporting prudent economic and financial analyses as part of predicting the magnitude and contagion effects of financial risks and supporting timely corrective policy actions. This paper highlights how the financial crisis has had a significant impact on the new function of statistics, in particular by creating the need to:

- (i) extend the scope of statistics;
- (ii) provide further granularity of existing statistics;
- (iii) standardise concepts and values;
- (iv) interlink and share statistics and data among authorities and economies;
- (v) use ad hoc surveys;

- (vi) use supplementary private (unofficial) sources; and
- (vii) release statistics within a shorter time frame.

The Directorate General Statistics of the European Central Bank is fully committed to providing the statistical support for the new European structural set-up as part of contributing to safeguarding the financial system, both at the macroeconomic and microeconomic level, and is committed to supplying the statistics and data required for a prudent overall functioning of the single supervisory mechanism. New roads are being constructed to safeguard the European financial system. History will not repeat itself in this field.

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Regulation (EU) No 1094/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Insurance and Occupational Pensions Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/79/EC (OJ L 331, 15.12.2010, p. 48).

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Treaty establishing the European Stability Mechanism between the Kingdom of Belgium, the Federal Republic of Germany, the Republic of Estonia, Ireland, the Hellenic Republic, the Kingdom of Spain, the French Republic, the Italian Republic, the Republic of Cyprus, the Grand Duchy of Luxembourg, Malta, the Kingdom of Netherlands, the Republic of Austria, the Portuguese Republic, the Republic of Slovenia, the Slovak Republic and the Republic of Finland.

# STATISTICS AFTER THE FINANCIAL CRISIS: RESPONSE TO NEW DATA DEMANDS AND DATA GAPS

Dr. He Qi<sup>1</sup>

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## Abstract

As the global economy is on the road to recovery from the financial crisis of 2008-2009, the International Monetary Fund (IMF) has been working with its member countries and other international agencies to fill the major data gaps revealed by the financial crisis. Among the various global initiatives to close existing data gaps, the primary focus is on the IMF/Financial Stability Board (FSB) G20 Data Gaps Initiative (DGI) which was launched in 2009 and endorsed by the G20 Finance Ministers and Central Bank Governors, and the IMF's International Monetary and Financial Committee.

The DGI is a comprehensive multi-year program that includes twenty recommendations to address data gaps in four main areas: build-up of risk in the financial sector, cross border financial linkages, vulnerability of domestic economies to shocks, and improving communication of official statistics, as identified in the report "The Financial Crisis and Information Gaps" presented to the G20 Finance Ministers and Central Bank Governors in November 2009. By enhancing the existing statistical framework and fostering the development of new ones, the DGI is aimed at creating a global reporting system that will comprehensively monitor global financial and non-financial flows and stocks to facilitate better policy analysis and decision making.

The presentation will elaborate the main data gaps and the twenty recommendations to address them. It will review progress made in the past four years by countries and international agencies through the

Inter-Agency Group on Economic and Financial Statistics (IAG), chaired by the IMF and comprising the Bank for International Settlements, the European Central Bank, Eurostat, the Organization for Economic Co-operation and Development, the United Nations, and the World Bank. It will also discuss emerging needs and work ahead in further addressing the data gaps.

## Introduction

As the global economy recovers from the financial crisis of 2008-2009, the International Monetary Fund (IMF) has been working with its member countries and other international agencies to fill the major data gaps revealed by the financial crisis. Among the various global initiatives to close these data gaps, the primary focus is the IMF/Financial Stability Board (FSB) G20 Data Gaps Initiative (DGI) launched in 2009 by the international community and endorsed by the G20 Finance Ministers and Central Bank Governors, and the IMF's International Monetary and Financial Committee.

The DGI is a comprehensive multi-year program that includes 20 recommendations to close data gaps in four main areas: build-up of risk in the financial sector, cross border financial linkages, vulnerability of domestic economies to shocks, and improving communication of official statistics. By enhancing the existing statistical framework and fostering the development of new ones, the DGI aims to create a global reporting system that will comprehensively monitor global financial and non-financial flows and stocks to facilitate better policy analysis and decision making.

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This paper elaborates the main features of the DGI, progress made in implementing the DGI, and the work ahead in further advancing the DGI.

### Data Dimensions of the Crisis

History has demonstrated that crises create new demands for financial and economic data. The recent crisis is no different. It highlighted the critical importance of timely, consistent, and comparable statistics across countries and revealed additional statistical needs for proper financial stability analysis and policy making. Broadly, the crisis manifested the need to address data gaps in three main areas that are interrelated, as follows:

- i. The build-up risk in the financial sector: The crisis demonstrated both the difficulty of capturing, and the importance of, sound indicators of the degree and location of leverage or excessive risk-taking within the system, particularly as regards unregulated or lightly regulated institutions and instruments (the shadow banking system) but also liquidity, credit and tail risks within regulated sector. It highlighted the need for a better understanding of where risks actually lie across institutions and markets given the growth of risk transfer instruments. It also demonstrated a need for improved data to construct many of these indicators and to make sure they are sufficiently timely and consistent.
- ii. Cross-border financial linkages: The crisis demonstrated that important financial network connections had developed over the years, but they are not captured by available statistics. For instance, the continued rapid growth of large financial institutions with a global reach has increased the importance of cross-border network links in national financial stability analysis, but there is insufficient information on these networks. Also bond holdings across borders have become more prevalent, equity prices more correlated, and financial contagion across border more

apparent. These developments called for better and timely data to close the gaps on financial interconnectedness.

- iii. Vulnerability of domestic economies to shocks: Data availability to monitor the behavior and exposure of economic agents within the domestic economy needs to be strengthened. Such data are relevant to ascertaining (i) the vulnerabilities embedded in the balance sheet positions of financial institutions, governments, nonfinancial corporate, and the households sectors; (ii) conditions in markets to which several of these sectors are exposed, such as the real estate markets; and (iii) the financial and real sector linkages within an economy.

Another important area identified is the need to improve the communication of official statistics and close the gaps in the availability of timely data to users. The lack of timely data that could have been useful in monitoring events during the crisis has prompted the statistical community to give urgent attention to produce timely data and make these data available in real time.

### The IMF/FSB G20 Data Gaps Initiative

In response to the request of the policymakers, the staff of the IMF and the FSB Secretariat proposed 20 recommendations to close the data gaps (the so-called DGI) in the report *The Financial Crisis and Information Gaps* presented to the G20 Finance Ministers and Central Bank Governors in November 2009.<sup>2</sup> The report was endorsed by the G20 Finance Ministers and Central Bank Governors and the IMF's International Monetary and Financial Committee. The implementation of the DGI has been coordinated by the Inter-Agency Group on Economic and Financial Statistics (IAG).<sup>3</sup>

The 20 recommendations are arranged around the four areas identified in the above section: build-up of risk in the financial sector, cross-border financial linkages, vulnerability of domestic economies to shocks, and improving communication of official statistics.

<sup>2</sup> Available at <http://www.imf.org/external/np/g20/pdf/102909.pdf>.

<sup>3</sup> The IAG is chaired by the IMF and consists of the Bank for International Settlements (BIS), the European Central Bank, Eurostat, the Organization for Economic Co-operation and Development (OECD), the United Nations, and the World Bank.

For ease of reference, Table 1 is a stylised overview of the 20 recommendations in a matrix form. The rows reflect the four main areas highlighted by the global crisis where data gaps were evident, and the columns reflect, from an implementation standpoint, whether reporting/conceptual frameworks at that time existed, but needed to be enhanced, or did not exist and needed to be developed to fill those gaps.<sup>4</sup> The full list of recommendations is set out as an appendix to the paper.

### Progress in Implementing the DGI

Four years after the launch of the DGI, significant progress has been made across the full range of the DGI 20 recommendations. As summarised in the 2013 Progress Report on the Implementation of the DGI<sup>5</sup>, work on developing the conceptual/statistical frameworks envisaged under the DGI is nearing completion; and considerable data enhancements are coming on stream.

**Table 1: Overview of the DGI 20 Recommendations**

Area	Conceptual/statistical framework needs development	Conceptual/statistical frameworks exist and ongoing collection needs enhancement
Build -up of risk in the financial sector	#3 (Tail risk in the financial system and variations in distributions of, and concentrations in, activity ) #4 (Aggregate Leverage and Maturity Mismatches) #6 (Structured products)	#2 (Financial Soundness Indicators (FSIs)) #5 (Credit Default Swaps) #7 (Securities data)
Cross -border financial linkages	#8 and #9 (Global network connections and systemically important global financial institutions) #13 and #14 (Financial and Nonfinancial Corporations cross - border exposures)	#10 and #11 (International Banking Statistics (IBS) and the Coordinated Portfolio Investment Survey (CPIIS)) #12 (International Investment Position (IIP))
Vulnerability of domestic economies to shocks	#16 (Distributional Information)	#15 (Sectoral Accounts) #17 (Government Finance Statistics) #18 (Public Sector Debt) #19 (Real Estate Prices)
Improving communication of official statistics		#20 (Principal Global Indicators)

<sup>4</sup> The numbers in the matrix refer to the recommendation numbers in the DGI. Recommendation #1 is not included as it states the need for the FSB Secretariat and the IMF staff to report periodically to the G-20 Finance Ministers and Central Bank Governors.

<sup>5</sup> See <http://www.imf.org/external/np/g20/pdf/093013.pdf>



### Development of Conceptual/Statistical Frameworks

The Build-up of Risk in the Financial Sector  
The developmental work on the recommendations covering the build-up of risks in the financial system is almost complete (Recommendations number 3, 4 and 6). In 2012/2013, the IMF published three conceptual papers on (i) a new heuristic measure of fragility and tail risks, (ii) an operational framework for measuring tail risks, and (iii) near-coincident indicators (Recommendation number 3)<sup>6</sup>. This follows the publication of the report of the International Organization of Securities Commissions (IOSCO) on disclosure principles for public offerings and listings of asset-backed securities in April 2010<sup>7</sup> (Recommendation number 6), and the completion of the BIS work on measures of maturity and leverage on banks' international balance sheets (Recommendation number 4). Further work on leverage and maturity mismatches is currently being undertaken by the FSB under its work program on shadow banking.

### Cross-border Financial Linkages

Significant progress was made on the developmental work regarding cross-border financial linkages (Recommendations number 8 and 9). In March 2013, Phase 1 of the FSB project on Global Systemically Important Financial Institutions (G-SIFIs) was completed with the launch of the data hub for Global Systemically Important Banks (G-SIBs) at the BIS (Recommendation number 8).<sup>8</sup> Phase 1 involved collecting and pooling consistent information on the bilateral credit exposures of G-SIBs and on their aggregate exposures to relevant risk factors, such as country and sector of counterparties. The data are currently being shared only among individual G-SIBs' national supervisory authorities in the form of reports. The project is expected to progress further following the FSB Plenary decisions in

March 2014 on Phases 2 and 3 of the project that cover the collection of improved data on bilateral funding dependencies (I-I) and more granular consolidated balance-sheet data (I-A).<sup>9</sup>

Work on improving data availability of cross-border exposures of financial and nonfinancial corporations is progressing (Recommendations number 13 and 14). The BIS is advancing the work on cross-border exposures of financial and nonfinancial corporations based on the paper published by the BIS in 2012 on concepts of nationality and global consolidation (Recommendation number 13).<sup>10</sup> This paper is currently being turned into a reference document with the input of experts from various international groups interested in these concepts for publication in 2014. In July 2013, a navigation template on available data on cross-border exposures of financial and nonfinancial corporations was launched on the Principal Global Indicators (PGI) website (Recommendation number 14).<sup>11</sup>

### Vulnerabilities of Domestic Economies to Shocks

Regarding measuring vulnerabilities of domestic economies to shocks, the OECD, in collaboration with Eurostat, finalised two reports on distributional information on income, consumption and wealth, which are consistent with macroeconomic indicators (Recommendation number 16) in June 2013. In addition, two reports were finalised with recommendations and guidelines for improving the collection of micro data; one on an integrated framework for collecting information on the distribution of household income, consumption and wealth; and the other one containing guidelines for micro statistics on household wealth.<sup>12</sup> The next step is to refine the methodology for compiling distributional information consistent with macroeconomic indicators in a timely manner.

<sup>6</sup> See <http://www.imf.org/external/pubs/ft/wp/2012/wp12216.pdf>, <http://www.imf.org/external/pubs/ft/wp/2013/wp13168.pdf> and <http://www.imf.org/external/pubs/ft/wp/2013/wp13115.pdf>

<sup>7</sup> <http://www.iosco.org/library/pubdocs/pdf/IOSCOPD318.pdf>

<sup>8</sup> [http://www.financialstabilityboard.org/publications/r\\_130418.pdf](http://www.financialstabilityboard.org/publications/r_130418.pdf)

<sup>9</sup> [http://www.financialstabilityboard.org/publications/r\\_130905c.pdf](http://www.financialstabilityboard.org/publications/r_130905c.pdf)

<sup>10</sup> <http://www.bis.org/ifc/publ/ifcwork08.pdf>

<sup>11</sup> <http://www.principalglobalindicators.org/default.aspx>

<sup>12</sup> Available at <http://www.oecd.org/statistics/icw-framework.htm> and <http://www.oecd.org/statistics/guidelines-for-micro-statistics-on-household-wealth.htm>

## Enhancement of Existing Conceptual/Statistical Frameworks and Ongoing Collection of Data

### The Build-up of Risk in the Financial Sector

Considerable progress has been made in enhancing information on build-up of risk in the financial sector (Recommendations number 2, 5 and 7). As of end-2013, 80 countries report FSIs (up from 45 in 2009). Among them, 18 G20 economies report some FSIs to the IMF for dissemination, with 13 G20 economies reporting all or most of the core FSIs with a quarterly or higher frequency.

With respect to enhancing data reporting on Credit Default Swaps, or CDS (Recommendation number 5), the BIS and the Committee on the Global Financial System (CGFS) have completed their work on this recommendation, based on expansions of the BIS CDS statistics decided in September 2009. Reporting central banks have provided more detailed data on the type of counterparties from June 2010, and more details on the geography of counterparties and underlying instruments from June 2011. Of the 13 central banks that have been invited by the CGFS to provide to the BIS CDS statistics for dealers in Over-The-Counter (OTC)/CDS derivatives in their jurisdiction, eight are from G20 economies covering the bulk of the CDS market.

In September 2012, Part 3 of the Handbook on Securities Statistics (HSS), dealing with equity securities issues and holdings, was published (Recommendation number 7). This followed the publication of Parts 1 and 2 dealing with debt securities issues and holdings in 2009 and 2010, respectively. All G20 economies report some securities statistics to the BIS and most of them are working on enhancing their data reporting practices in accordance with the Handbook. A consolidated Handbook based on the published parts 1-3 is under preparation.

### Cross-border Financial Linkages

Work on enhancing data availability with regard to cross-border financial linkages is making good progress (Recommendations number 10, 11, and 12). Coverage of significant financial centers and of other economies, including G20

economies in the BIS's International Banking Statistics (IBS) and the IMF's Coordinated Portfolio Investment Survey (CPIS), has continued to improve. As of end 2013, 44 economies are IBS reporters and 78 economies are CPIS participants; of them 17 G20 economies participate in both the BIS's IBS and the IMF's CPIS (Recommendation number 10).

With key enhancements of the IBS (Recommendation number 11) approved by the CGFS in 2012, BIS work is now focused on implementation. A major milestone was the commencement of the reporting of Stage 1 enhancements (including coverage of banks' locally extended domestic currency positions). Reporting of more detailed locational and consolidated banking statistics in terms of sector, instrument, and other breakdowns is tentatively expected to begin with data for fourth quarter of 2013 (Stage 2 enhancements).

Regarding CPIS enhancements, preparations were undertaken for the introduction of semi-annual reporting of the IMF's CPIS data beginning with the reference date of end June 2013 (Recommendation number 11). Further CPIS enhancements are aimed at increasing economies' participation; by improving timeliness (a dissemination lag of less than nine months) and expanding scope (collecting data on the institutional sector of the foreign debtor and on short negative position on an encouraged basis); and facilitating data accessibility. Collection of enhanced data for the CPIS starts in January 2014.

Regarding the recommendation on the international investment position (IIP), the number of quarterly IIP reporters has increased to 82 as of end 2013 (Recommendation number 12). In March 2010, the IMF's Executive Board decided to prescribe for subscribers to the IMF's Special Data Dissemination Standard (SDDS), after a four-year transition period, quarterly reporting (from annual) of the IIP data, with a maximum lag of one quarter (quarterly timeliness). Currently, all G20 economies collect and disseminate IIP data, of which 10 (plus the Euro Area) disseminate quarterly IIP data on a quarterly timeliness.

### Vulnerability of Domestic Economies to Shocks

Progress has been made in enhancing the availability of data to measure vulnerability of domestic economies to shocks (Recommendations number 15, 17, 18, and 19). Recommendation number 15 aims at promoting the compilation and dissemination of the balance-sheet approach (BSA), the flow-of-funds, and financial and nonfinancial sectoral accounts data. A working group has been created under the auspices of the IAG and led by the IMF. The data template on sectoral accounts was finalised in June 2012 and posted on the IMF/OECD's conference website hosted by the IMF and linked to the SNA webpage hosted by the United Nations Statistics Division.<sup>13</sup> Available sectoral accounts data reported to the OECD are hyperlinked to the PGI website. Currently all G20 economies produce some components of sectoral accounts or have plans to produce these information, but only half disseminate at least some data (financial or nonfinancial) on a quarterly basis. Going forward, the focus is on implementation through outreach, technical assistance and training.

Work on promoting timely, cross-country standardised, and comparable government finance statistics (GFS) based on the accepted international standards is progressing (Recommendation number 17). From May 2011, IMF staff reports adopted a standardised presentation of fiscal data following the GFSM 2001. Such presentations are now incorporated in over 100 IMF staff reports, including for most G20 economies. In addition, the fiscal data of the IMF's World Economic Outlook (WEO) now follows the GFSM 2001 format. Among the G20 economies, seven economies compile quarterly general government operations and two compile quarterly general government cash flow data. Under the auspices of the IAG, a standard template was developed for the regular reporting of key GFS data. In July 2013, this standard GFS template was populated with data for 17 G20 economies (including the Euro area) and posted on the PGI website.<sup>14</sup>

Considerable progress has been made in disseminating cross-country and comparable public sector debt data (Recommendation number 18). In December 2010, the World Bank, jointly with the IMF, launched the quarterly public sector debt database initially for developing and emerging economies. In March 2012, in collaboration with the OECD, the public sector debt database was expanded to the advanced economies. Around 90 countries have agreed to participate. Among the G20 economies, 17 have agreed to participate, of which 13 are reporting General Government Gross Debt and four are reporting Central Government Gross Debt. A Public Sector Debt Statistics Guide was published in 2011 to provide the methodological guidance for compiling these data. Work remains in improving the timeliness of data reporting, the sectoral breakdown, the instrument coverage, including other accounts payable and pension entitlements, as well as maturity and currency breakdowns.

Availability of data on real estate prices has recently increased significantly (Recommendation number 19). Sixteen G20 economies (including the Euro area) report some data on real estate prices for inclusion on the BIS website. Currently, the reported data are heterogeneous and not comparable. With the official publication of the Handbook on Residential Property Price Indices (RPPI)<sup>15</sup> in April 2013, improvements in the comparability and coverage of RPPIs are expected in the coming years. At the EU level, a regulation on providing data on residential real estate prices to the European statistical institutions was adopted in early 2013.<sup>16</sup> In August 2013, the OECD launched a survey aimed at developing (i) a House Prices database in line with the Handbook on RPPIs, and (ii) a set of additional indicators that provide a more complete picture of the residential real estate market. Work towards the definition of the methodological framework for Commercial Property Price Indices (CPPI) is ongoing with a Handbook on CPPI expected to be completed by early 2015.

<sup>13</sup> The agreed templates, which countries are expected to aim at completing in the coming years, are posted at: <http://www.imf.org/external/np/sta/templates/sectacct/index.htm> and <http://unstats.un.org/unsd/nationalaccount/imp.asp>.

<sup>14</sup> <http://www.principalglobalindicators.org/default.aspx>

<sup>15</sup> [http://epp.eurostat.ec.europa.eu/portal/page/portal/product\\_details/publication?p\\_product\\_code=KS-RA-12-022](http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-RA-12-022)

<sup>16</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32013R0093:EN:NOT>

### Improving Communication of Official Statistics

Since the launch of the PGI website in April 2009 by the IAG, considerable progress has been made in improving communication of official statistics (Recommendation number 20). Currently, the PGI website brings together data for G20 economies and 10 non-G20 economies with systemically important financial sectors. Enhancement to the PGI website has been ongoing. In 2013, key enhancements included the launch of the GFS template (Recommendation number 17) and Phase 1 of the navigation template on cross-border exposures of financial and nonfinancial corporations on the PGI (Recommendations number 13 and 14).<sup>17</sup> In addition, the PGI website was enhanced by including the CPIS data for the G20 economies plus the 10 non-G20 members. Data on the aggregate GDP growth rate for G20 economies was posted on the PGI website in March 2012 and the aggregate G20 consumer price index, as compiled by the OECD, was posted in October 2013.

### Work Ahead in Further Advancing the DGI

With significant progress already achieved, the work ahead will focus on completing the implementation of all the recommendations and providing timely and comparable economic and financial statistics in line with policy needs; as well as improving communication with policymakers on the availability, benefits, and policy relevance of data emerging from the DGI.

For the coming year, the priority work and milestones include FSB Plenary decisions on the common template for the G-SIBs and a timeline for Phase 2 and 3 activities by mid-2014; collection of data from the Stage 2 enhancements of BIS IBS; release of CPIS enhancements beginning with the reporting of semi-annual data for end-June 2013 position, in early 2014; dissemination of quarterly IIP data by all SDDS subscribers; and enhancements to sectoral accounts and balance-sheet data.

<sup>17</sup> There are ongoing efforts to finalise an improved version of the navigation template (Phase 2) by early 2014.

**List of DGI 20 Recommendations**

Recommendation	
1.	Staff of FSB and the IMF report back to G20 Finance Ministers and Central Bank Governors by June 2010 on progress, with a concrete plan of action, including a timetable, to address each of the outstanding recommendations. Thereafter, staff of FSB and IMF to provide updates on progress once a year. Financial stability experts, statisticians, and supervisors should work together to ensure that the program is successfully implemented.
Monitoring Risk in the Financial Sector	
2.	The IMF to work on increasing the number of countries disseminating Financial Soundness Indicators (FSIs), including expanding country coverage to encompass all G20 members, and on other improvements to the FSI website, including preferably quarterly reporting. FSI list to be reviewed.
3.	In consultation with national authorities, and drawing on the Financial Soundness Indicators Compilation Guide, the IMF to investigate, develop, and encourage implementation of standard measures that can provide information on tail risks, concentrations, variations in distributions, and the volatility of indicators over time.
4.	Further investigation of the measures of system-wide macroprudential risk to be undertaken by the international community. As a first step, the BIS and the IMF should complete their work on developing measures of aggregate leverage and maturity mismatches in the financial system, drawing on inputs from the Committee on the Global Financial System (CGFS) and the Basel Committee on Banking Supervision (BCBS).
5.	The CGFS and the BIS to undertake further work in close cooperation with central banks and regulators on the coverage of statistics on the credit default swap markets for the purpose of improving understanding of risk transfers within this market.
6.	Securities market regulators working through IOSCO to further investigate the disclosure requirements for complex structured products, including public disclosure requirements for financial reporting purposes, and make recommendations for additional improvements. If necessary, taking account of work by supervisors and other relevant bodies.
7.	Central banks and, where relevant, statistical offices, particularly those of the G20 economies, to participate in the BIS data collection on securities and contribute to the further development of the BIS-ECB-IMF Handbook on Securities Statistics (Handbook). The Working Group on Securities Databases to develop and implement a communications strategy for the Handbook.
International Network Connections	
8.	The FSB to investigate the possibility of improved collection and sharing of information on linkages between individual financial institutions, including through supervisory college arrangements and the information exchange being considered for crisis management planning. This work must take due account of the important confidentiality and legal issues that are raised, and existing information sharing arrangements among supervisors.
9.	The FSB, in close consultation with the IMF, to convene relevant central banks, national supervisors, and other international financial institutions, to develop by end 2010 a common draft template for systemically important global financial institutions for the purpose of better understanding the exposures of these institutions to different financial sectors and national markets. This work should be undertaken in concert with related work on the systemic importance of financial institutions. Widespread consultation would be needed, and due account taken of confidentiality rules, before any reporting framework can be implemented.
10.	All G20 economies are encouraged to participate in the IMF's Coordinated Portfolio Investment Survey (CPIS) and in the BIS's International Banking Statistics (IBS). The IMF and the BIS are encouraged to continue their work to improve the coverage of significant financial centers in the CPIS and IBS, respectively.

11. The BIS and the CGFS to consider, amongst other improvements, the separate identification of nonbank financial institutions in the consolidated banking data, as well as information required to track funding patterns in the international financial system. The IMF, in consultation with the IMF's Committee on Balance of Payments Statistics, to strive to enhance the frequency and timeliness of the CPIS data, and consider other possible enhancements, such as the institutional sector of the foreign debtor.
12. The IMF to continue to work with countries to increase the number of International Investment Position (IIP) reporting countries, as well as the quarterly reporting of IIP data. The Balance of Payments and International Investment Position Manual, sixth edition (BPM6) enhancements to the IIP should be adopted by G20 economies as soon as feasible.
13. The Interagency Group on Economic and Financial Statistics (IAG) to investigate the issue of monitoring and measuring cross-border, including foreign exchange derivative, exposures of nonfinancial, and financial, corporations with the intention of promoting reporting guidance and the dissemination of data.
14. The IAG, consulting with the FSB, to revisit the recommendation of the G-22 to examine the feasibility of developing a standardised template covering the international exposures of large nonbank financial institutions, drawing on the experience with the BIS's IBS data, other existing and prospective data sources, and consulting with relevant stakeholders.

#### Sectoral and Other Financial and Economic Datasets

15. The IAG, which includes all agencies represented in the Inter-Secretariat Working Group on National Accounts, to develop a strategy to promote the compilation and dissemination of the balance sheet approach (BSA), flow of funds, and sectoral data more generally, starting with the G20 economies. Data on nonbank financial institutions should be a particular priority. The experience of the ECB and Eurostat within Europe and the OECD should be drawn upon. In the medium term, including more sectoral balance sheet data in the data categories of the Special Data Dissemination Standard could be considered.
16. As the recommended improvements to data sources and categories are implemented, statistical experts to seek to compile distributional information (such as ranges and quartile information) alongside aggregate figures, wherever this is relevant. The IAG is encouraged to promote production and dissemination of these data in a frequent and timely manner. The OECD is encouraged to continue in its efforts to link national accounts data with distributional information.
17. The IMF to promote timely and cross-country standardised and comparable government finance data based on the accepted international standard, the Government Finance Statistics Manual 2001.
18. The World Bank, in coordination with the IMF, and consulting with the Inter-Agency Task Force on Finance Statistics, to launch the public sector debt database in 2010.
19. The Inter-Secretariat Working Group on Price Statistics to complete the planned handbook on real estate price indices. The BIS and member central banks to investigate dissemination on the BIS website of publicly available data on real estate prices. The IAG to consider including real estate prices (residential and commercial) in the Principal Global Indicators (PGI) website.

#### Communication of Official Statistics

20. The G20 economies to support enhancement of the Principal Global Indicators website, and close the gaps in the availability of their national data. The IAG should consider making longer runs of historical data available.



# STRENGTHENING STATISTICAL COMPILATION AND USAGE OF RELEVANT STATISTICS IN MALAYSIA

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## Abstract

The Department of Statistics, Malaysia's (DOSM) vision is to become a leading statistical organisation internationally by 2020. To achieve this, DOSM has to provide internationally comparable, coherent, timely, adequate, reliable, accurate and relevant statistics. Therefore, continuous steps and measures have been implemented to strengthen statistical compilation by improving and updating its business registrar as well as manual references and classifications. Besides that, DOSM continuously improves its statistical methodologies and enhances its products, aligned with international standards.

DOSM is currently innovating its new main products such as Malaysia's Early Warning Signals, Updating Input-Output Tables, System of Environmental-Economic Accounting and the Tourism and ICT Satellite Accounts. In addition, DOSM is upgrading its existing products such as GDP by States, GDP by Income Approach, CPI by States and Core Inflation, Wages and Salary Survey and Index of Services.

## Introduction

The Department of Statistics, Malaysia (DOSM) was established 64 years ago and was formerly known as Bureau of Statistics, operating under the Statistics Ordinance 1949. In 1965, the name Bureau of Statistics was changed to the Department of Statistics, Malaysia, under the provisions of the Statistics Act 1965 (Revised 1989).

DOSM plays an important role in collecting, interpreting and disseminating national statistics. To support Malaysia's national development programmes, DOSM is

committed to provide data and statistical services which are user oriented, timely and of good quality.

To achieve DOSM's vision as a leading statistical organisation internationally by 2020, DOSM has to provide internationally comparable, coherent, timely, adequate, reliable and accurate relevant statistics. Strengthening statistical compilation is the necessary condition for DOSM to move forward. These include continuously upgrading its products and adopting new statistical methodologies aligned with international standards.

DOSM is responsive to the various challenges as it affects the structure and function of the Department. Among the challenges faced by the Department include globalisation and economic liberalisation, high expectations from stakeholders, the need to reduce respondents' burden as well as the dynamic advancement in ICT which have direct impact on the statistical compilation processes. In view of these challenges, DOSM has carefully strategised its actions and implementation plans under its Strategic Plan.

## Strengthening Statistical Compilation

The programmes to strengthen DOSM's statistical compilation are embedded in the DOSM Strategic Plan 2010-2014 (DOSM-SP 2010-14). DOSM SP 2010-14 outlined three strategic thrusts to strengthen DOSM's role as the producer of national statistics. The Strategic Thrust 1 is to produce information of integrity and reliability. Under the Strategic Thrust 1, DOSM has outlined four main strategies: the first strategy is to strengthen statistical services amidst the challenging and dynamic environment. This strategy is

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implemented through six programmes which include improving data collection, usage of up-to-date classifications, development of a central repository, improvement in data presentation, coordination of data collection between DOSM and other agencies, and strengthening of the statistical framework. The second strategy is to optimise the use of statistical methodologies which is embedded in four main programmes: strengthening data analysis, enhancing the sampling design, upgrading the estimation procedure and enhancing data management. The third strategy is to increase the understanding and use of statistics among users and communities through the intensification of publicity, promotion and improvements in data accessibility by users. The fourth strategy is to expand networking with data providers and users through enhancing collaboration with data providers and increasing consultation with data users.

#### [Improving and Updating the Business Registrar](#)

This activity comes under one of the strategies adopted by DOSM to strengthen its statistical services. DOSM collaborates with various data providers such as Companies Commission of Malaysia (CCM) in order to obtain the complete list of companies operating in Malaysia. From this list, DOSM conducts censuses and surveys for the purpose of effective statistical compilation.

#### [Updating Manual References and Classifications](#)

DOSM has built a Central Register System (CRS) which stores a profile of active business establishments and enterprises in 1998. This system was designed as a PC based system and uses as a sampling frame for establishment surveys (economic surveys). The CRS contains information relating to individual establishments or enterprises such as name, business location, correspondence address, type of business activity, number of employees, revenue, date of business commencement, date of business registration and organisation type. In order to ensure the accuracy of this sampling frame, DOSM regularly updates the establishment records

in the CRS using information obtained from various sources such as the Employees Provident Fund (EPF) and Construction Industry Development Board (CIDB) as well as CCM. The information obtained from these sources is validated using TM Smart Map.

#### [Manual References](#)

It is one of DOSM missions to adopt the best practices and methodologies in its work. In order to ensure the international comparability of its data, DOSM adheres to international standard classifications and references.

The System of National Accounts (SNA) is a standard of recommendations on how to compile and measure economic activity. It also provides an overview of economic processes on the distribution of production among consumers, businesses, government and foreign countries. Throughout the years, the SNA has evolved to provide better methods and approaches that are applicable for every country. In 1993, changes in the SNA were made to reflect the advancement in national accounting. The recent version of SNA 2008 on the other hand addresses issues brought about by the changes in the economic environment, advances in methodological research and changes in the requirement of users.

DOSM uses the SNA as a reference in producing key information such as Gross Domestic Product, Supply Use and Input-Output Tables and the Distribution & Use of Income Accounts and the Capital Account. These data provide information about developments in the domestic economy during the reference year. DOSM began implementing SNA 2008 as a reference for publications starting 2010. The migration from SNA 1993 to SNA 2008 resulted in slight differences in the data compiled from the previous reference year. According to the SNA 2008, there are six major components that affect the GDP: Research and Development (R&D) expenditure, output for final use by Households and Corporations, military expenditure, Financial Intermediation Services Indirectly Measured (FISIM), unfunded pension fund and Employee Stock Options (ESOs).

The changes from SNA 1993 have been grouped by the United Nations Statistics Division (UNSD) into six parts:

- i. Further specifications of statistical units and revisions in institutional sectoring;
- ii. Further specifications of scope of transactions including the production boundary;
- iii. Extension and further specification of concept of assets, capital formation and consumption of fixed capital (CFC);
- iv. Further refinement of treatment and definition of financial instruments and assets;
- v. Further specifications of the scope of transactions concerning government and public sector; and
- vi. Harmonisation between concepts and classifications of SNA 2008 and BPM6.

BPM6 or rather known as Balance of Payments Manual Sixth Edition is a standard used by the IMF. It provides a standard compilation framework of transactions between residents of the compiling economy and the rest of the world. It is also an updated version from BPM5.

#### Classifications

The evolution of Malaysia's economic structure is reflected in the rapid changes in the country's industrial and production structure. In response to these changes, DOSM frequently updates its classifications in line with the international standards.

Prior to 2008, DOSM adopted the Malaysia Standard International Classification (MSIC) 2000, a classification methodology which conformed to the United Nations' Standard Industrial Classification of All Economic Activities (ISIC) Rev. 3.0 (1989). In 2006, taking into account the rapid changes in countries' economic structures, the United Nations revised the industrial classification (ISIC Rev. 4). In line with these changes, DOSM updated the MSIC 2000 to MSIC 2008 Version 1.0 which conforms to ISIC Rev. 4. Similarly, for products classification,

DOSM has compiled and published Malaysian Classification of Products by Activity (MCPA) in relation to United Nations Central Product Classification (CPC). MCPA 2005 was published in May 2005, based on MSIC 2000 and CPC Version 1 while, MCPA 2009 is derived from CPC Version 2 and ISIC Rev. 4.

#### Usage of Relevant Statistics

Usage of relevant statistics is embedded in the Strategic Thrust 2 which outlined three main strategies to strengthen research and analysis as well as to inculcate an innovation culture within DOSM. To achieve this strategic objective, DOSM is currently producing several new products namely Malaysia's Early Warning Signals, Updated Input-Output Tables and the System of Environmental-Economic Accounting. In addition, DOSM is also innovating and upgrading its existing products such as GDP by States, GDP by Income Approach, Tourism Satellite Account, ICT Satellite Account, Index of Services and CPI by States and Core Inflation.

#### The Development of Malaysia's Early Warning Signals

The statistics of Business Cycle Indicators (BCI) and Early Warning Signals (EWS) was one of agendas discussed during the 42nd Statistical Commissions Meeting in 2010. In relation to the BCI development, the Statistics of Netherlands has produced a conceptual framework of Business Cycle Tracer (BCT). Since then, the BCT which is also known as Business Cycle Clock (BCC) has been adopted by many countries in monitoring their economy.

The BCC is an interactive tool used to monitor the current economic position visually. It is a coordinated system with the horizontal axis representing the period-on-period change of indicators (direction of change) and the vertical axis is the distance to its trend (state of indicators).

The Clock is graphically divided into four quadrants to differentiate each BCI situation. They are:

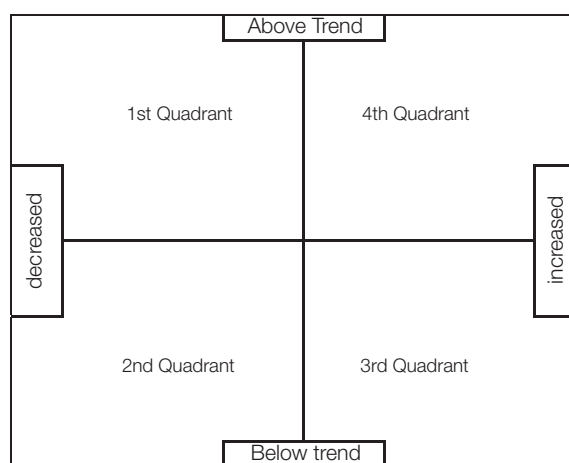
- First quadrant - above trend and decreased
- Second quadrant - below trend and decreased
- Third quadrant - below trend and increased
- Fourth quadrant - above trend and increased

(I-O) Tables 2010 is in progress and is expected to be released in early 2014.

#### The Benchmark Regional Input-Output Tables

Statistics on the Trade in Value Added are among the information which will be demanded in the near future. UNSD defines the Trade in Value Added initiative as an attempt to account for the double counting implicit in current gross flows of trade and flows related to the value that is added (labour compensation, taxes and

**Figure 1: Conceptual Framework of the BCC**



Source: Ruth et al (2006)

DOSM is currently developing the BCC for Malaysia by reviewing the methodology of indicators selection for BCI intensively. Supported with the appropriate software, DOSM believes that the BCC for Malaysia can be realised in the near future.

#### The Development of Annual Update Input-Output Tables and the Benchmark Regional Input-Output Tables

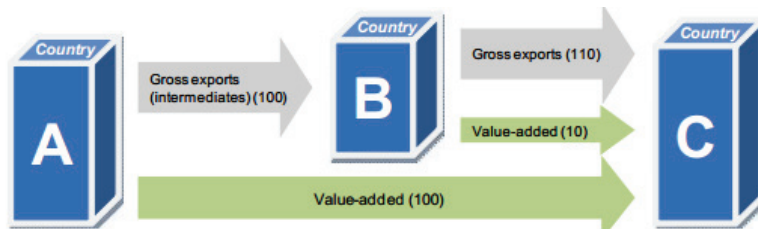
##### Annual Update Input-Output Tables

Malaysia's Input-Output (I-O) tables are produced once in five years. Realising the increasing demand for I-O Tables especially from the stakeholders, DOSM takes an initiative to develop the annual I-O under its SP 2010-14 development programme. Currently, DOSM is in the midst of constructing the Annual Update I-O Tables for the following reference years – 2007, 2008 and 2009. Simultaneously, the construction of the Benchmark Input-Output

profits) by country in the production of any goods or services that are exported. According to Ahmad (2013), Trade in Value Added is important because of the following reasons:

- Trade in Value Added provides detailed information about trade, growth and employment. The flows can indicate where jobs are created and highlight the benefits of trade for all economies involved in the value chain.
- Value added provides a better measure of bilateral trade. It reflects who benefits, both in monetary and employment terms.
- Conventional measures may lead to trade dispute by inaccurate perception of the origin of trade imbalances. The example is as follows:
- A better understanding of Trade in Value Added flows provides tools for policymakers to identify the transmission of macro-economic shocks and adopt the right policy responses.

**Figure 2: Example on Importance of Trade in Value Added**



The simple example above illustrates this. Country A exports \$100 of goods, produced entirely within A, to country B that further processes them before exporting them to C where they are consumed. B adds value of \$10 to the goods and so exports \$110 to C. Conventional measures of trade show total global exports and imports of \$210 but only \$110 of value-added has been generated in their production. Conventional measures also show that C has a trade deficit of \$110 with B, and no trade at all with A, despite the fact that A is the chief beneficiary of C's consumption.

Source: *Measuring Trade in Value Added, and Beyond*, Nadim Ahmad, OECD (2013)

The concept of Trade in Value Added is not new. It has been studied widely at venues like the World Trade Organisation, with the aim of bringing an alternative perspective on the issue of trade imbalances, and thus facilitates trade negotiations among countries. Nevertheless, this idea was hardly realised due to the lack of appropriate methodologies or databases. The evaluation of Trade in Value Added requires a rigorous estimation of value-added generation process, which cannot be captured by conventional trade statistics which only record the physical transfer of commodities across borders.

Notwithstanding the challenges involved in the compilation of information on Trade in Value Added, DOSM takes an initiative by developing its capacity towards the compilation of Trade in Value Added in the near future. As an initial step, DOSM is currently developing the Benchmark Regional Input-Output Tables which covers three regions namely Peninsular Malaysia, Sabah and Sarawak. These activities are also outlined in the DOSM SP 2010-2014.

#### [The Development of System of Environmental-Economic Accounting](#)

Another statistics which has grown in importance is environmental statistics which have been discussed in every statistical commission meeting since 2002. Malaysia strongly believes that national effort is

important to achieve the goal of sustainable development. The Third Malaysia Plan (1967-1980) emphasised that the objective of development and environmental conservation be kept in balance in order to ensure that the benefits of development are not negated by the costs of environmental damages.

Statistical evidence is important to support national sustainability goals. This is because statistics allow us to gauge the impact of policies implemented on a country. Statistics also assist in the planning and monitoring of the progress of development as well as to monitor the impact of economic development on the environment. However, providing statistics which are coherent, timely, adequate, reliable and accurate is not an easy task. As such, DOSM intends to produce the System of Environmental-Economic Accounting (SEEA).

The SEEA is an integrated measurement framework comprising agreed concepts, definitions, classifications and accounting. It is used to organise environmental data which are applied in sustainability and green economy decision-making. In addition, SEEA provides a broader accounting framework to understand the longer-term contribution of economic development programmes as it links environment, economic and social statistics. It also adheres to the principles of the SNA and expands its scope by:<sup>2</sup>

<sup>2</sup> Source: SEEA Diagnostic Tool, Draft version 2.0 by Department of Economic and Social Affairs Statistics Division, United Nation, September 2013

- i. Providing standard terminology, definitions and classifications for environment-economy statistics;
- ii. Including measures of the physical stocks of natural capital and their values;
- iii. Adding physical measures of flows of natural resources and residuals (land, metals and minerals, timber, energy, water, fish, air emissions, solid waste); and
- iv. Linking these to economic activities (producers and consumers) and societal benefits.

The role of the SEEA in the statistical system can be illustrated in Figure 3. The SEEA arranges and reconciles basic economic, environmental and socio-demographic statistics using accounting concepts and structures so that a time series of consistent, comparable and coherent statistics can be obtained. As the indicators are derived from basic statistics, the use of accounts is to ensure that the indicators are consistent because the component data are derived from a common framework. This will in turn ensure that the signals of the statistics and indicators are coherent.

The SEEA relies on basic environment statistics such as statistics on natural resources like water, energy, forest, flows of materials and pollutants which are generally collected for specific purposes. Here, the purpose of the SEEA is to inform integrated

policies, evaluate trade-offs between different policies and assess their impact on the economy, environment and society since it can add value to individual information by bringing them together.

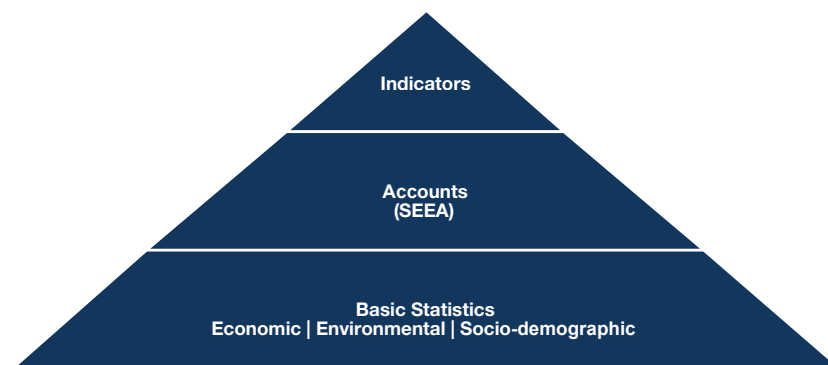
Figure 4 depicts sustainable development policy areas according to four simple quadrants related to how information is derived from the SEEA. The first quadrant refers to policies that are proposed to ensure that households have access to appropriate, affordable and reliable resources and services. The SEEA can offer a variety of indicators to guide policymakers in assessing and managing the performance of providers of critical services such as water and energy.

The second quadrant specifies the allocation of natural resources to meet the needs of current and future generations in relation to the available endowments.

The third quadrant recognises the potential for economic activities to protect or restore natural capital for future benefit and the potential to cause harm to the environment.

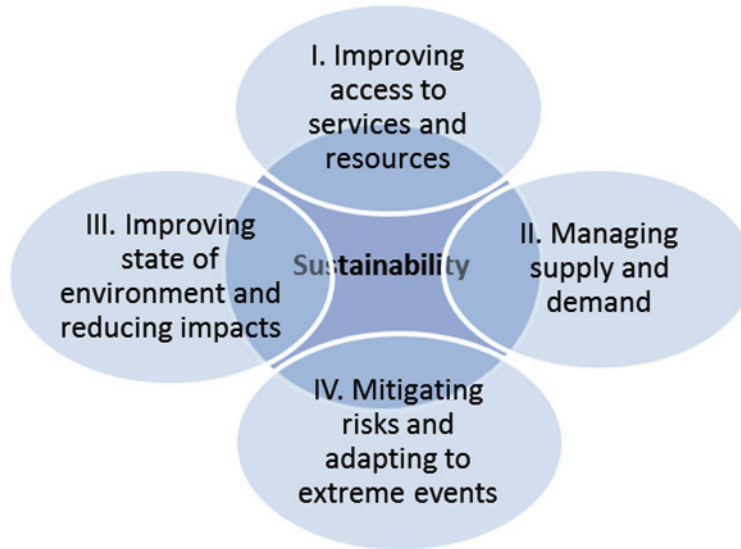
Finally, the fourth quadrant refers to policies that aim to reduce human, economic and ecological harm created by extreme natural events and changing environmental patterns. The example of measures and indicators for each quadrant are as in Table 1.

**Figure 3: The Information Pyramid**



*Source: The SEEA: Measurement Framework in Support of Sustainable Development and Green Economy Policy, Briefing Note*

**Figure 4: SEEA and Sustainable Development Policy**



Source: *The SEEA: Measurement Framework in Support of Sustainable Development and Green Economy Policy, Briefing Note*

**Table 1: Indicators Used in SEEA**

Quadrant	Indicators
Quadrant 1	<ul style="list-style-type: none"> <li>• Current and capital costs associated with the provision of the services and their financing</li> <li>• Losses in distribution</li> <li>• Quantity of resource used</li> </ul>
Quadrant 2	<ul style="list-style-type: none"> <li>• Resource use of production and consumption</li> <li>• Generation of emissions and waste by economic activity and household</li> <li>• Investment in infrastructure</li> </ul>
Quadrant 3	<ul style="list-style-type: none"> <li>• Stocks of natural resources</li> <li>• Emissions into water, air and soil and waste generation</li> <li>• Environmental protection expenditures and resources management</li> </ul>
Quadrant 4	<ul style="list-style-type: none"> <li>• Greenhouse gas emissions by type of economic activity</li> <li>• Expenditure on mitigation (e.g. technology)</li> <li>• Expenditures for adaption to extreme events (e.g. dykes, etc.)</li> </ul>

Source: *The SEEA: Measurement Framework in Support of Sustainable Development and Green Economy Policy, Briefing Note*

### Implementation of the SEEA

In general, environmental accounts do not require a large amount of data. Nevertheless, the SEEA gathers those data to enhance the understanding of the interrelationships. Hence, it can be used to improve the quality of the data as well as to assist the identification of data gaps and overlaps.

Currently, DOSM is at the early stage of producing the SEEA-Water and the SEEA-Energy. They are constructed to elaborate the concepts of the SEEA while maintaining close links with the concepts and terminology of the specific subject areas. DOSM has chosen to construct the SEEA-Water and the SEEA-Energy since these are essential to achieve equitable and sustainable social and economic development.

The SEEA-Water is a subsystem of the SEEA that presents a conceptual framework to support water policy design and evaluation. It was adopted by the United Nations Statistical Commission (UNSC) in 2007. The SEEA-Water framework sets the basis for compiling a full range of information such as investments in water and sanitation services, the levels of pollutants emitted to water and the economic losses that associated to floods and droughts.

Similarly, SEEA-Energy portrays the progress across the variety of energy related issues. For example, it assists those who concerned with environmentally sustainable energy supply by providing information on the impact of various policies on the environment, household and business expenditure, business income and taxes. Besides that, the SEEA-Energy can also be used to assess the emissions generated by the energy mix, energy prices paid and energy expenditures as a proportion of household income or business income.

However, in the process of developing the environmental accounts, DOSM encountered challenges such as lack of financial and human resources, access to training materials and the issues of availability and the quality of the data. Yet, experience has shown that SEEA implementation works best when there is a clear use of the data and accounts as well as well coordinated activities across sectors. In addition, the producers and users of

statistics must collaborate to define their need in order to ensure that SEEA is worth to be constructed. Cooperation and commitment at the national and international level is required in order to realise the full potential of the SEEA. International agencies and donors need to contribute to the implementation of the SEEA. At the national level, it is important to create appropriate institutional arrangements for coordination purposes considering that there are many institutions that either produce or use environmental information.

### Gross Domestic Product (GDP) by State

In providing a comprehensive information about the Malaysian economy, DOSM has successfully disaggregated the annual GDP into 15 regions namely GDP by State. The first publication was released in 2009. The latest publication which was published in September 2013, presents the GDP for year 2005 to 2012 for all states in Malaysia. The compilation of these statistics was based on some of the recommendations of SNA 2008 which includes the new treatment on FISIM and R&D. GDP is compiled annually at constant prices based on the production approach which provides the value added of each economic activity for each state.

### Gross Domestic Product (GDP) Income Approach

GDP can be estimated through three approaches, namely production approach, expenditure approach and income approach. These three approaches offer different perspectives of GDP and ensure the accuracy of GDP calculated.

In practice, DOSM adopts the production and expenditure approaches in producing the national GDP. Acknowledging the demand for factors of income by economic activity, the income approach has been used to measure GDP since 2008, as a complement to the production and expenditure approaches.

GDP by income approach can be measured by adding up the total income i.e. operating surplus and remuneration received by factors of production namely household and firms engaged in the process of production plus taxes less subsidies on production and imports during a certain period, usually one year.

### Tourism Satellite Account

The United Nations (UN) developed satellite accounts to measure economic activities that are not defined as industries in National Accounts, such as the environment, ICT, or tourism. The Tourism Satellite Account (TSA) links industry supply and visitor demand, generating economic aggregates on tourism comparable with those of "traditional" sectors, like agriculture or manufacturing, but also between countries and over time.

By allowing tourism to be understood in the same way as other sectors of the economy such as agriculture or construction, it can be used to demonstrate the contribution of tourism to GDP. It also represents a powerful instrument for designing policies related to tourism development.

DOSM has published the latest version of Malaysian TSA in November 2012 to provide information on tourism statistics in Malaysia for the period of 2005 to 2011. It presents data on expenditure for inbound, domestic, outbound and internal tourism, supply & consumption and employment in the tourism industries.

### Information and Communication Technology Satellite Account

The compilation of Information and Communication Technology (ICT) Satellite Account is the first endeavour undertaken by DOSM to monitor the performance of ICT sector and attain evidence-based decision making on the formulation of ICT policies. The latest publication was released for limited circulation in November 2012. This account identifies ICT products and measures their supply and use so that a comprehensive economic picture related to ICT activity can be compiled for the Malaysian economy. It allows the estimation of the size of ICT production in relation to GDP, domestic output, supply and use, imports and exports, income components and employment in the related ICT industries.

### Index of Services

According to the OECD (2007), the Index of Services (IoS) measures changes over time in the volume of output of the services

sector. It is defined as a ratio of the volume of output produced by the services industries in a given time period to the volume produced by the same industry in a specified based period. The purpose of producing the IoS is to describe the changes in services sector in the short term, as a primary input in the compilation of quarterly national account data and as a complement to Index of Industrial Production.

DOSM started compiling Index of Services (2005=100) in Q4 2012, using 2005 as the base year. It contains four subsectors: Transportation and Storage, Information and Communication, Accommodation and Food & Beverage. Starting Q1 2013, DOSM added another two subsectors which are Private Health and Private Education. In Q3 2013, Index of Services (2005=100) will include Finance and Insurance and the existing subsectors will be rebased to the base year 2010. Other subsectors of IoS are expected to be included in 2014. These include Real Estate, Professional and Art, Entertainment & Recreation. All of these 10 subsectors including Index of Distributive Trade (IoDT) are expected to be published in 2014 as the Composite Index of Services (2010=100).

### Consumer Price Index by State and Core Inflation

The Consumer Price Index (CPI) Malaysia measures the percentage change through time in the cost of purchasing a constant basket of goods and services which represent the expenditure pattern of all household in Malaysia in a specified time period. It is also used as a deflator to GDP.

Currently, DOSM publishes CPI according to three regions namely Peninsular Malaysia, Sabah and Sarawak. In January 2011, DOSM has successfully produced the CPI based on four zones namely North, South, East and West Peninsular Malaysia. In order to capture price change across all 15 states in Malaysia, DOSM has started compiling the CPI for every state in Malaysia and thus, is expected to be published in January 2014.



In providing a better insight on the living cost of Malaysian residents, DOSM takes the initiative to compile Core Inflation (CI) as a complement to the CPI. CI can be defined as a measure of inflation that excludes items that high in volatility. In other words, CI removes items that have temporary price shock since they might give a false measure of inflation. In 2013, DOSM has started compiling the CI data based on expenditure class and items. There are two categories of items being eliminated namely price administrated and price volatile items. The examples of price administrated items are rice (local rice – 15% broken), fresh meat, frozen meat, fresh seafood, and unleaded-Ron 95 and diesel. An example of price volatile item is gold jewellery.

### Conclusion

To be a leading statistical organisation, DOSM has carefully planned its strategy through its Strategic Plan. There are three thrusts in the recent DOSM Strategic Plan 2010-2014. In line with the Strategic Thrust 1, DOSM is strengthening its statistical compilation. Under this strategy, DOSM collaborates with various data providers in order to improve and update business registers which resulted in the creation of CRS.

In addition, DOSM adopts international manual references and classifications to facilitate international comparison. DOSM also published its own classifications

namely the MSIC and MCPA to better suit Malaysia's economic needs. Realising the increasing demand for Input-Output Tables from stakeholders, DOSM has initiated the development of the Annual Input-Output Tables under its SP2010-14 development.

To strengthen its research and analysis as well as to promote innovation, as mentioned in the Strategic Thrust 2, DOSM is currently developing Malaysian Business Cycle Clock, the Annual (Update) Input-Output Tables and the Inter-Regional Input-Output Tables. In addition, DOSM is upgrading its existing products such as GDP by States, GDP by Income Approach, CPI by States and Core Inflation, Index of Services as well as producing new products namely Tourism Satellite Account and ICT Satellite Account.

DOSM has also taken an initiative to develop the SEEA. DOSM is now at the early stage of producing the SEEA-Water and SEEA-Energy as they are both essential to achieving equitable and sustainable socio and economic development.

DOSM will keep producing relevant statistics to cope with the dynamic changes nationally and internationally as well as to fulfil its users' needs. As the task of compiling those statistics has proven to be challenging, DOSM requires cooperation from other relevant parties such as other government agencies, private sectors and the society.

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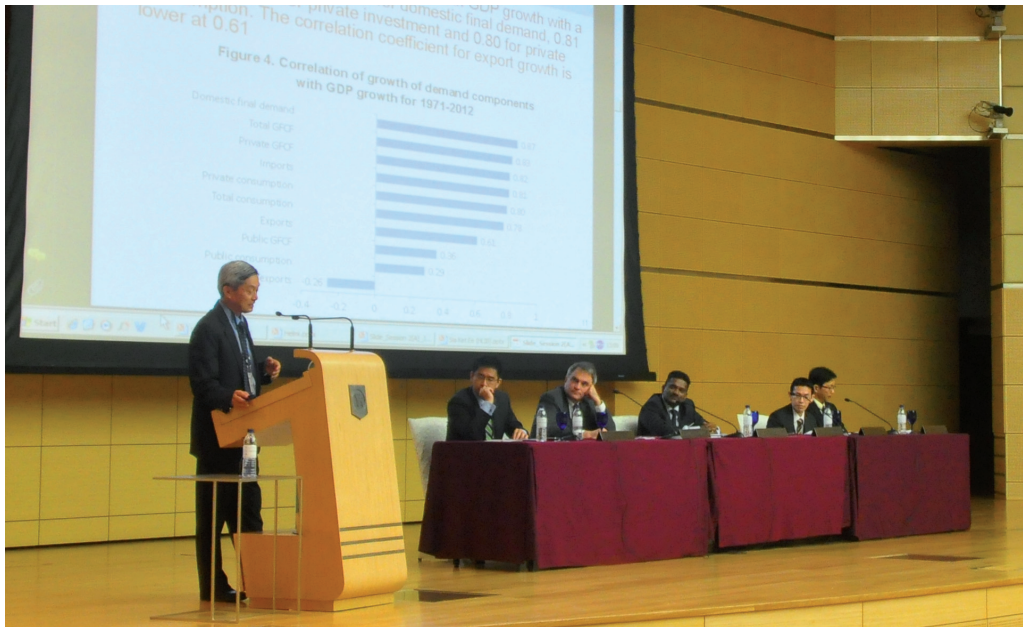
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# COMPILATION AND MANAGEMENT OF LABOUR MARKET STATISTICS FOR MACROECONOMIC ANALYSIS AT THE U.S. BUREAU OF LABOR STATISTICS

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## Abstract

The U.S. Bureau of Labor Statistics (BLS) is the principal Federal agency responsible for measuring labour market activity, working conditions, and price changes in the U.S. economy. Its mission is to collect, analyse, and disseminate essential economic information to support public and private decision-making. BLS serves its user communities by providing data that are objective, timely, and relevant. This paper will provide a brief overview of the compilation and management of labour market statistics at the BLS. This will include a discussion of data collection and data processing practices, with some best practices for publication and dissemination of these key economic data.

## Key Labour Market Indicators Produced by BLS

The U.S. Bureau of Labor Statistics (BLS) produces a wide range of data, news releases, and articles to inform government officials, business, academia, students, and others in the public about the state of the U.S. economy. Seven of these news releases have been designated by the U.S. Office of Management and Budget (OMB) as *Principal Federal Economic Indicators* (PFEIs). The PFEIs<sup>2</sup> published by the BLS are as follows:

- i) [Monthly] The Employment Situation, which includes data from two surveys, the Current Population Survey (CPS - the household survey) and the Current Employment Statistics survey (CES - the establishment survey)

- ii) [Monthly] Real Earnings
- iii) [Monthly] Producer Price Indexes (PPI)
- iv) [Monthly] Consumer Price Indexes (CPI)
- v) [Monthly] Employment Cost Index (ECI)
- vi) [Monthly] U.S. Import and Export Price Indexes
- vii) [Quarterly] Productivity and Costs

These timely economic indicators provide key information to evaluate the state of the U.S. economy. The BLS labour market indicators are, however, not limited to these PFEI news releases. The Bureau also produces a substantial number of non-PFEI data series for the nation, states, metropolitan statistical areas, and counties – this information is highly valued by the many customers that use it.

Data series, news releases, and documentation for all of these programs are free and available on the BLS website. Together, the BLS' PFEI and non-PFEI data provide an important and timely snapshot of the U.S. economy. These data allow federal, state, and local governments to make informed economic policy decisions. They allow business owners to make informed decisions about business locations, opening and closing of worksites, and about wages, hiring, and layoffs. And they allow private citizens to make informed decisions about areas of study in school, what wages are reasonable to expect when looking for a job, and the state of economy when considering job changes. For examples of BLS data releases, and related supporting materials, see the BLS public website: <http://www.bls.gov/>.

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<sup>2</sup> <http://www.whitehouse.gov/sites/default/files/omb/infoereg/statpolicy/pfei-schedule-of-release-dates-2013.pdf>

## Standards and Statutes for BLS Operations

### Formal Statutes and Policy Standards

The BLS operates under a number of different statutes and policy standards. The publication *Principles and Practices for a Federal Statistical Agency* (National Research Council, 2013) provides an overview of the general concepts that have led to current standards for U.S. government surveys, and also provides practical guidance following from those concepts. In addition, the principal U.S. government statistical agencies have adopted a joint “Statement of Commitment to Scientific Integrity” based on the Principles and Practices book.

More specifically, both data collection and processing at the BLS, and other federal statistical agencies, are based on detailed standards for operating statistical surveys (United States Office of Management and Budget, 2007); guidance on collecting information surveys (United States Office of Management and Budget, 2006); guidance on protecting the confidentiality of respondent data surveys (United States Office of Management and Budget, 2002); standards for classification of industry (United States Census Bureau, 2012); occupation (United States Bureau of Labor Statistics, 2010); geographic area (United States Office of Management and Budget, 2013); and race and ethnicity (United States Office of Management and Budget, 1997); and standards for compiling, disseminating, and evaluating survey data (United States Office of Management and Budget, 1985, 2008).

The BLS also operates under the Confidential Information Protection and Statistical Efficiency Act of 2002 (i.e. Public Law 107-347).<sup>3</sup> This law prohibits disclosure or release, for non-statistical purposes, of information collected under a pledge of confidentiality. This allows BLS to include a standard pledge of confidentiality with all of its voluntary requests for data:

“The Bureau of Labor Statistics, its employees, agents, and partner statistical

agencies, will use the information you provide for statistical purposes only and will hold the information in confidence to the full extent permitted by law. In accordance with the Confidential Information Protection and Statistical Efficiency Act of 2002 (Title 5 of Public Law 107-347) and other applicable Federal laws, your responses will not be disclosed in identifiable form without your informed consent.”

Finally, in keeping with the general principles of statistical transparency, the BLS provides detailed technical information about major programs in the BLS *Handbook of Methods* (United States Bureau of Labor Statistics, 2013). Additional information about methodologies, and reliability is available on the website for each program.

### Methodological Background and Ongoing Research to Inform Technical Standards

The above mentioned technical standards are informed by a large body of methodological literature. In brief, that literature has arisen from efforts to evaluate and balance a wide range of measures of data quality, cost and risk. Technical work has tended to focus primarily on a complex set of multivariate measures of quality. For example, Brackstone (1999) presents a quality assessment framework that encompasses six dimensions: accuracy, timeliness, relevance, interpretability, coherence and accessibility. The first criterion – accuracy – has received extensive quantitative study by methodologists, and has led to the development of detailed ‘total survey error’ models. These models have been based on in-depth theoretical and empirical assessment of several conceptually distinct error components associated, respectively, with imperfect frame coverage, sampling error, nonresponse effects, measurement errors, and processing effects. For general background on total survey error models, see, e.g., Andersen et al. (1979), Biemer and Lyberg (2003), Groves (1989), Lessler and Kalsbeek (1992), Weisberg (2005), and references cited therein.

<sup>3</sup> Confidentiality of data collected by BLS for Statistical Purposes  
-<http://www.bls.gov/bls/confidentiality.htm>

Survey costs have received some attention in the general methodological literature, e.g., Groves (1989), Karr and Last (2006), Laflamme (2011) and references cited therein; but receive additional attention in agency- and survey-specific studies. Assessment of risks arising in survey processes generally have been studied on a case-specific basis, but can have an important effect on practical decisions related to many components of survey work, including frame development, sample design, fieldwork procedures, data management, and the design and management of production systems.

### Management of Data Collection at BLS

#### Data Collection

Data at BLS are collected using a variety of modes. For example, the Current Employment Statistics survey collects data via Computer Assisted Telephone Interviews (CATI), Electronic Data Interchange (EDI), Touchtone Data Entry (TDE), Web, and in limited numbers we collect data by FAX, Spreadsheets, and email. EDI collects data for companies that have hundreds (or thousands) of worksites. In EDI, we work with the company to identify a file format that is easily provided from their computer systems that includes the variables that we need. BLS then creates a company-specific decoder program that reformats the electronic data from that company so that it will feed into our systems. The TDE system is older technology, but a significant number of smaller businesses still prefer to self-report using the phone. For surveys collecting only a few data elements, this is still a viable technology. More about CES innovations in data collection can be found in Robertson and Hatch-Maxfield (2012). Managing a multi-mode data collection operation can be very complex. Decisions must be made with respect to optimising the response/quality/cost tradeoffs. For CES, the highest quality mode, and the mode that returns the highest response rate is CATI; it is also the most costly mode of data collection for the survey. Therefore, businesses that have a history of on-time quality reporting are quickly transitioned to self-reporting where possible, and other businesses are kept on CATI to the extent of the available resources.

### Data Collection and Quality Assurance

#### Response Rates

BLS programs incorporate a number of quality assurance policies and procedures related to data collection. First among these are the response rate requirement from the Office of Management and Budget. The response rate for data collections that will serve as a sampling frame (e.g. a business register) are required to be 95 percent or higher. Survey response rates are required to be 80 percent or higher, and survey item response rates are required to be 70 percent or higher. Any collection of data that falls below these thresholds must plan and execute a nonresponse bias analysis. This requirement ensures that the survey results are representative of the target population and can be used with confidence to make informed decisions.

#### Questionnaire Design

Questionnaire design is an important and complex topic. BLS maintains a core staff of research statisticians and cognitive scientists to assist with statistical issues. Several of these staff have expertise in the design of questionnaires, and understand the impact that a change in wording or question order can have on the results. When possible, BLS also enlists academic experts in this field to evaluate and improve the quality of its questionnaires and its data collection processes. For example, the Current Employment Statistics survey recently enlisted the assistance of Dr. Don Dillman (Dillman et al., 2009), who is recognised internationally as a major contributor to the development of modern mail, telephone, and internet survey methods, to evaluate and redesign the questionnaire for the CES survey (Harrell and Park, 2012).

#### Training

Training, especially periodically repeated training, is a powerful tool to ensure high quality data collection. In order for data to be of high quality, the interviewers must understand the subject matter. They must also understand and follow the protocols for asking the questions the right way and in the right sequence. Interviewers must also be

able to help the respondent understand what information is requested if questions arise, and they must be able to record responses correctly. All of these issues are critical to a successful data collection, and they contribute to the quality of the data collected. Training on converting reluctant respondents into participants is also a valuable and cost-effective tool to ensure high response rates. BLS ensures that appropriate periodic training is a component of the data collection process for each of its programs.

#### Monitoring Data Collection

It is of course very important to have processes and procedures in place to monitor data collection activities. Procedures should be in place to prevent curb-stoning (i.e. a data collector making up data) and if possible statistical routines might be in place to detect this. For repeated surveys, actual collection overtime should be tracked against previous data collection results. Collection rates of individual data collectors and teams of data collectors can be monitored against targeted goals, with corrective action taken if substantial gaps are found. For first-time or one-time surveys, actual response can be compared against targets derived from similar surveys conducted in the past.

Many surveys will have a supervisor specifically tasked with responsibility for the data collection. This supervisor would be likely to monitor data collection activities on a daily basis. This supervisor would then share management reports on the status of the data collection with the survey manager. The periodicity of management reports monitoring data collection is typically dependent upon the data collection time frame. A monthly survey with a two-week data collection period should have daily reports so that the survey manager and the data collection supervisor can quickly identify problems and take corrective action. A twelve-month data collection period may suggest a report to the survey manager every few weeks. The periodicity should be such that corrective action can be taken in time to have a successfully completed data collection process.

The capability to monitor data collection varies across BLS' programs. Some programs have very mature monitoring programs, which include the ability to listen in on random or specific interviewer calls, refined management reports, and refined routines to detect curb-stoning. Other programs have these capabilities in various states of development.

#### Editing

Editing of data is a critical component of data quality. Much thought should go into the within-collection unit, cross-sectional, and longitudinal relationships for the data elements collected. For example, a within-unit relationship might be that the number of women employees within a single business cannot be greater than the number of all employees at that business. A cross-sectional relationship that might elicit a review of the data is if the ratio of production employees at a particular business is substantially less than the average ratio for all businesses within a selected industry (e.g. manufacturing). A longitudinal relationship that might draw attention is if a particular business reports that it has 15 employees one month, and 155 employees the next month. Business reports that fail one or more of these relationships can be ranked as to the severity of the failure, with follow-ups to data collection and additional reviews targeted at the worst cases first as a way to control resources directed to this activity.

#### Data Breaches

##### Micro Data Breaches

Micro data breaches are usually isolated occurrences. For example, a single envelope may be accidentally mailed to a company with another companies request for data, or a single email is incorrectly addressed. At BLS, each of these occurrences is documented, and procedures are reexamined to ensure that appropriate steps are being taken to protect against these micro data breaches. To the extent possible these breaches should be kept to a minimum to guard the agencies reputation as a protector of persons and business' confidential reports.

### Macro Data Breaches

Macro data breaches, or a release of estimates prior to the scheduled release data and time, are very serious. Breaches of this nature can have a debilitating impact on the reputation of an agency. One of the key features of a federal statistical agency is the need to provide data to the public in an unbiased manner; this includes providing data to all of the public at the same time. Breaches of this type are rare at BLS. When they do occur, BLS has a management oversight group that is tasked with documenting the occurrence, and to make recommendations to mitigate a reoccurrence.

When a macro data breach occurs, BLS staff members have very specific instructions on what to do. The first step is to inform a supervisor of the occurrence – this notification goes then to the senior agency managers. A quick assessment is made to determine if the breach can be fully contained (for example, the data might be directed early to a single person at another federal agency by mistake). If containment is not an option then a decision is made about how to get the data to the rest of the public as soon as possible, with as little disruption as possible to the media, the financial markets, and other public users of the data.

### Management of Data Processing at BLS

#### Data Processing

##### Systems Design and Change Control

Processing systems at BLS range the gamut from older mainframe systems (which are close to retirement) to newer state-of-the-art systems. Many of the newer systems utilise a client-server architecture, with a web-browser based client interface. This architecture works very well in the distributed processing environment that many BLS programs use, and ensures that all users are in fact using the same version of the software for processing. In a distributed processing environment, this also allows for a mostly client-agnostic configuration of the local hardware and operating system.

A major feature of all major systems at BLS is Change Management. There is a two-part approach to managing established systems.

First, the production system is housed in a Production environment. New or updated modules for the system are developed in a Development environment. And the new or updated modules are tested in a Test environment. These three environments may be three separate hardware servers, but are more likely to be three virtualised servers on one or two hardware servers. The second part of this approach is the requirement to manage change to the system; this is done using a Change Control Board (CCB). This Board usually consists of senior program managers, management of the programming (Information Technology - IT) staff, and senior staff representing each major group of system users. The CCB reviews and prioritises proposed system changes. Approved modifications are passed to the IT staff for development. When developed, a team of testers that includes end-users of the system test all existing functionality and the new functionality to ensure that the system is working correctly. After that, a signoff from the CCB allows the updated system to replace the current production system.

#### Systems Access and Security

Systems access is controlled in many BLS systems, usually by controlling access both to the servers that the systems reside on, and by controlling access to the system itself. Additional security is required for any data designated by the OMB as a Principle Federal Economic Indicator. Those data are required to have additional security, which includes additional constraints on physical access to the servers that house the data. For BLS, the servers that house PFEI data are located in a secured room with physical access limited to essential personnel.

#### Processing Schedules, Training, and Documentation

Data processing for most BLS programs is a very structured operation. Written documentation is required that outlines each step in the production process. The step-by-step processing instructions are accompanied by production calendars which indicate when each step is to take place. The calendars are typically available to all affected staff on an internal website.



Processing documentation is developed along with a new system. As initial users utilize the system, they are asked to document the steps they take to perform each job. After that, other staff members are asked to perform the job with the experienced staff, but using only the written documentation. Any omission of steps in the written documentation is thereby identified and then corrected. This process continues until a new staff member can perform the job with minimal training.

Training of new staff members to perform processing jobs is typically accomplished as a four-step process. The first step is to provide the person with a survey overview. This way they understand the goals of the survey, the uses of the data, and who the users of the data are. Another goal of the overview is to provide an understanding of survey operations; how the data are collected, what data elements are collected, how data flow from collection systems into the processing system, how data are processed and reviewed, and how estimates get from the processing system into a dissemination system. The second step is to have the new person shadow an assigned mentor. That is, they watch what the mentor is doing as they perform the processing and review steps. After that, the third step is to have the new person and the mentor change places, and the mentor watches the new staff member go through the processing steps. Once the mentor and new staff member agree that processing has been accomplished correctly, the final step is for the new person to perform the processing steps alone – but usually with a senior staff member reviewing the final results of the production processing.

#### Management Oversight of Processing

For most BLS surveys, management is directly involved in monitoring the status of production processing and in reviewing the end results. For data collection, there are many management reports that can be developed and reviewed. The frequency of management review of these reports is typically based on the periodicity of the survey.

For estimation systems, management reports should be available for each major task which includes weighting adjustment, non response adjustment, calibration to a population total, and production of totals (or means or other aggregate values).

#### Macro Data Review

The macro data (estimates) system should also indicate when review steps are completed, and should include an audit trail to track any changes to the data. For example, if the system allows the reviewer to manually designate a micro data report as atypical (and thereby change its weighting for estimation) the system should track that change. Similarly, if the estimation software allows direct changes to estimate values the change should be tracked in the system and documented.

#### Macro Data Editing

Estimates produced using collected data should mostly be self-supporting, but there are clearly cases where the collected sample will not be sufficient to produce an appropriate result. This may occur because, for example, a major employee strike occurs in a business that failed to report to the survey, or similarly a major retailer publicly changed its prices (in a way that other survey data do not show) but failed to report to a survey. In cases like these the estimate may require a direct change to the estimated value, but this change and the reason for it should be recorded. Similarly, the identification of unusual reports should be facilitated by either the data collection system or the estimation system (or both). Respondent follow-up about unusual reports is a standard survey operation. Designating unusual reports as atypical (and changing its weight) should be carefully considered, as changes in weighting can have a dramatic impact on estimates; these cases should be documented. This documentation process will allow the estimate to be recreated in the future, if needed, for research purposes. It also provides management an ability to track interventions in the estimates and gauge their overall frequency and impact.

## Best Practices for Publication and Dissemination of Economic Data at BLS

### Publications

Publication of economic data by a federal statistical agency should be factual, consistent, and unbiased. While analyses will change as different elements of the economy change, the approach to analysis should remain as consistent as possible to mitigate the appearance of political influence in the production and analysis of data. The usual practice is for BLS to note significant changes – positive or negative – in each industry super-sector as part of the monthly employment situation report. Reporting only positive results would be biased, and would tarnish the public trust in the results. BLS' role is to collect, tabulate, and disseminate data in an unbiased manner. BLS does not get involved in the policy and decision process, other than by providing unbiased data to inform those processes.

BLS staff members publish articles covering a wide range of topics, centred on its statistical programs. Papers range from scholarly statistical and economic papers for peer-reviewed journals, papers for statistical and economic conferences, articles for the BLS' Monthly Labor Review publication, and shorter articles meant for the BLS website. A general theme is to inform the public about theoretical and applied aspects of BLS procedures, to inform the public about analytical features of BLS data, to highlight major turning points in the economy, and to document specific aspects of BLS programs.

### Dissemination

Data produced by the BLS are a public good, and the aggregate results are made available to the public free of charge as soon as the data are released. News release schedules are published months in advance – if not for the entire year. Having a pre-announced release schedule allows everyone who is interested in the data to have access to it at the same time. Prior access to the data are provided only under the restricted circumstances described in Statistical Policy Directives #3 and #4 (see the references at

the end). Access to the data may be given to a few members of the press in a lock-up to allow them to have a news story ready to go at release time. This is done to promote an orderly review of the data, and to foster improved public understanding of the data in the news release.

Questions about surveys and the results typically follow soon after the dissemination of data. BLS maintains a press office as one point of contact for the media and the public. The staff members in the press office are trained to answer general questions about all BLS surveys. Detailed questions about analysis of results or methodology are usually answered by the economists or statisticians who work on the survey. The public is encouraged to ask questions about the data and methodology - each BLS program website includes contact information to facilitate this.

In addition to the BLS national office in Washington, D.C., BLS also maintains six full-service Regional Offices. These offices employ staff who coordinate the work BLS does with its State partners to produce State, Metropolitan area, and county data; they manage a large part of the BLS' data collection operations; they perform outreach operations to foster understanding of why the data we collect and produce are important; and they participate in the dissemination of regional, state, and sub-state data. Each Regional Office produces a number of news releases each year, which focus on the economies of the States within the region, and they serve as a local point of contact for the media and public.

### Helpful Analyses and Diagnostics: Moving Averages, Standard Errors and Seasonal Adjustment

An agency should periodically review the analyses that the agency presents on various topics, and provide customers of the data with an opportunity for input on them. Ensuring that the analyses being done are helpful for the customers understanding of the data is an important outreach activity. If the data are too volatile due to small

sample sizes, the agency might consider a model-based estimator – e.g. a small domain estimator – to provide some stability to the estimate, or the agency might publish a simple moving average with the primary estimate to provide a less volatile perspective of the data. An agency should strive to provide standard errors with estimates, to inform users of the confidence they might place in them.

Seasonally adjusted data can be helpful to customers, in cases where there is a strong seasonal effect present in the data. Removing the normal seasonal movements can help customers identify changes in the economic cycle earlier. When producing seasonally adjusted data, it is advisable to examine the diagnostic outputs to ensure that an appropriate model has been selected, and that the seasonal adjustment process is performing as intended.

#### Disclosure Limitation

In keeping with the confidentiality pledges reviewed in Section 2 above, the BLS has an obligation to take appropriate and prudent steps to ensure that data releases do not inadvertently compromise the confidentiality rights of individual respondents to BLS surveys. Views on appropriate confidentiality commitments by statistical agencies generally vary across countries and depend heavily on societal expectations and the applicable legal framework. For the BLS, confidentiality issues receive special attention because almost all of our surveys depend on voluntary cooperation by respondents, and participation in a survey can depend heavily on the extent to which the respondent is fully confident that their data will not lead to inappropriate disclosure risks.

Technical work with disclosure limitation takes place in two relatively distinct areas. The first area centres on disclosure risks arising from the publication of aggregated data in tabular form. Standard examples include publication of estimated employment counts, wage rates or price indices in tables that are defined by the intersection of several classification variables, for, e.g., geography, industry, occupation or product type. Various U.S.

government statistical agencies use a range of methodological approaches for tabular disclosure limitation, including suppression of data for specific problematic cells, addition of random error to some data, or replacement of directly observed data with synthetic data.

The second area centres on disclosure risks associated with the use of micro data, i.e., data associated with an individual respondent. In some cases, U.S. government statistical agencies release micro data subject to certain technical restrictions, e.g., top coding of some sensitive variables, omission of certain design-related information, or use of perturbed or synthetic data. In other cases, statistical agencies allow researchers to have relatively broad access to micro data within a carefully controlled computing environment, subject to constraints on release of the aggregate-level estimates produced by these researchers.

#### [Analysing BLS Major Data Series - Where is the U.S. Economy Now?](#)

Analysing BLS data series is, as mentioned earlier, a fact-based and unbiased assessment of the results of our surveys. Decisions about the data to publish, and about the format of publications, are based on extensive consultation with data users. The examples listed below illustrate some of the primary features that are emphasised in several BLS news releases.

#### [Employment and Unemployment](#)

On October 22, 2013, the BLS reported that total nonfarm payroll rose by 148,000 in September 2013, and the unemployment rate was little changed at 7.2 percent. Temporary help services, typically considered a leading indicator of employment change, added 20,200 jobs. Health care employment added 6,800 jobs; this industry has shown a slight deceleration in job gains per month so far in 2013 (18,500) compared to the monthly job gain in 2012 (26,700). In September, employment increased in construction (20,000), wholesale trade (16,100), and transportation and warehousing (23,400).

In September, the number of long-term unemployed (persons without jobs for 27 weeks or more) was little changed; these individuals accounted for 36.9 percent of the unemployed. The number of persons employed on a part-time basis for economic reasons (sometimes referred to as involuntary part-time workers) was unchanged at 7.9 million; these individuals were working part time because their hours had been cut back or because they were unable to find a full-time job. In addition to the usually reported unemployment rate, the BLS also publishes a number of alternative measures of labour underutilisation (Table A-15 in The Employment Situation news release). These measures provide rates based on alternative definitions. The broadest measure, referred to as U-6, is the total unemployed, plus all persons marginally attached to the labour force, plus total employed part time for economic reasons, as a percent of the civilian labour force plus all persons marginally attached to the labour force. In September 2013, the U-6 measure was 13.6 percent, little changed from August 2013 (13.7 percent).

On October 24, 2013, the BLS reported that there were 3.9 million job openings on the last business day of August, little changed from July. The hires rate (3.3 percent) and separations rate (3.2 percent) also were little changed in August.

#### Prices

On September 17, 2013, the BLS reported that the Consumer Price Index for All Urban Consumers (CPI-U) increased 0.1 percent in August on a seasonally adjusted basis. Over the last 12 months, the all items index increased 1.5 percent before seasonal adjustment.

#### Wages and Earnings

On July 31, 2013, the BLS reported that compensation costs for civilian workers

increased 0.5 percent, seasonally adjusted, for the 3-month period ending June 2013, following a similar 3-month percent increase in March. Wages and salaries rose 0.4 percent in the June quarter, similar to the 0.5 percent increase for the previous period.

On September 17, 2013, the BLS reported that real average hourly earnings for all employees rose 0.1 percent from July to August, seasonally adjusted. Real average weekly earnings rose 0.4 percent over the month due to the increase in real average hourly earnings and a 0.3 percent increase in the average workweek.

#### Productivity

On September 5, 2013, the BLS reported that nonfarm business sector productivity increased at a 2.3 percent annual rate during the second quarter of 2013. The increase in productivity reflects increases of 3.7 percent in output and 1.4 percent in hours worked.

#### Conclusion

One of the most important issues that has not been addressed yet, is the importance of the staff of a federal statistical agency. The importance of hiring educated, motivated staff cannot be overstated. BLS provides its excellent staff with opportunities to attend University courses to further their education when it contributes to the work of the BLS. Examples include technical training in economics, methodology, information technology, and project management as well as continuing education in non-technical areas such as communication and leadership. Also, staff are encouraged to do independent or team-based research on projects that further the BLS mission, and then to report on the results of the research in appropriate statistical and economic venues. Mentoring of junior staff by more senior staff is encouraged, and in this manner the BLS tradition of excellence is passed on.

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## Appendices

### Statement of Commitment to Scientific Integrity by the U.S. Principal Statistical Agencies

In 2012, the U.S. Principal Statistical Agencies issued a joint statement of commitment to scientific integrity, and each of those agencies placed the statement on their respective public websites. The BLS statement is available at: <http://data.bls.gov/cgi-bin/print.pl/bls/integrity.htm> and is reproduced below.

#### U.S. Bureau of Labor Statistics

##### BLS Information

##### Statement of Commitment to Scientific Integrity by Principal Statistical Agencies

Our Nation relies on the flow of objective, credible statistics to support the decisions of governments, businesses, households, and other organisations. Any loss of trust in the integrity of the Federal statistical system and its products can foster uncertainty about the validity of measures our Nation uses to monitor and assess performance and progress.

Federal statistical agencies (or units) whose principal function is the collection, analysis, and dissemination of information for statistical purposes have set for themselves a high standard of scientific integrity. The following agencies are designated as 'principal statistical agencies'<sup>[1]</sup>:

- Bureau of Economic Analysis (Commerce Department)
- Bureau of Justice Statistics (Justice Department)
- Bureau of Labor Statistics (Labor Department)
- Bureau of Transportation Statistics (Transportation Department)
- Census Bureau (Commerce Department)
- Economic Research Service (Agriculture Department)
- Energy Information Administration (Energy Department)
- National Agricultural Statistics Service (Agriculture Department)
- National Center for Education Statistics (Education Department)

- National Center for Health Statistics (Health and Human Services Department)
- National Center for Science and Engineering Statistics (National Science Foundation)
- Office of Research, Evaluation, and Statistics (Social Security Administration)
- Statistics of Income Division (Treasury Department)

These agencies embrace a common set of professional standards and operational practices designed to ensure the quality, integrity and credibility of their statistical activities. Implementation of these professional standards involves a wide range of managerial and technical challenges.

##### Principles and Practices of Statistical Agencies

To address these challenges, the National Research Council of the National Academies (NRC) has developed practical guidance in its publication, Principles and Practices for a Federal Statistical Agency<sup>[2]</sup>

The principal statistical agencies use this volume to guide their strategic planning, daily operations, and interactions with stakeholders. The principal statistical agencies embrace the four fundamental principles articulated in the Fourth Edition:

- Principle 1: a Federal statistical agency must be in a position to provide objective information that is relevant to issues of public policy;
- Principle 2: a Federal statistical agency must have credibility with those who use its data and information;
- Principle 3: a Federal statistical agency must have the trust of those whose information it obtains;
- Principle 4: a Federal statistical agency must have a strong position of independence within the government.

Actual and perceived violations of any of these principles undermine the scientific integrity of, and public confidence in, the data produced by principal statistical agencies. Of special note is the emphasis that the NRC publication places on the impartiality and independence of each statistical agency. The NRC discussion of

independence includes the following:

- Independence must include separation of the statistical agency from the parts of its department that are responsible for policy-making or law enforcement activities.
- Independence must include control over personnel actions, especially the selection and appointment of qualified professional staff, including senior executive career staff.
- Independence must include the statistical agency having authority for professional decisions over the scope, content, and frequency of data collected; analysis, or publishing of the information; authority to release statistical information without prior clearance; and adherence to predetermined schedules for public release of statistical information.
- Independence must also include the statistical agency's ability to control information technology systems used in collection, storage and dissemination of statistical information, since such control is essential for ensuring adherence to laws and regulations requiring appropriate protection of data collected under a promise of confidentiality.

The principal statistical agencies also subscribe to the 11 practices identified by the NRC as critically important in the application of these principles:

- Practice 1:** A Clearly Defined and Well-Accepted Mission;
- Practice 2:** Continual Development of More Useful Data;
- Practice 3:** Openness about Sources and Limitations of the Data Provided;
- Practice 4:** Wide Dissemination of Data;
- Practice 5:** Cooperation with Data Users;
- Practice 6:** Fair Treatment of Data Providers;
- Practice 7:** Commitment to Quality and Professional Standards of Practice;
- Practice 8:** An Active Research Program;
- Practice 9:** Professional Advancement of Staff;
- Practice 10:** A Strong Internal and External Evaluation Program; and
- Practice 11:** Coordination and Cooperation with Other Statistical Agencies.

All of these practices are important to achieving and safeguarding scientific integrity.

Implementation details of these practices vary across agencies.

#### Statistical Policy Directives and Standards

The Principles and Practices are closely related to Statistical Policy Directives and other standards issued by the Office of Management and Budget (OMB) in its role as coordinator of the Federal statistical system (44 U.S.C 3504(e)). Specifically, OMB's directives and standards are designed to preserve and enhance the objectivity, utility, and transparency, in fact and in perception, of the statistical products themselves and the processes used to release and disseminate them. Examples include:

- **Statistical Policy Directive Number 3<sup>[3]</sup>**, which is intended to preserve the time value of principal economic indicators, strike a balance between timeliness and accuracy, prevent early access to information that may affect financial and commodity markets, and preserve the distinction between the policy-neutral release of data by statistical agencies and their interpretation by policy officials.
- **Statistical Policy Directive Number 4<sup>[4]</sup>**, which enumerates procedures intended to ensure that statistical data releases adhere to data quality standards through equitable, policy-neutral, and timely release of information to the general public.
- **Standards and Guidelines for Statistical Surveys<sup>[5]</sup>**, which documents important technical and managerial practices that Federal agencies are required to adhere to, and the level of quality and effort expected in all statistical activities to ensure consistency among and within statistical activities conducted across the Federal Government.

#### Information Quality Guidelines

The Principles and Practices are also related to the Information Quality Act<sup>[6]</sup>, which requires OMB and all other Federal agencies to maximise the quality, objectivity, utility, and integrity of information, including statistical information, provided to the public. Through the adoption and implementation of the Government-wide Information Quality Guidelines<sup>[7]</sup>, each statistical agency:

- maintains its commitment to using the best available science and statistical methods;
- subjects information, models, and analytic



- results to independent peer review by qualified experts, when appropriate;
- disseminates its data and analytic products with a high degree of transparency about the data and methods to facilitate its reproducibility by qualified third parties; and
  - ensures that the presentation of information is comprehensive, informative, and understandable.

#### Using Best Scientific Methods to Ensure Data Quality and Integrity

Finally, scientific methods play a critical role in maximising the quality, objectivity, and credibility of information collected and disseminated by the principal statistical agencies. Examples of the application of scientific methods include probability sampling designed to avoid biased samples and randomised assignment for assessing the impacts of alternative protocols or question wording. Measures need to be valid and reproducible, and interpreting variations in these measures across data sources requires scientific knowledge of their properties. Combining data from disparate sources, such as surveys and administrative records, is increasingly important given the growing reluctance of respondents to provide data in Federal data collection efforts. These efforts require statistical modelling, as does the provision of statistics on small areas where direct estimates from surveys may be subject to large sampling errors. The procedures, equations, and assumptions, which define these models,

must be publicly available to ensure that the information is presented in an accurate, clear, complete, and unbiased manner. Moreover, Federal statistical agencies apply complex statistical methods to the information that is publicly released to protect the confidentiality of data about respondents to Federal surveys.

Methodological improvements and rigorous approaches to data collection and analysis require the application of scientific methods. Computer scientists, demographers, economists, geographers, mathematicians, survey statisticians, and other scientists are needed for producing high quality, objective statistics from surveys or administrative data. Subject area experts, such as epidemiologists and engineers, are also needed to maximise data quality. Research and methodological innovation are required to continuously improve the quality and scope of our data products while protecting privacy and ensuring confidentiality. All of the above mentioned factors are critically important to ensuring the credibility of Federal statistical agencies.

#### Conclusion

We reaffirm our commitment to maintaining the highest level of scientific integrity in producing official statistics. Together, the *Principles and Practices*, *Statistical Policy Directives and Standards*, and *Information Quality Guidelines* form the foundation for achieving and maintaining scientific integrity within and among the principal statistical agencies.

## Notes

- <sup>[1]</sup> The Office of Management and Budget designates principal statistical agencies. The exact number of units considered principal statistical agencies has evolved over time. The most recent listing of such agencies is available in the Office of Management and Budget's *Statistical Programs of the United States Government*, available at: [http://www.whitehouse.gov/sites/default/files/omb/assets/information\\_and\\_regulatory\\_affairs/12statprog.pdf](http://www.whitehouse.gov/sites/default/files/omb/assets/information_and_regulatory_affairs/12statprog.pdf).
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- <sup>[3]</sup> [http://www.whitehouse.gov/sites/default/files/omb/assets/omb/inforeg/statpolicy/dir\\_3\\_fr\\_09251985.pdf](http://www.whitehouse.gov/sites/default/files/omb/assets/omb/inforeg/statpolicy/dir_3_fr_09251985.pdf); 38932 Federal Register / Vol. 50, No. 186 / Wednesday, September 25, 1985.
- <sup>[4]</sup> [http://www.whitehouse.gov/sites/default/files/omb/assets/omb/fedreg/2008/030708\\_directive-4.pdf](http://www.whitehouse.gov/sites/default/files/omb/assets/omb/fedreg/2008/030708_directive-4.pdf); 12622 Federal Register / Vol. 73, No. 46 / Friday, March 7, 2008.
- <sup>[5]</sup> [http://www.whitehouse.gov/sites/default/files/omb/assets/omb/inforeg/statpolicy/standards\\_stat\\_surveys.pdf](http://www.whitehouse.gov/sites/default/files/omb/assets/omb/inforeg/statpolicy/standards_stat_surveys.pdf); announced in 55522 Federal Register / Vol. 71, No. 184 / Friday, September 22, 2006.
- <sup>[6]</sup> Section 515 of the Treasury and General Government Appropriations Act, 2001 (Pub. L. No. 106-554, 44 U.S.C. § 3516 note).
- <sup>[7]</sup> These guidelines are available at: <http://www.whitehouse.gov/omb/fedreg/reproducible2.pdf>.



# DOMESTIC DEMAND-DRIVEN GROWTH: ANALYSIS PERSPECTIVE AND STATISTICS NEEDED

Dr. Yeah Kim Leng<sup>1</sup>

## Abstract

Given the imbalances in global demand and sluggish growth in the advanced economies, which had absorbed the bulk of world exports before the onset of the 2008/09 global financial crisis (GFC), the shift from export-led growth (ELG) strategies to domestic demand-driven growth (DDDG) strategies appears inevitable for export-oriented economies. In dissecting Malaysia's growth performance into various demand components and sources, it was found that DDDG in Malaysia had helped to offset the weak export demand it had faced over the last decade and, importantly, during the post-GFC years. Using input-output tables to assess the changes in output structure arising from substituting current export demand with domestic demand, the analysis showed that the country's high export orientation in a large number of industries precludes its ability to fully offset any sharp decline in exports. The implication is that DDDG can only effect a partial decoupling from external demand and that given the differences in the composition of export and domestic demand, there will be sectoral differences in the impact on industrial capacity, employment and income arising from the ELG-DDDG shift.

In cross-country comparisons, Malaysia's "apparent" under-consumption and low private investment levels, in concert with its narrowing but still positive savings-investment gap, lend further support to the feasibility and desirability of promoting DDDG to support economic growth. Importantly, DDDG is sustainable only if it maximises economic efficiency and utilisation of resources, skills, human capital, and physical and social infrastructures subject to structural, credit and other constraints. On the consumption side of DDDG, a higher level of spending by the middle and upper income groups will need to be elicited while the low income groups will need

to be boosted. Private investment, regardless of domestic or foreign sources or DDDG versus ELG orientation, will be one of the key drivers of DDDG, given the excess savings in the private sector as well as the capacity expansion and productivity growth associated with gross fixed capital formation. Some evidence of lower productivity growth in domestic-oriented industries compared to export-oriented ones reiterates the need for policy measures to boost productivity as part of the DDDG thrusts.

Based on a suggested DDDG framework, whereby the fundamental sources of economic growth emanate from output and structural shifts to higher value activities, productivity increases and institutional quality improvements, the statistical needs can be examined from the perspective of four strategic DDDG thrusts:

- i. Inter-sectoral DDDG thrust whereby changes in output and demand arising from DDDG need to be closely monitored through the provision of nominal and constant price output and value added data by industry (preferably 2 or 3-digit MSIC) so that structural changes, productivity shifts and industry competitiveness can be analysed at the industry level. Information on technology classification and R&D intensity are also important to monitor the desired shift up the value chain and technology ladder;
- ii. Productivity-led DDDG thrust whereby productivity growth is seen as the key driver of competitiveness and growth. Further statistical needs relate to the availability of disaggregated or sub-components such as labour categories by skill levels and types of capital investment (equipment and machineries, R&D, technology, etc) as these will enable more refined and useful analysis of productivity performance and understanding of its determinants at the industry level;

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- iii. Consumption-led DDDG thrust whereby given the constraints posed by the country's rising indebtedness, a DDDG focus on raising consumption will require data on household assets and liabilities by income groups. The suggested DDDG focus on upper middle and high income groups, given their higher savings and ability to withstand rising inflation, is to encourage spending on goods and services that have large multiplier effects as well as on merit goods that have positive externalities such as enhancing consumers' well-being in terms of health or skills upgrading. The availability of data that enable "merit" goods and services to be identified and their multiplier effects or "positive externalities" to be quantified are highly pertinent to the design and implementation of DDDG strategies; and
- iv. Investment-led DDDG thrust whereby given that under-investment continues to prevail in the private sector, it is appropriate for DDDG to focus on promoting capacity expansion, technological upgrading, research and development (R&D), product innovation and investment in new businesses. A more detailed breakdown of the types of capital investment and industries by technology classification will be helpful to ascertain the ability of the industries to move up the value chain. Additionally, statistics on business formations, establishment of new industries and new product diversification are useful to understand the dynamics of existing and new industries as well as changes in their competition dynamics.

The paper reiterates that domestic demand-driven growth (DDDG) should not be viewed as a substitute for export-led growth (ELG) strategies. Rather, by harnessing the complementarities of the two paradigms, Malaysia can capture the growth opportunities arising from an upswing in external demand while mitigating the adverse effects on output and employment due to volatility in export markets by strengthening the resilience of domestic demand.

### Introduction

In the aftermath of the 2008/09 Global Financial Crisis (GFC), growth of the world exports of goods and services has halved to 4% from an

average increase of 8.2% per annum in the pre-crisis 2003-07 period and 7.3% in the 1990s. Consequently, countries focusing on export-led growth strategies will unlikely be able to achieve their desired pre-GFC growth rates. With the G3 economies (US, Japan and Europe) remaining fragile and unable to resume trend or potential output growth in the foreseeable future, their import levels will likely remain below the pre-GFC levels for a prolonged and possibly decade-long period.

Malaysia's export-oriented growth strategy is once again under scrutiny given the changes in the post-global crisis economic landscape. A notable feature is that developing economies and export-oriented industrialised economies are confronted with the urgent need to deal with weak or slumping growth in the G3 economies while acceding to calls to increase domestic absorption and redress the imbalance in global demand.

This paper will present various analytical perspectives on the feasibility and challenges of implementing DDDG for the Malaysia economy. The analyses also serve to highlight the statistics needed to extend the research and to inform policy debates. The basis for DDDG is first examined in section 2 where the advantages and disadvantages of DDDG versus export-led growth (ELG) strategies are elucidated. In section 3, various economic analyses are presented to determine the efficacy and necessary conditions for DDDG to succeed and to illustrate the various types of official statistics employed. In the section 4, a framework for formulating DDDG strategies is suggested together with the statistics required. Section 5 concludes with some broad findings and observations on the feasibility of DDDG for Malaysia and related statistical needs for more in-depth analyses.

### Basis for Domestic Demand-Driven Growth (DDDG)

Malaysia, and most of the East Asian economies, have benefitted from trade openness and the pursuit of export-led growth (ELG) strategy since the early 1970s. China's entry into the World Trade Organization in 2001 and its phenomena growth and emergence as the world's largest manufacturer in 2011 has lent further credence to the

efficacy of export-led growth (ELG) strategies. In the aftermath of the 2008/09 global financial crisis, the prolonged weakness in the advanced economies, however, has led to a renewed focus on domestic demand-driven growth strategies especially among the export-oriented Asian economies (Yeah, 2013). Compared to ELG strategies, DDDG offers the following advantages:

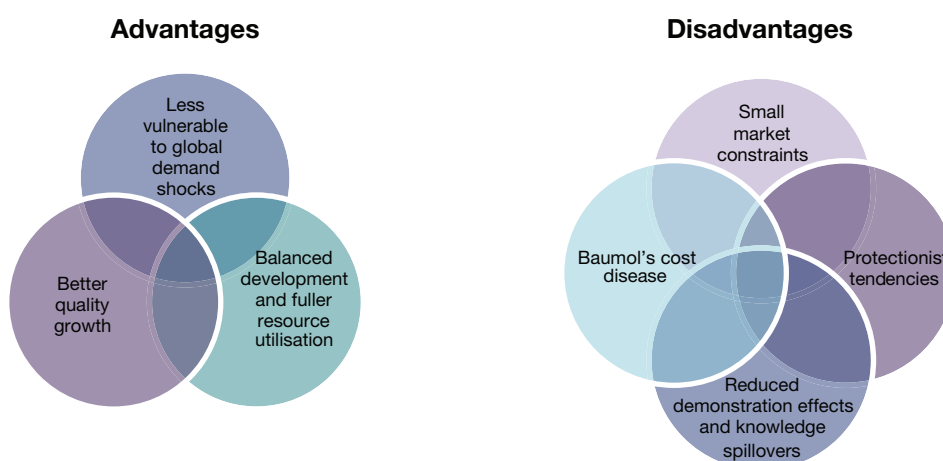
- i. *Reduced vulnerability to global demand shocks:* Given the increasing volatility and unpredictability of international markets and doubts over the ability of advanced economies to absorb all exports from developing countries, a DDDG strategy will lead to more stable and sustainable growth.
- ii. *Prospects for better quality of growth:* The pursuit of export growth to the extreme of mercantilism whereby trade is viewed as a zero-sum game may entail sacrificing labour and human rights and environmental standards, leading to a worse outcome than a DDDG approach that takes into consideration such concerns.
- iii. *Development of a more balanced economy and fuller utilisation of resources:* The production of goods and services that caters to foreign demand tends to be highly concentrated, leading to unbalanced growth

and more pronounced income inequality. A DDDG strategy on the other hand can lead to a more optimal utilisation of resources.

The disadvantages of DDDG, which mirror in reverse the benefits of ELG, include:

- i. *Small market constraints:* For small economies, the limited domestic markets inhibit industries from reaping efficiency gains from economies of scale in production and sales.
- ii. *Demonstration effects and knowledge spillovers:* Being confined to domestic markets, there is less pressure as well as fewer opportunities to learn from more sophisticated demand in the more advanced markets.
- iii. *Protectionist tendencies:* Domestic industries, when threatened with import competition, tend to seek government assistance, leading invariably to protectionism.
- iv. *Baumol's cost and growth diseases:* Since export industries tend to be more efficient and internationally competitive, a shift to domestic-oriented sectors with lower efficiency and productivity could result in stagnating or lower growth.

**Figure1: DDDG's advantages and disadvantages**



In examining the relative merits and pitfalls of DDDG versus ELG, policy makers and planners should not view it as an “either-or” menu choice but rather to optimise their complementarities in order to maximise the country’s growth potential as well as to strengthen national competitiveness.

Such policy analyses will require various macro, industry and firm-level data that can illuminate the relative importance and role of domestic demand in Malaysia’s changing patterns of growth and its demand and production as discussed next.

#### Analysis of Domestic Demand-Driven Growth

The strategic fit of DDDG to Malaysia’s economic development can be elucidated through an analysis of the role and contribution of domestic demand to the country’s growth, structural change and competitiveness in relation to the domestic and external sector balances, as well as the changing dynamics of international trade and investment flows.

In the sections below, several analyses performed to shed further light on the efficacy of DDDG as well as to highlight the use of official statistics and data gaps.

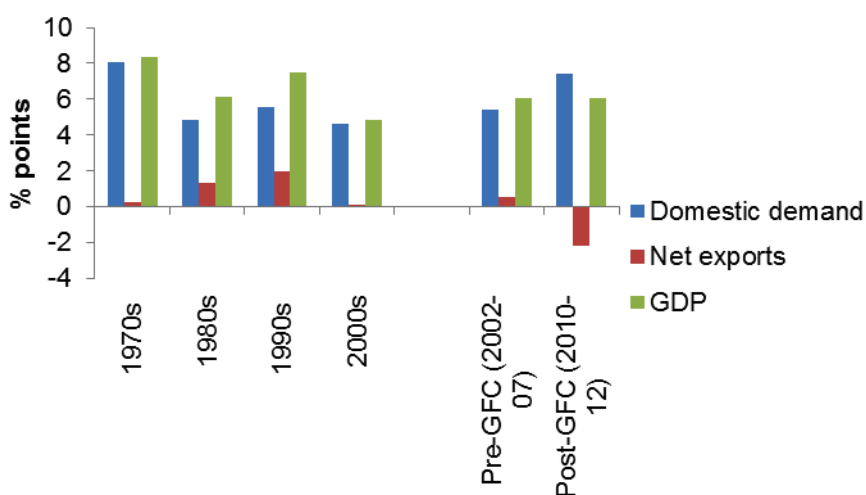
#### Contribution of Aggregate Domestic Demand to Economic Growth

##### Growth Rate and Contribution Analysis of Domestic Final Demand

Over the decades, the pace of aggregate domestic final demand expansion in the Malaysian economy moderated to 5.8% in the 2000s from 6.4% in the 1990s. There was a sharp deceleration in net export growth from 39.0% to 0.1% as the country’s GDP growth eased from 7.5% in the 1990s to 4.9% per annum in the 2000s. Over the two decades, the contribution of aggregate domestic final demand to GDP growth showed a slight decrease from 5.5 percentage points (ppts) to 4.9 ppts while net exports’ contribution registered a sharper decline from 2.0 ppts to 0.1 ppt (Table 1 and Figure 2).

The shift to DDDG was more pronounced in the post-global crisis period from 2010-12 whereby aggregate domestic final demand contributed 7.4 ppts while net exports’ contribution was negative at 2.2 ppts. GDP growth averaged 6.1% per annum in both the pre and post-global financial crisis (GFC) periods (Table 1).

**Figure 2: Contribution of domestic demand and net exports to GDP growth**



Source: Computed from national account statistics published by Department of Statistics Malaysia (DOSM); based on constant 2005 prices.

**Table 1: Contribution of domestic demand and net exports to Malaysia's GDP growth performance**

Period	Domestic final demand	Net exports	Gross Domestic Product (GDP)
<b>Average annual growth (%)</b>			
1970s (1971-80)	9.1	13.7	8.4
1980s (1981-90)	5.6	-57.7	6.2
1990s (1991-2000)	6.4	39.0	7.5
2000s (2001-10)	5.8	0.1	4.9
Pre-GFC (2002-07)	7.0	2.4	6.1
Post-GFC (2010-12)	7.6	-7.9	6.1
<b>Share to GDP (%)</b>			
1970	93.1	7.2	100.0
1980	97.2	2.4	100.0
1990	89.7	10.2	100.0
2000	76.4	23.8	100.0
2010	84.0	14.8	100.0
2012	86.5	13.1	100.0
<b>Contribution to GDP growth (% points)</b>			
1970s (1971-80)	8.1	0.3	8.4
1980s (1981-90)	4.9	1.3	6.2
1990s (1991-2000)	5.5	2.0	7.5
2000s (2001-10)	4.6	0.1	4.9
Pre-GFC (2002-07)	5.4	0.6	6.1
Post-GFC (2010-12)	7.4	-2.2	6.1

Source: Computed from national accounts statistics published by Department of Statistics Malaysia (DOSM); all series rebased to 2005 constant prices. Totals may not tally due to stock changes which are excluded from domestic final demand.

The above trends suggest that contribution of net exports to GDP growth had begun to decline during the last decade (2001-2010). The decline was magnified by slumping exports in the post-GFC period. Conversely, domestic demand was already the main driver of

growth before the global financial crisis and its importance was accentuated by the onset of the GFC. Nevertheless, exports of goods and services, despite expanding at half the pace in the 1990s, still constitute a sizeable share of the economy as examined in the next section.



### Breakdown by Demand Components

A disaggregation of the performance of various demand components, as shown in Table 2, will shed further light on their relative role and contribution to GDP growth. Malaysia's export-led growth was most evident in the 1970s till the 1990s. Export growth averaged 7.5% in the 1970s, rising to 10.7% in the 1980s and 12.5% in the 1990s. The corresponding GDP growth rates were 8.4%, 6.2% and 7.5% per annum (Table 2). There was a marked slowdown in Malaysia's external trade in the 2000s. The average annual export growth more than halved to 4.1%, while import growth averaged slightly higher at 5.0% per annum. In the post-GFC period (2010-12), exports growth picked up pace to 7.8% while imports grew at 10.9% per annum.

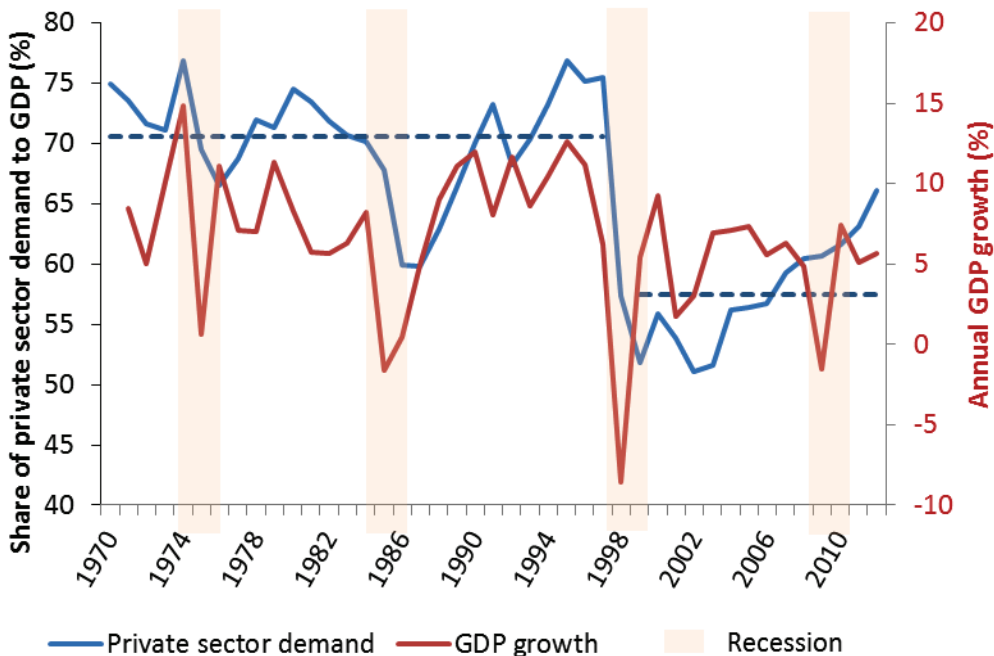
Meanwhile, the share of exports to GDP peaked at 112% in 2000 before declining to a low of 103% in 2003. It then rose to 114% in 2006 before easing to 97.6% in 2009 during the height of the global financial crisis. Since then, it has picked up slightly to 100.5% of

GDP in 2012, suggesting that the share of exports in the economy remains sizeable despite its slower growth during the last decade as well as during the post-GFC period.

Private consumption and investment, which averaged around 70% of GDP in the earlier decades prior to the 1997/98 Asian Financial Crisis (AFC), fell to an average of 58% between then and 2012. It exhibits a rising trend since the AFC and, in contrast to previous recessions where it took a dip, did not experience any decline during the most recent recession caused by the GFC.

The resilience of private sector demand during the GFC can be attributed to a number of factors such as aggressive monetary easing and government stimulus programmes, pent-up demand and high savings, stable commodity prices, continuing credit flows, among others. The pent-up demand explanation is explored further in section 3.2.1 where the country's under-consumption and under-investment is examined further.

**Figure 3: Private sector demand and GDP growth trends**



**Table 2: Malaysia's changing demand structure and growth performance<sup>2</sup>**

Period	Consumption			Gross fixed capital formation			Stocks	Exports of goods & services	Imports of goods & services	GDP at market prices
	Total	Private	Public	Total	Private	Public				
<b>A. Average annual growth (%)</b>										
1970s (1971-80)	7.8	7.4	10.2	13.2	13.5	14.2	59.0	7.5	9.1	8.4
1980s (1981-90)	4.9	5.1	4.3	7.6	8.1	7.1	-47.2	10.7	9.9	6.2
1990s (1991-2000)	5.7	5.8	5.5	8.2	7.6	10.8	-330.4	12.5	12.3	7.5
2000s (2001-10)	6.9	6.7	7.7	3.6	4.6	4.6	-103.8	4.1	5.0	4.9
2010-12 (Post-GFC)	7.4	6.8	9.5	8.5	13.9	2.3	-127.1	7.8	10.9	6.1
<b>B. Share to GDP (%)</b>										
1970	71.1	59.8	11.3	22.0	15.2	6.9	-0.3	51.6	44.4	100.0
1980	67.5	54.2	13.3	29.8	20.3	9.5	0.4	47.0	44.6	100.0
1990	59.3	48.2	11.1	30.4	21.8	8.7	0.1	70.7	60.5	100.0
2000	50.3	41.1	9.2	26.2	14.8	11.4	-0.2	112.1	88.4	100.0
2010	60.8	48.8	12.0	23.2	12.5	10.6	1.2	101.5	86.6	100.0
2012										
(Post-global crisis)	63.0	49.8	13.2	23.5	13.4	10.1	0.5	100.6	87.5	100.0
<b>C. Contribution to GDP growth (% points)</b>										
1970s (1971-80)	5.1	4.0	1.2	2.9	2.0	0.9	0.1	3.6	3.4	8.4
1980s (1981-90)	3.0	2.4	0.6	1.9	1.3	0.6	0.0	6.0	4.7	6.2
1990s (1991-2000)	3.1	2.6	0.6	2.4	1.3	1.1	0.0	10.7	8.7	7.5
2000s (2001-10)	3.8	2.9	0.8	0.8	0.4	0.5	0.2	4.2	4.1	4.9
2010-12 (Post-GFC)	4.5	3.3	1.1	1.9	1.7	0.3	1.0	7.7	8.9	6.1

Source: Derived from national accounts statistics published by DOSM; all series rebased to 2005 constant prices.

Given the significant share of exports in the economy, the feasibility of DDDG to sustain growth will have to take into consideration the

production structure and its substitutability with domestic demand as analysed in section 3.2.

<sup>2</sup> Similar to Table 1, the tSource: SEEA Diagnostic Tool, Draft version 2.0 by Department of Economic and Social Affairs Statistics Division, United Nation, September 2013

### Decomposition of Sources of Demand

A commonly used approach to estimate the various sources of demand is the structural decomposition analysis (SDA). The technique decomposes aggregate demand into domestic demand expansion, import substitution and export demand expansion. Using the input-output (IO) tables of Malaysia for 1991, 2000 and 2005 published by the DOSM, the country's sources of demand is decomposed for two periods, 1991-2000 and 2000-2005 and the results are summarised in Table 3.

The decomposition results re-affirmed the rising role of domestic demand in explaining Malaysia's growth performance in the post-AFC period, as represented by the 2000-2005 period, compared to the 1990s as established earlier in the growth rate and contribution analysis.

In the 1991-2000 period, export demand expansion accounted for 29% of total demand whilst in the following period 2000-2005, there was decline of the same magnitude. Both domestic demand and import demand expansion contributed the bulk of the demand during the first half of the 2000s decade.

**Table 3: Decomposition of sources of demand for 1991-2000 and 2000-05 (percent)**

Sector	1991-2000				2000-2005			
	Domestic demand	Import demand	Export demand	Total	Domestic demand	Import demand	Export demand	Total
<b>AGRICULTURE</b>	<b>172</b>	<b>(17)</b>	<b>(55)</b>	<b>100</b>	<b>158</b>	<b>4</b>	<b>(62)</b>	<b>100</b>
Other agriculture	79	(48)	69	100	11	(13)	102	100
Fisheries	98	1	1	100	116	(49)	33	100
Forestry	339	(15)	(224)	100	98	(3)	6	100
<b>MINING</b>	<b>122</b>	<b>(13)</b>	<b>(9)</b>	<b>100</b>	<b>129</b>	<b>42</b>	<b>(71)</b>	<b>100</b>
<b>MANUFACTURING</b>	<b>89</b>	<b>(22)</b>	<b>33</b>	<b>100</b>	<b>115</b>	<b>40</b>	<b>(55)</b>	<b>100</b>
<b>Consumer Goods</b>	<b>91</b>	<b>(4)</b>	<b>13</b>	<b>100</b>	<b>91</b>	<b>11</b>	<b>(2)</b>	<b>100</b>
Food, bev. & tobacco	101	3	(4)	100	85	(1)	15	100
Wearing apparel & footwear	119	22	(41)	100	160	(8)	(52)	100
Paper & furniture	59	(83)	124	100	112	60	(72)	100
Prof. & scientific equip.	74	6	20	100	141	27	(68)	100
Other manufactures	44	35	22	100	84	26	(10)	100
<b>Investment goods</b>	<b>114</b>	<b>(2)</b>	<b>(11)</b>	<b>100</b>	<b>119</b>	<b>9</b>	<b>(28)</b>	<b>100</b>
Textiles	122	18	(41)	100	(69)	128	41	100
Wood & cork products	272	(15)	(157)	100	277	7	(184)	100
Printing & publishing	84	8	8	100	73	15	12	100
Industrial chemicals	80	19	1	100	146	21	(67)	100
Other chemicals	46	3	52	100	100	(4)	3	100
Petroleum refineries	114	(17)	3	100	102	5	(7)	100
Rubber products	171	(48)	(22)	100	256	59	(215)	100
Plastic products	68	(13)	45	100	165	42	(108)	100
Cement, clay & other NMMP	89	(12)	23	100	99	(5)	6	100
Glass & glass products	113	4	(17)	100	126	11	(37)	100
<b>Capital goods</b>	<b>79</b>	<b>(27)</b>	<b>48</b>	<b>100</b>	<b>123</b>	<b>66</b>	<b>(89)</b>	<b>100</b>
Iron & steel basic industries	107	(39)	33	100	44	30	26	100
Non-ferrous metals	93	(17)	24	100	182	151	(234)	100
Fabricated metal products	130	(21)	(9)	100	87	4	9	100
Non-electrical machinery	54	(11)	57	100	155	2	(57)	100
Electrical machinery	88	(17)	29	100	137	97	(133)	100
Transport equipment	112	(78)	66	100	81	4	15	100
<b>CONSTRUCTION</b>	<b>71</b>	<b>6</b>	<b>23</b>	<b>100</b>	<b>124</b>	<b>(3)</b>	<b>(21)</b>	<b>100</b>
<b>SERVICES</b>	<b>102</b>	<b>(13)</b>	<b>11</b>	<b>100</b>	<b>83</b>	<b>14</b>	<b>2</b>	<b>100</b>
Utilities	96	2	2	100	89	0	11	100
W&R trade, hotels & rest.	116	(15)	(1)	100	68	29	3	100
Transp. storage & comm.	106	(16)	10	100	107	32	(40)	100
Fin., insur. & real estate	97	(3)	6	100	72	7	22	100
Business services	71	(31)	60	100	102	7	(9)	100
<b>TOTAL ECONOMY</b>	<b>93</b>	<b>(22)</b>	<b>29</b>	<b>100</b>	<b>103</b>	<b>26</b>	<b>(29)</b>	<b>100</b>

Source: Computed from Input-output Tables of Malaysia for 1991, 2005 and 2005 published by DOSM.

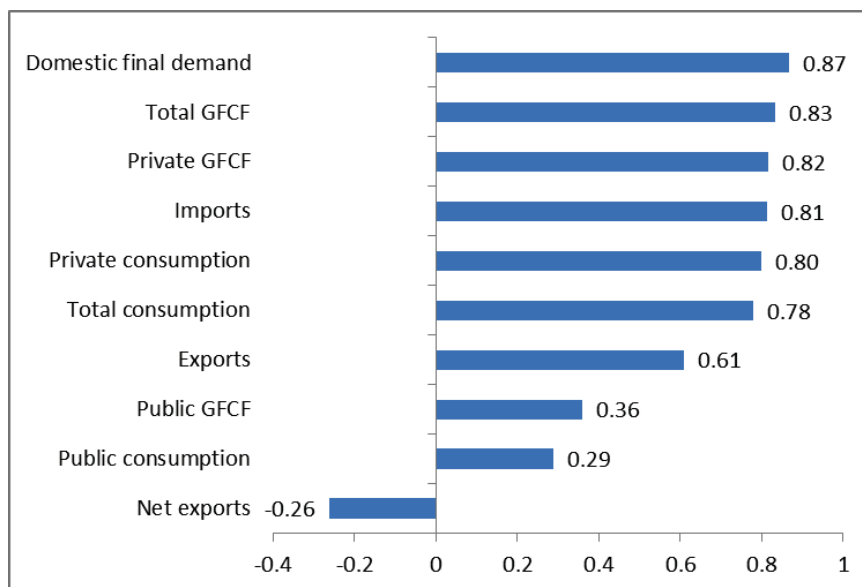
### Relationship with GDP Growth

The growth in the various domestic demand aggregates is strongly correlated with GDP growth with a correlation coefficient of 0.97 for domestic final demand, 0.81 for imports, 0.82 for private investment and 0.80 for private consumption. The correlation coefficient for export growth is lower at 0.61 (Figure 4).

However, correlation relationship does not imply causation. Since establishing causality is outside the scope of this paper, we can

draw upon the findings of several studies using econometric tests such as Granger causality and co-integration techniques. Mixed or inconclusive results were obtained in a number of empirical studies on export-led growth. A study that included the role of domestic demand found that both ELG and DDDG hypotheses are valid in the short-run but the results are not supportive of ELG hypothesis in the long run. Instead the study found highly significant positive impact of domestic expenditure on economic growth (Lai, 2004).

**Figure 4: Correlation of growth of demand components with GDP growth for 1971-2012**



Source: Computed from national account statistics published by DOSM with 2005 as the base year.

## Output Gap and Demand

The gap between actual and potential growth provides an indication of the extent to which demand, both domestic and external, can be stimulated without resulting in excessive inflationary pressures. The economy's potential growth can be estimated from a 'production function' approach where the fundamental sources of growth are derived from the production factors, capital and labour, and total factor productivity (TFP).

The decomposition results are shown by decades in Table 4. The forecast for the 2013-20 period is based on labour input growth of 2% per annum and capital input growth of 8% per annum. Assuming that TFP growth can be maintained at 1.5% per annum, broadly similar to the previous decade's achievement, Malaysia's potential growth is projected at 5.2% per annum for the rest of this decade.

The policy implication arising from the above analysis is that a DDDG thrust that sustains growth at around the estimated potential

output of 5.2% per annum will not result in a negative output gap (actual exceeding potential output) that signals the build-up of inflationary pressures. Another implication is that if an investment-targeted DDDG thrust is able to raise the annual investment rate to 10%, then the country's potential output is lifted to 5.7%, assuming no change in the other variables.

## Sustainability of Domestic Demand-Driven Growth

Though the empirical issue of causality between domestic demand and growth may seem trivial, the main concern with the DDDG strategy is its sustainability and ability to duplicate the benefits associated with an ELG strategy while avoiding the costs highlighted in section 2. To shed light on the sustainability issue, we examine the structure of demand components for any imbalances that may constrain growth in the short and long run. The findings presented next augur well for sustaining a DDDG-oriented strategy while simultaneously capturing the complementarities of ELG more fully.

**Table 4: Growth decomposition and estimated potential output based on the production function approach**

Period	% point contribution to GDP growth				% share of total contribution			
	Capital	Labour	TFP	Total	Capital	Labour	TFP	Total
1971-80	3.6	2.6	1.1	7.3	50%	34%	16%	100%
1981-90	3.1	2.3	0.6	6.0	51%	38%	11%	100%
1991-00	2.6	2.5	2.1	7.2	36%	35%	29%	100%
2001-12	1.5	1.8	1.6	4.8	30%	37%	33%	100%
2013-20f	2.3	1.4	1.5	5.2	44%	27%	29%	100%

Source: Computed using Gollop-Jorgenson translog production function; 2013-20 forecasts based on labour input growth

### Under-Consumption and Under-Investment

As shown in Figure 5, the share of private consumption to GDP turned around in 2000 after falling to its lowest level of 40% in 1999. Since then, private consumption growth has risen 6.7% annually in the period of 2001-2010 from an average of 5.8% in the 1990s and 5.1% in the 1980s. Meanwhile, its share to GDP has risen steadily to about 50% of GDP in 2012, thereby contributing to the robustness of domestic demand and helping to offset the weaker export demand.

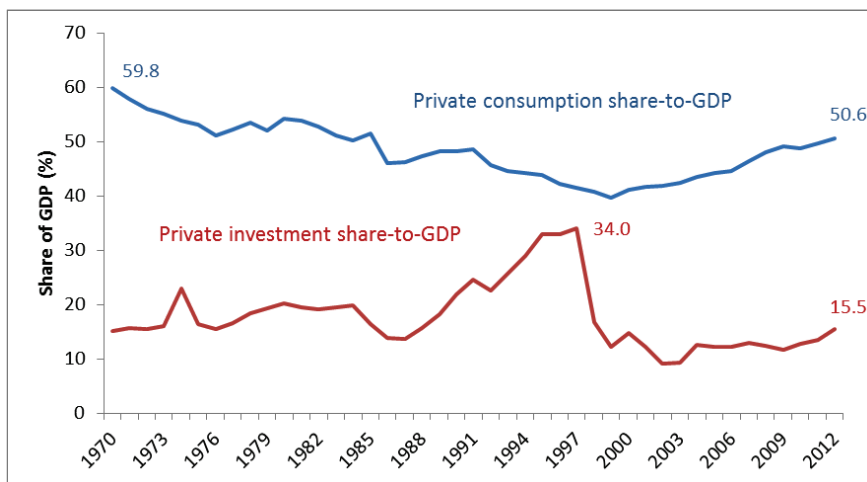
Despite the rise over the last decade, there is an “apparent under-consumption” when compared to the various country groupings by income levels as shown in Figure 6. Over the last decade, Malaysia’s household final expenditure to GDP averaged 46% or about 10 percentage points below that of upper middle income countries (average 56% GDP share) and 16 percentage points below that for high income countries (average 62% GDP share).

More recently in 2010, the difference with the upper middle income and high income groups has closed to 5 and 15 percentage points respectively, suggesting that there is significant scope to boost private consumption (or its equivalent, household final expenditure) as part of DDDG strategy.

Malaysia’s private investment similarly exhibits an even more pronounced “under-investment” phenomenon, an issue that has attracted much research interest. Private investment growth slowed to 4.6% per annum in the 2000s decade compared to 7.6% in the 1990s and 8.1% in the 1980s (Table 2). Its share to GDP, which reached a peak of 34% in 1997, slumped to a low of 9.1% in 2002 before fluctuating upwards to 13.4% in 2011.

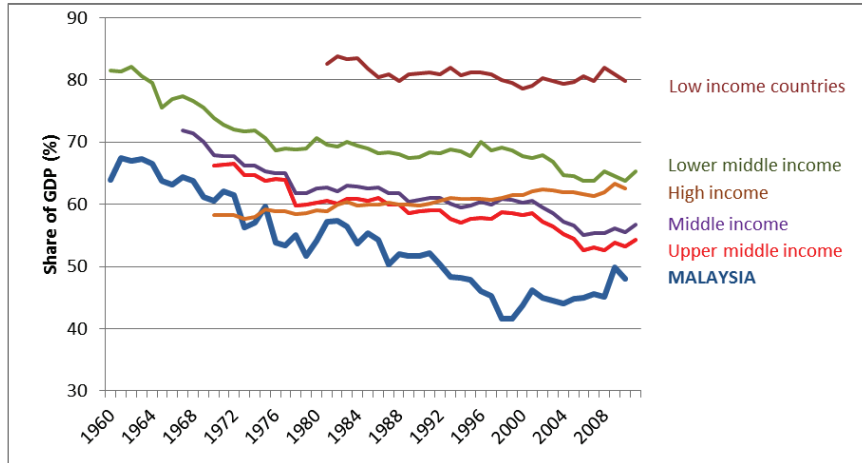
A cross-country comparison with the mean investment levels for different income groupings reveals not only the significant gap in Malaysia’s private investment level but also the divergent trends, with the former rising and latter remaining flattish (Figure 7).

**Figure 5: Trends in private consumption and private investment-to-GDP ratios**



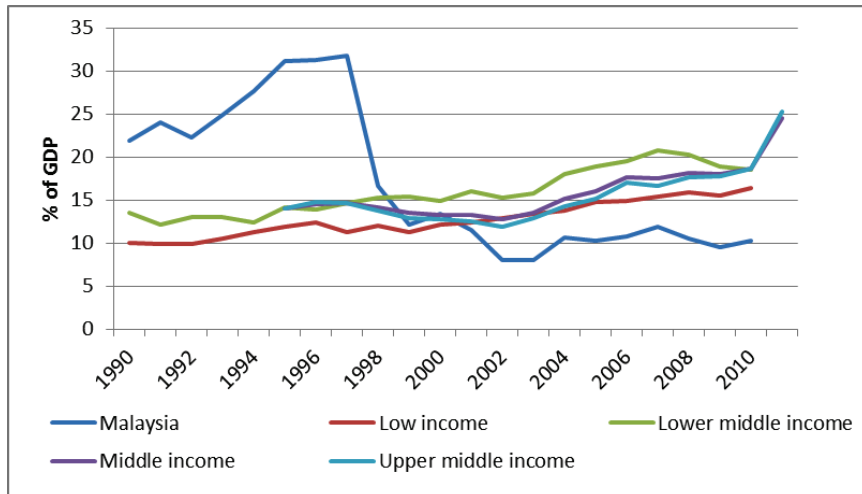
Source: DOSM; rebased to 2005 constant prices.

**Figure 6: Comparison of household final expenditure among countries in different income groups**



Source: The World Bank Databank

**Figure 7: Trends in the GDP share of gross fixed capital formation by private sector for Malaysia and various country groupings**



Source: The World Bank Databank



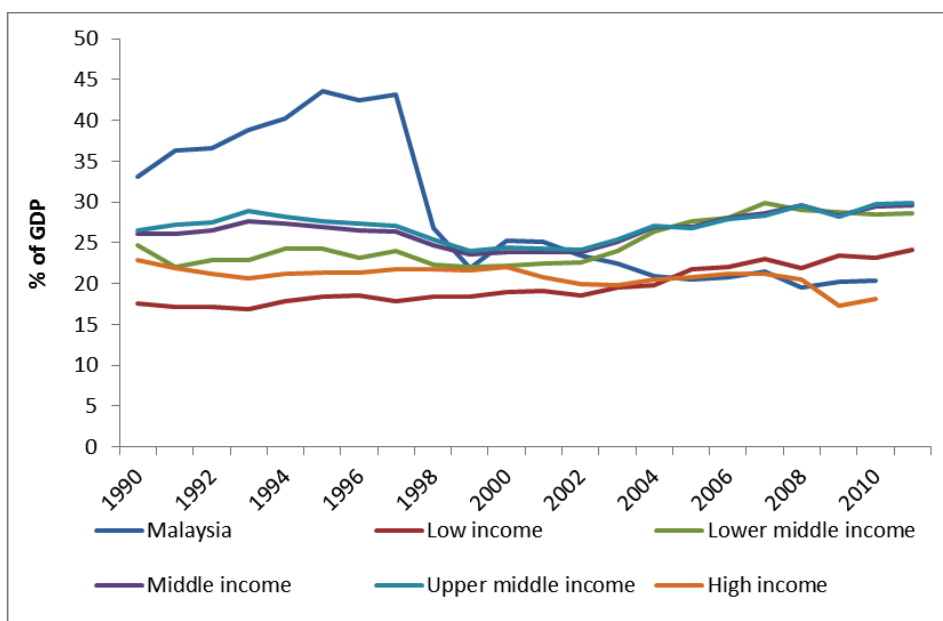
Since a significant portion of investments in Malaysia is undertaken by government-linked companies, it may be more appropriate to compare the total investment as shown in Figure 8. Malaysia's "under-investment" still holds when compared to the higher levels and rising trends exhibited in the low, middle and upper middle income countries. Malaysia's total investment was only slightly above the high income group in recent years despite the latter countries being already industrialised as well as struggling with low growth and high unemployment in the aftermath of the global financial crisis.

An investment-based DDDG strategy is certainly appropriate and sustainable given the low investment, and importantly, the

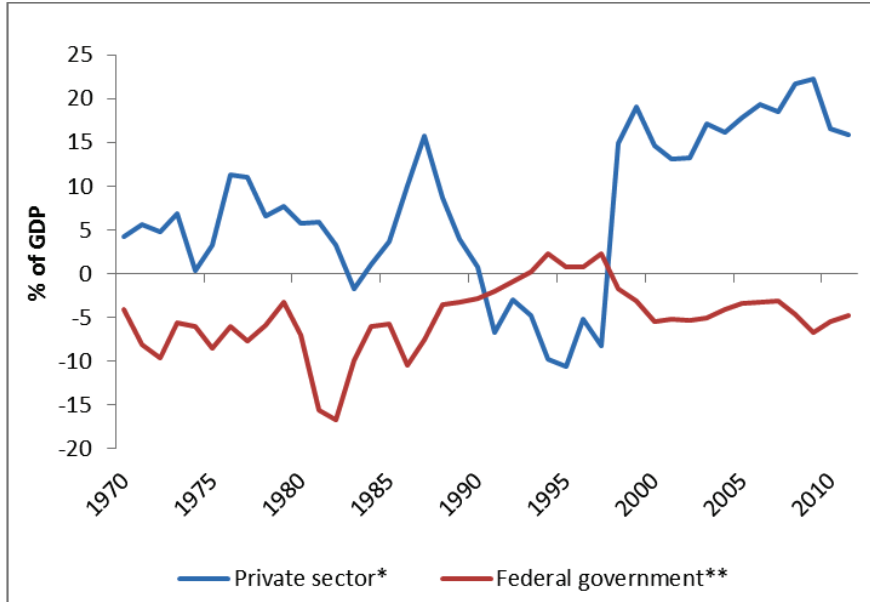
sizeable savings-investment gap (Figure 9). The excess national savings over investment in the private sector amounting to more than 16% of GDP in 2011 suggests that there is no aggregate domestic financing constraint to a private sector-led DDDG strategy.

On the other hand, the role of government spending will have to be redefined for the sustainability of DDDG strategy given the negative savings-investment gap in the government sector. The fallacy of composition also applies in this case as what is true for the whole may not be true for the parts, notably the relatively high government debt level amounting to 54% of GDP in 2012 and household debt level at 80% of GDP in 2012.

**Figure 8: Comparison of total investment trends**



**Figure 9: Positive savings-investment gap for private sector but not the government sector**



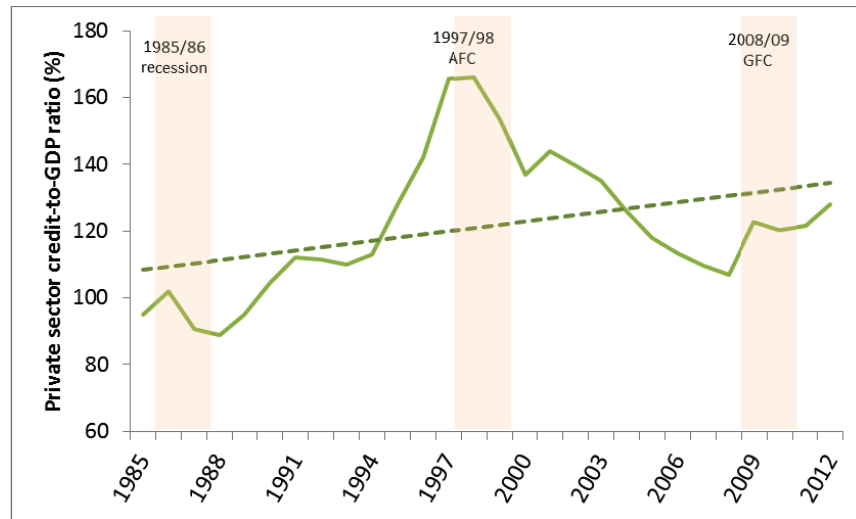
Note: \*Based on current account balance – fiscal balance. \*\*The federal government’s fiscal deficit is used as the proxy for the savings-investment gap for the public sector.

#### Rise in Private Sector Indebtedness

A key factor underpinning the sustainability of domestic demand is leverage. It is noted that private sector credit-to-GDP, a widely used indicator of economy-wide leverage, peaked at 166% of GDP in 1997 before the on-set of the Asian Financial Crisis (Figure 10). Following a decade-long deleveraging, the leverage ratio leveled off at 107% in 2008 before rising gradually to 128% of GDP in 2012.

Although the current leverage ratio is still lower than the pre-AFC level, it is nonetheless approaching the trend level. This suggests that any domestic demand-led expansion will be increasingly constrained by over-leveraging concerns as well as prudential measures taken by the central banks and lending institutions to guard against credit over-exposures.

**Figure 10: Private Sector Leverage**



Source: Bank Negara Malaysia's Monthly Statistical Bulletin.

### Changes in Production Structure and Productivity

The changes in Malaysia's aggregate demand structure have been accompanied by marked shifts in its output structure. Malaysia's manufacturing sector slowed sharply in the 2000s to 3.8% per annum in the 2000s compared to 10.3% in the 1990s and 9.8% in the 1980s. Correspondingly, its share to GDP declined to 25.2% in 2010 from 27.7% in 2000, after rising to 21.7% in 1990 from 14.7% in 1980 (Table 5).

An examination of the annual trend shows that manufacturing share to GDP peaked at 28.0% in 2006 before fluctuating downwards to 25.1% in 2011.<sup>3</sup> Meanwhile, services share to GDP rose from 45% in 2000 to 53.2% in 2010 despite chalking slower growth of 6.4% per annum, down from 9.2% in the 1990s. The

shares of resource-based sectors (agriculture and mining) continue to register decline but at a slower pace due to the rising but fluctuating commodity export demand.

These changes in production structure are consistent with the rising role of domestic demand as against export demand since 2000. Besides the issue of sustainability, the rising importance of domestic demand and the pursuit of DDDG strategy give rise to two other concerns centered on demand rebalancing and inter-sectoral productivity shifts. Given the sizeable contribution of exports to the economy, amounting to approximately 101% of GDP in 2012, a DDDG strategy is desirable not only to offset export demand slack but also as a means to smooth output and ensure labour market stability.

<sup>3</sup> Based on the 2000 constant price series, the manufacturing share to GDP is computed at 30.7% in 2005. The rebasing to 2005 constant prices has resulted in a "statistical drop" in the manufacturing GDP share when compared to those reported using different base year. This however does not change the finding of its declining share in the economy.

**Table 5: Changes in Malaysia's production structure and sectoral performance**

Period	Agriculture, forestry & fishing	Mining & quarrying	Manufacturing	Construction	Services	GDP at purchasers' value
<b>Average annual growth (%)</b>						
1970s (1971-80)	6.1	7.5	14.7	9.9	9.9	8.4
1980s (1981-90)	3.4	3.7	9.8	3.5	6.2	6.2
1990s (1991-2000)	0.8	4.6	10.3	7.2	9.2	7.5
2000s (2001-10)	2.9	0.4	3.8	3.0	6.4	4.9
Pre-GFC (2002-07)	3.9	2.5	6.4	1.6	6.8	5.9
Post-GFC (2010-12)	3.1	-1.5	7.1	5.3	11.4	6.1
<b>Share to GDP (%)</b>						
1970	26.8	28.8	9.2	4.6	32.8	100.0
1980	20.4	23.6	14.7	4.9	35.4	100.0
1990	16.7	19.4	21.7	3.9	38.0	100.0
2000	8.9	14.8	27.7	3.6	45.0	100.0
2010	7.6	9.8	25.2	3.0	53.2	100.0
2012 (Post-GFC)	7.3	8.4	24.9	3.5	54.6	100.0
<b>Contribution to GDP growth (% points)</b>						
1970s (1971-80)	1.5	2.2	1.8	0.4	3.4	8.4
1980s (1981-90)	0.6	0.9	1.8	0.2	2.3	6.2
1990s (1991-2000)	0.1	0.8	2.6	0.3	3.9	7.5
2000s (2001-10)	0.3	0.1	1.4	0.1	3.0	4.9
Pre-GFC (2002-07)	0.3	0.4	1.8	0.1	3.2	5.9
Post-GFC (2010-12)	0.2	-0.1	1.8	0.4	3.8	6.1

Source: Computed from DOSM; National Accounts Statistics; data rebased to 2005 constant prices. Totals may not tally due to import taxes and rounding.

The efficiency gains of re-allocating labour and capital resources to the more productive sectors will also need to be looked into given the well-known Baumol's diseases where price and cost increase not coming from productivity growth but due to higher wages in other sectors. Applying this hypothesis to growth, changes in spending could result in slower economic growth because of the shift in composition of output away from industries with rapid productivity growth like manufacturing toward those with stagnant technologies like many types of services, resulting in overall slowdown in aggregate productivity growth. These issues will be addressed in the next section where the substitutability of domestic demand for export demand is analysed.

#### Substitutability of Domestic and Export Demand

Given the availability of input-output tables for Malaysia, a partial equilibrium analysis is conducted to explore the implication of substituting export demand with domestic demand expansion. It is noted that more advanced approaches such as the use of computable general equilibrium (CGE) models are better suited to examine the economy-wide impact of substituting export demand with domestic demand. However, the development of CGE models is resource-intensive, given their complexity, software and specific data requirements, such as production transformation and substitution elasticities as well as income and expenditure flows in the form of social accounting matrix.

### Input-Output Analysis of an Export Demand Shock

A breakdown of Malaysia's production structure based on 34 industry groupings which have been aggregated from Malaysia's 120x120 input-output table for 2005 is shown in Table 6.

As indicated by the export ratio, many industries are heavily dependent on overseas markets with the highest being electrical and electronics (68.5%), and professional and scientific equipment (64.9%) with an overall average of 35.9% for the country's total gross output in 2005.

**Table 6: Key indicators from the 2005 input-output table for Malaysia**

Activity	Value (RM million)					Share of total (%)		Key industry ratios(%)		
	Gross output	Intermediates	Value added	Exports	Imports	Gross output	Value added	Value-added (%)	Export (%)	Import (%)
Food agriculture	14,167	5,611	7,795	1,585	758	0.9	1.5	55.0	11.2	5.3
Plantation crops	28,769	8,458	18,177	5,196	2,108	1.8	3.6	63.2	18.1	7.3
Forestry	9,227	1,299	6,251	2,401	825	0.6	1.2	67.7	26.0	8.9
Fisheries	7,838	3,005	3,934	583	844	0.5	0.8	50.2	7.4	10.8
Crude oil & gas	90,651	14,866	71,472	46,543	4,241	5.7	14.0	78.8	51.3	4.7
Mining & quarry	4,759	2,580	1,752	1,540	410	0.3	0.3	36.8	32.4	8.6
Food products	32,803	18,015	6,145	8,332	8,566	2.0	1.2	18.7	25.4	26.1
Oils & fats	54,037	44,070	6,462	22,165	3,273	3.4	1.3	12.0	41.0	6.1
Beverages & tobacco	8,748	4,517	1,993	2,932	2,062	0.5	0.4	22.8	33.5	23.6
Textiles	8,845	4,771	1,735	3,708	2,305	0.6	0.3	19.6	41.9	26.1
Apparels	6,615	2,614	2,545	4,063	1,428	0.4	0.5	38.5	61.4	21.6
Wood products	16,120	9,510	4,699	9,715	1,867	1.0	0.9	29.2	60.3	11.6
Paper & furniture	25,203	13,322	7,148	10,477	4,592	1.6	1.4	28.4	41.6	18.2
Printing & publishing	6,878	3,028	2,418	999	1,413	0.4	0.5	35.2	14.5	20.5
Chemicals	71,548	34,531	19,283	36,771	17,178	4.5	3.8	27.0	51.4	24.0
Petroleum	84,815	58,398	4,753	20,583	20,745	5.3	0.9	5.6	24.3	24.5
Rubber	21,325	14,192	3,971	6,330	2,936	1.3	0.8	18.6	29.7	13.8
Plastic	21,602	9,356	5,392	6,849	6,753	1.3	1.1	25.0	31.7	31.3
Non-metallic min. pdts	17,673	9,417	4,615	4,451	3,535	1.1	0.9	26.1	25.2	20.0
Basic metal	34,855	17,354	6,135	14,428	11,271	2.2	1.2	17.6	41.4	32.3
Fabricated metal	32,412	16,669	5,018	7,672	10,599	2.0	1.0	15.5	23.7	32.7
Machinery	19,046	7,986	4,648	10,198	6,358	1.2	0.9	24.4	53.5	33.4
E&E	360,540	143,547	51,567	246,883	165,121	22.5	10.1	14.3	68.5	45.8
Transport	51,643	25,757	4,700	11,846	14,991	3.2	0.9	9.1	22.9	29.0
Other manufactures	5,181	1,822	2,156	2,439	1,192	0.3	0.4	41.6	47.1	23.0

Electricity, gas & water	35,149	18,183	13,865	2,243	2,940	2.2	2.7	39.4	6.4	8.4
Construction	61,070	29,594	15,810	55	15,311	3.8	3.1	25.9	0.1	25.1
W&R trade, hot & rest.	105,103	36,103	63,964	13,408	4,863	6.6	12.6	60.9	12.8	4.6
Transport	119,451	69,561	40,585	23,776	9,005	7.4	8.0	34.0	19.9	7.5
Finance, ins. & real est.	140,522	55,185	75,898	30,332	9,276	8.8	14.9	54.0	21.6	6.6
Education & health	35,007	12,951	18,655	72	3,393	2.2	3.7	53.3	0.2	9.7
Public administration	44,319	21,840	16,642	5,108	5,816	2.8	3.3	37.5	11.5	13.1
Other services	11,491	5,349	5,375	2,151	277	0.7	1.1	46.8	18.7	2.4
Gross in/output	1,603,907	729,584	509,272	576,542	352,891	100.0	100.0	31.8	35.9	22.0

Source: Computed from 2005 Input-output Table of Malaysia, DOSM. To estimate the magnitude of domestic final demand needed to absorb a 10% drop in exports, the Leontief inverse matrix  $(I - A)^{-1}$  is applied to the respective final demand aggregates to derive the gross output.

The computation results showed that a 10% decline in exports will result in a loss of export earnings amounting to RM57.7 billion and a reduction in gross output of RM104.8 billion. To offset this volume of gross output, domestic demand will have to be raised by an estimated 19%.

#### Impact of Changing Demand on Industries

Although domestic final demand can be raised at the aggregate level, the sectoral impact will vary according to the composition of export and domestic demand. The differences for

the 34 industry groupings are shown in Figure 11 assuming that the respective demand structure remains unchanged for export and domestic demand.

While the aggregate effects of an export decline could be offset to some extent by raising domestic demand, the above analysis indicates that industries with high exposure to foreign markets, particularly the electrical and electronics industry, will remain vulnerable (the difference for each industry group is indicated by the shaded region).

**Figure 11: Sectoral impact of offsetting export demand with domestic demand**



Note: YD = Gross output of domestic demand; YX = gross output of export demand

### Productivity Shifts That May Arise From DDDG

An assessment on whether the shift to DDDG detected in the 2000s is accompanied by a decline in productivity will provide some indication of the possible affliction by Baumol's disease.

From the growth decomposition results shown in Table 4 (page 11), it is seen that the country's total factor productivity (TFP) growth had slowed from 2% per annum in the 1991-00 period to 1.6% in the 2001-12 period, suggesting a slight decline in productivity associated with the period during which domestic demand was the main growth driver.

A closer look at labour productivity at the sectoral level may shed further light on the productivity trends according to their ELG or DDDG orientation. The value added for the major economic sectors in constant 2005 prices is divided by total employed to obtain value added per employee. The yearly changes in the value added per employee or labour productivity are shown in Table 7.

Similar to findings for other countries, the sectors recording negative or low labour productivity growth include construction, utilities, mining and quarrying, finance, government and other services. Consistent with findings in other countries, manufacturing recorded the highest labour productivity growth averaging 5.2% for the 2002-12 period but its flat growth during the post-GFC period (2010-12) is a concern.

For the overall economy, the moderately strong labour productivity increases averaging 3.8% per annum during the 2002-07 period and the weaker 0.8% rise for 2010-12 is consistent with the TFP results for the two periods.

The above findings suggest that Baumol's disease may not be evident at the economy-wide level but it manifests at the sectoral level where it afflicts the largely domestic-oriented service industries. It is evident therefore that a DDDG strategy will need to consider measures to boost productivity in the largely domestic-based services sector.

**Table 7: Labour productivity growth by major production sectors**

Period	Agriculture, forestry & fishing	Mining & quarrying	Manufacturing	Construction	Services							All
					Total	Electricity, gas & water	Transport, storage & communication	Wholesale & retail trade, hotels & restaurants	Finance, insurance, real estate & business services	Government services	Other services	
2002	2.2	1.4	9.9	-6.2	1.4	20.4	-2.0	0.7	-1.4	5.4	-1.6	3.3
2003	7.3	-1.1	6.0	-2.2	-0.5	-8.2	7.6	-3.7	6.4	7.1	-6.9	2.3
2004	1.5	-11.5	15.4	4.9	2.2	6.1	-2.2	5.4	-5.3	3.1	3.0	5.6
2005	1.4	-4.2	7.0	-2.9	6.0	8.2	3.8	9.3	6.0	1.0	3.2	4.6
2006	3.5	-15.0	2.6	-1.0	5.4	-21.5	7.5	7.2	1.7	20.6	2.1	3.2
2007	-2.2	8.8	8.6	6.9	4.5	29.8	8.5	11.7	-0.3	-1.9	-0.5	3.6
2008	8.8	-29.5	2.5	-3.5	6.2	3.9	-1.4	8.0	10.9	2.6	4.2	3.6
2009	1.2	-18.7	-2.0	4.3	-2.9	6.2	-0.1	-1.8	-1.2	-4.6	-5.0	-3.7
2010	2.1	12.9	7.6	5.7	-0.2	-45.3	-7.7	8.6	-1.5	-21.9	5.8	1.9
2011	7.7	-29.1	-5.1	-9.7	-3.5	-3.4	-4.2	-3.3	-9.3	3.7	-3.6	-4.2
2012	-8.6	-7.5	-2.4	19.8	8.4	-11.2	-1.1	-0.7	71.8*	-12.0	23.3	4.4
Average	3.3	-8.6	5.2	-0.4	1.9	-0.4	1.0	4.2	0.6	1.5	0.1	2.0
Pre-GFC (2002-07)	2.3	-3.6	8.3	-0.1	3.2	5.8	3.9	5.1	1.2	5.9	-0.1	3.8
Post-GFC (2010-12)	0.4	-7.8	0.0	7.1	1.6	-19.8	-4.2	1.5	20.5	-10.0	8.6	0.8

Note: \* Employment was reported at 700,000 in 2012 compared to 111,700 in 2011 and 955,000 in 2010, resulting a sharp spike in value-added per employee in 2012.

Source: Computed from employment and value added data in constant 2005 prices published by DOSM.

## DDDG Thrusts and Statistical Needs

Fast-growing economies are characterised by their ability to diversify trade, move labour from low to high productivity sectors and generate new dynamic activities characterised by higher productivity and increasing returns to scale. To be successful in sustaining growth, a DDDG strategy cannot deviate from these core principles. These together with the analyses conducted in the preceding section have helped to highlight several key findings and tentative conclusions on how a DDDG could be used to meet Malaysia's high income aspirations as well as point to further research and statistical needs.

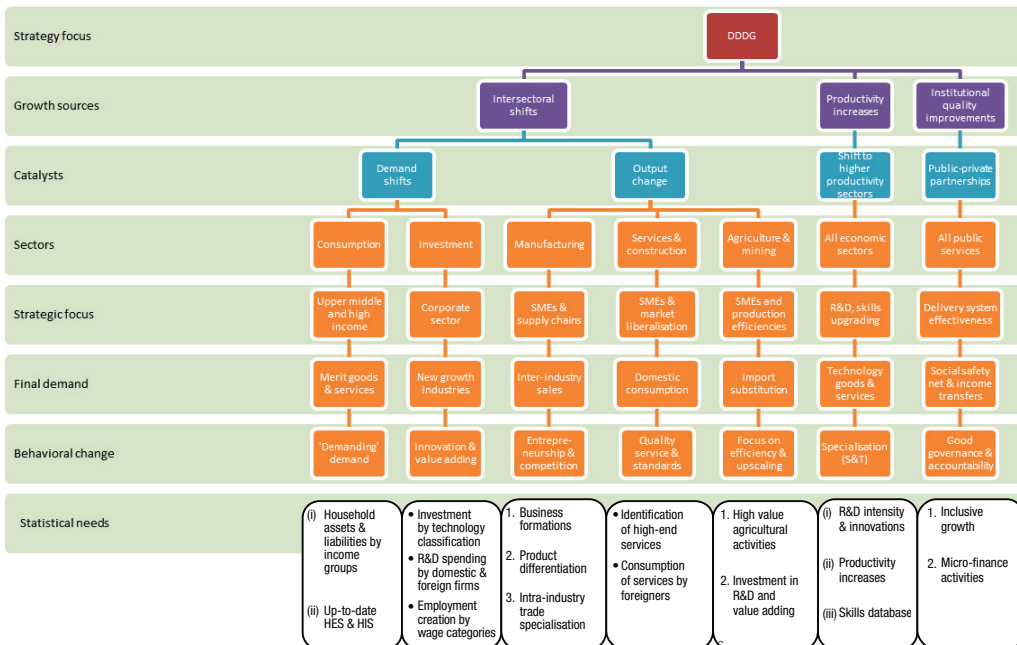
Having reaped the benefits of ELG over the last four decades and reached upper middle income status, the shift to DDDG appears to be a natural progression in the stage of economic development in Malaysia. For DDDG to be effective, policy makers not only have to focus on the proximate and wider sources of

growth, but also to cultivate the deep sources of growth which focus on the quality of institutions including government effectiveness, good governance, accountability, social capital, etc. (Temple, 1999).

A schematic diagram illustrating the framework for sustaining DDDG and the accompanying statistical needs is depicted in Figure 12. It highlights the suggested strategic focus, catalysts and behavioral change for the key components and sectors considered to be important to maximise economic growth in Malaysia. The main statistical requirements are shown in the bottom-most level. The list is not meant to be exhaustive but it is intended to highlight the areas where more disaggregated as well as detailed statistics are required for more detailed analyses to be carried out.

A brief review of the key DDDG dimensions and associated statistical needs are presented below.

**Figure 12: DDDG framework and statistical needs**





## Growth Sources and Catalysts

### Inter-Sectoral DDDG Thrusts and Statistical Needs

Although the principal statistics are sufficient to perform country-level analyses on growth sources, consistent and longer series principal industry statistics are needed at a more disaggregated level to better understand the inter-sectoral shifts in output and demand, especially in tracking the movement of industries up the value chain. At the industry level, preferably at 2 and 3-digit MSIC, the availability of reliable price deflators is crucial to perform real sector analyses.

The availability of nominal and constant price industry statistics, particularly gross output and value added data will enable such deflators to be derived for use in various growth and structural change analyses. These analyses can be further extended to include technology classification and R&D intensity. Data on these two characteristics are crucial to better aid policy analyses and understanding on the extent to which the domestic-oriented and export-oriented industries are advancing technologically as well as developing their own innovation capabilities.

Although technology classification systems (for example, low, medium and high technology) can be adopted from those that have developed elsewhere (eg. OECD), it may be appropriate to conduct a validation study before applying it locally to track the technology profile of Malaysian industries and the extent to which they upgrade and innovate in-house or through technology acquisitions. Likewise, given the importance of R&D, its inclusion in various industrial surveys will greatly enhance the formulation and implementation of policy initiatives targeted at raising the level of R&D in the private sector. Any boost to R&D spending will contribute to domestic demand-led expansion as well as the creation of high skills and high wage employment.

### Productivity-Led DDDG Thrusts and Statistical Needs

Given that productivity increases is the key to competitiveness and sustainable high growth, the shifts to sectors that have higher

productivity (particularly manufacturing), and investment in technology, innovations, R&D and skills upgrading that leads to higher productivity increases across all sectors are essential for DDDG to avoid the cost and price increases associated with Baumol's diseases.

Productivity analyses are often fraught with challenges especially with regards to reliable labour and capital investment statistics. The recent addition of capital stock statistics by the DOSM has filled a gaping hole in analysing the country's macro-level productivity performance. Further statistical needs relate to the availability of disaggregated or sub-components such as labour categories by skill levels and types of capital investment (equipment and machineries, R&D, technology, etc) as these will enable more refined and useful analysis of productivity performance and understanding of its determinants at the industry level.

In line with the institutional view of "deep" sources of growth, developing high quality institutions, enhancing government effectiveness, and focusing on social safety net and well-targeted income transfers will help to boost DDDG. The behavioral change that inculcates good governance and accountability in both the public sector and private sector is critical for DDDG to avoid the critique that import substitution and other domestic-oriented development strategies will likely fail because of institutional failures and poor governance.

### Sector Thrusts, Strategic Focus and Final Demand

#### Consumption-led DDDG thrust and statistical needs

A DDDG strategy to address the "under-consumption" phenomenon has to be holistic as well as consider inter-generation transfer issues. The suggested DDDG focus on upper middle and high income groups, given their higher contribution to excess savings, is to encourage spending on goods and services that have large multiplier effects and on merit goods that have positive externalities such as enhancing consumers' well-being in terms of health or skills upgrading. The availability of data and statistics

that enable “merit” goods and services to be identified and their multiplier effects or “positive externalities” to be quantified are highly pertinent to the design and implementation of DDDG strategies.

For the low income groups, the use of direct income transfers, targeted subsidies and programmes that expand their income will help to augment aggregate consumption. Increasing the efficiency and effectiveness of government spending will also boost the multiplier effects on the economy.

Ensuring prudent financing of consumption is also important as over leveraging can also lead to “boom” and “bust” cycles in consumer demand. Sophistication of demand or “demanding” demand is the required behavioral change as it is one of the national competitive advantages in that it creates the pressure for industries to innovate, upgrade and meet exacting demand standards.

Besides up-to-date Household Expenditure Surveys (HES) and Household Income Survey (HIS), a DDDG strategic focus on raising consumption is the availability of data on household assets and liabilities by income groups. In some countries, surveys that began as industry-led initiatives to provide detailed household finance data for more focused marketing by financial institutions eventually became regular sectoral surveys mounted to provide useful information on the status of household finances in the country.

#### Investment-Led DDDG Thrust and Statistical Needs

The focus on corporate investment, as highlighted under the Economic Transformation Programme (ETP), is an obvious core DDDG driver given the country’s under-investment phenomenon. Investment in capacity expansion, technological upgrading, R&D, product innovation and new businesses is the key to sustaining the country’s long term growth. In relation to investment data needs, a more detailed breakdown of the types of capital investment and industries by technology classification will be helpful to ascertain the ability of the industries to move up the value chain.

A diversified and broad-based economy is more resilient to external shocks. It also provides more income-generating opportunities as well as enables an optimal utilisation of resources to drive DDDG. Consequently, statistics on business formations, new industries and product diversification are useful to understand the dynamics of existing and new industries as well as changes in competition dynamics.

Statistics that capture the direct and indirect investment activities of small and medium enterprises (SMEs), supply chains, market liberalisation, production efficiencies and competitive markets are also needed to determine the extent to which DDDG can be sustained through enhancements in economic efficiency, inclusivity, innovativeness, entrepreneurship and delivery of high quality services and standards.

#### Conclusion and the Way Forward For DDDG

In examining Malaysia’s relatively successful ELG strategy since its adoption in the early 1970s, it is instructive to relate to the prevailing global economic environment and optimise the country’s sources of growth, irrespective of the external or domestic demand orientation. The focus of the analyses on the viability and challenges of the DDDG for Malaysia therefore is not so much as to whether it can substitute ELG but rather how DDDG can be applied judiciously to complement the export sector.

A DDDG approach is feasible and sustainable for Malaysia but its limitations have to be recognised. The key findings are as follows:

- DDDG has helped to offset the weak export demand prevailing during the last decade, and importantly, during the post-GFC period;
- Although DDDG continues to predominate in the Malaysian economy today, the sizeable export capacity in a large number of industries precludes its ability to offset fully any sizeable external demand reduction. Thus, DDDG can only contribute to a partial decoupling from external demand;

- Given the different structure between domestic and export demand, there will be sectoral differences in the impact on industrial capacity, employment and income arising from the ELG-DDDG shifts;
- Malaysia's "apparent" under-consumption and low private investment levels, in concert with a sizeable savings-investment gap, suggest that a DDDG is both feasible and desirable. Importantly, a sustainable DDDG will need to aim at maximising economic efficiency and utilisation of resources, skills, human capital, and physical and social infrastructures;
- Despite Malaysia's under-consumption and under-investment, a DDDG strategy is also subject to the fallacy of composition; in this case, what is true at the aggregate level is not necessary true for some components. As noted, spending limitations are already evident in the government and the household sector, both being constrained by high debt levels; and
- On the consumption side of DDDG, a higher level of spending by the middle and upper income groups will need to be elicited, while the income of the low income groups will need to be boosted. The focus of the ongoing ETP on private investment, regardless of domestic or foreign sources, will be the main driver of DDDG, given the excess savings in the private sector and the capacity and productivity growth associated with gross fixed capital formation.

Although international trade has slumped since the onset of the global financial crisis in 2008/09, it is not expected to remain in a prolonged state of doldrums as the crisis-hit advanced economies gradually rebuild household and corporate balance sheets and public finances. In spite of the intensifying global economic integration as countries continue to pursue market reforms, liberalise foreign trade and investment policies and forge trade pacts bilaterally and regionally, a DDDG strategy is needed for export-oriented countries such as Malaysia to optimise the sources of growth as well as to damp fluctuations of output that is increasingly vulnerable to global demand instability.

It is reiterated that DDDG should not be viewed as a substitute for ELG strategies. Rather, by harnessing the complementarities of the two paradigms, Malaysia can capture the growth opportunities arising from an upswing in external demand, while mitigating the adverse effects on output and employment due to volatile export markets by strengthening the resilience of domestic demand.

Applying a holistic DDDG framework, the key strategy components and statistical needs can be grouped broadly into four thrusts:

- *Inter-sectoral DDDG thrusts and statistical needs:* Inter-sectoral shifts in output and demand arising from DDDG need to be closely monitored through the provision of nominal and constant price output and value added data at a disaggregated industry level (preferably 2 or 3 digit MSIC) so that structural change, productivity shifts and industry competitiveness can be analysed. Information on technology classification and R&D intensity are also important to monitor the desired shift up the value chain and technology ladder;
- *Productivity-led DDDG thrusts and statistical needs:* Productivity growth is the key to sustaining competitiveness and growth. Further statistical needs relate to the availability of disaggregated or sub-components such as labour categories by skill levels and types of capital investment (equipment and machineries, R&D, technology, etc) as these will enable more refined and useful analysis of productivity performance and understanding of its determinants at the industry level;
- *Consumption-led DDDG thrusts and statistical needs:* Given the constraints posed by rising indebtedness, a DDDG focus on raising consumption will require the availability of data on household assets and liabilities by income groups. The suggested DDDG focus on upper middle and high income groups, given their higher savings and ability to withstand rising inflation, is to encourage spending on goods and services that have large multiplier effects as well as on "merit" goods that have positive externalities such as enhancing

consumers' well-being in terms of health or skills upgrading. The availability of data and statistics that enable "merit" goods and services to be identified and their multiplier effects or "positive externalities" to be quantified are highly pertinent to the design and implementation of DDDG strategies;

- *Investment-led DDDG thrusts and statistical needs*: Given that under-investment continues to prevail in the private sector, it is appropriate for DDDG to focus on promoting capacity expansion, technological

upgrading, R&D, product innovation and investment in new businesses. A more detailed breakdown of the types of capital investment and industries by technology classification will be helpful to ascertain the ability of the industries to move up the value chain. Additionally, statistics on business formations, establishment of new industries and new product diversification are useful to understand the dynamics of existing and new industries as well as changes in their competition dynamics.

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# CORE INFLATION: THE MALAYSIAN CASE

Mohd Helmi Ramlee<sup>1</sup> and Muhamad Shukri Abdul Rani

## Abstract

Price stability is one of the primary goals of central banks. In assessing price stability, some central banks monitor core inflation rather than headline inflation, as it provides a signal about persistent movements in inflation, which is important for the conduct of monetary policy.

The objective of this paper is three fold. First, is to highlight the importance of core inflation for the conduct of monetary policy. Second, is to derive estimates of core inflation for Malaysia. Finally, it seeks to evaluate the performance of each measure of core inflation in forecasting headline inflation. We consider a number of measures for core inflation, and note their merits and demerits. Of significance is that each measure performs differently when used to forecast headline inflation. This alludes to the possibility that some measures of core inflation could act as good predictors of future inflation, while others are best at describing current developments.

## Introduction

Active research on core inflation has been on-going for some time and its importance in the study of inflation dynamics and discussions on monetary policy is well established. Wayne (2008) reported that the term first appeared in an article written by Schreder (1952) who used it in a discussion on the inflationary gap that the United States was undergoing in the early 1950s. During the period of high inflation and stagnant global growth of the 1970s, both Sprinkle (1975) and Tobin (1981) used the term core inflation in their discussions on the short-term outlook of the American economy and of sacrifices ratios respectively. Blinder (1997), meanwhile, provided a brief but important insight into how core inflation was measured and how it was used in policy discussions at the Federal Reserves.<sup>2</sup> Among other things, he said:

*“...policymakers had to answer a key question: given the month-to-month inflation, how does one distinguish the signal from the noise. Or in other words, what part of the each monthly observation on inflation is durable and what part is fleeting?”*

Today, that question remains valid and of even greater importance, in light of the recent spike in prices for global commodities that led to historically high levels of headline inflation in both advanced and emerging economies. In the case of Malaysia, pertinent questions remain unanswered about core inflation, such as why should monetary policy focus on it and what measures could best represent it. To a certain extent, these questions were addressed by Bank Negara Malaysia in its Annual Report 2000 (Bank Negara Malaysia, 2000, p. 82-84).

Although the task is formidable, this working paper attempts to shed some light on the above key questions. Our research questions are as follow:

- Why should monetary policy focus on core inflation?
- Which measure of core inflation is best suited for accounting and forecasting headline inflation?
- What policy lessons could be learned?

There are, nonetheless, limitations to our work. First, we do not intend to promote any particular measure of core inflation. Rather, we would encourage the usage of a multitude of approaches to support policy analysis at the Bank. Second, we recognise that the ultimate aim of monetary policy is to ensure price stability and maximum attainable growth. Hence, there will be conflicts and concordances between the two axioms that we shall not cover.

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<sup>2</sup> He served as Vice Chairman from June 1994–January 1996.

This paper is organised as follows. In the next section, we survey the literature on the link between total and core inflation, its concepts, properties and importance to monetary policy. In section 3, we describe Malaysia's historical inflationary trends, followed by a short section on the consumer price index (CPI) data for Malaysia that will be used for measuring core inflation. The descriptions of the various measurements of core inflation and evaluations of their performance are presented in section 4 followed by a discussion in section 5. As our readers will later see, these measures of core inflation perform differently when evaluated. This alludes to the possibility that some measures of core inflation could act as good predictors of future inflation, while others are best at describing and accounting current inflation. The final section concludes this paper.

#### The Connection between Headline Inflation and Core Inflation

Most central banks are concerned and are tasked with achieving price stability. Price variability does carry some economic costs that both the Government and society would like to avoid. They could come in the form of eroded consumer purchasing power, lower tax revenues, or lower real benefits and wages for workers. Hence, this requires for continued surveillance of vital price statistics in order to be on guard against significant and volatile movements in prices.

Given such costs and concerns, monetary policy would need to focus on factors that drive overall inflation away from its long-run trend. This would require a connection between overall inflation and core inflation to be established. Formally, Rogers (1998) describe a short-run aggregate supply curve, based on Quah and Vahey (1995)<sup>3</sup> definition of core inflation, in the following manner:

$$\pi_t = \pi_t^{LR} + g(x_{t-1}) + v_t$$

where,  $\pi_t$  is aggregate inflation at time  $t$ ,  $\pi_t^{LR}$  is the long-run or trend inflation (which may be time varying),  $g(x_{t-1})$  stands for a measure cyclical excess demand pressure and  $v_t$  is a measure of transient disturbances to inflation. Institively, core inflation can be defined as  $\pi_c = \pi_t^{LR} + g(x_{t-1})$ , which corresponds to the long-run component and any cyclical movements. It excludes temporary disturbances to inflation. This definition is consistent with the long-term view of a vertical Philips curve, where monetary policy affects only the general price level and not real macroeconomic variables. It brings to our attention that monetary policy should not react to short-term deviations in prices brought by temporary supply disturbances such as an oil price shock. However, one should recognise the potential threat of a "second round effect" in motion as labour demand higher nominal wages to compensate for their dwindling purchasing power. Under such circumstances, the risk of inflation expectations being un-anchored is real and warrants firm monetary policy actions. This undertaking, to a certain degree, requires one to have a good appreciation of the underlying inflation and a solid prognosis of future headline inflation.

Thus, the main motivation to focus on core inflation is because there is a significant amount of transitory noise in the monthly consumer price data. Removing these noises would allow the central bank to have a better sense of the underlying price movements (Rich and Steindel, 2007). Moreover, several studies have shown that over the long-term, overall inflation tend to revert more strongly to core inflation rather than the other way around (Mishkin, 2007).<sup>4</sup> This suggests by focusing on core inflation, monetary policy could work to achieve its price stability objective. The following section takes us deeper into the discussion on core inflation.

<sup>3</sup> Quah and Vahey (1995) define core inflation as "...as that component of measured inflation that has no medium to long-term impact on real output". In this context, inflation is output neutral given a vertical long-run Philips curve. This definition also excludes the permanent impact on price level stemming from supply shocks.

<sup>4</sup> Mishkin (2007) cited different studies on the US to support the reversion of headline inflation to core inflation over the long-run. However, results for other countries are more ambiguous.

## Core Inflation: Concepts and Properties

### Concepts of Core Inflation

Under the first concept, core inflation should be a good indicator of the underlying inflation trend, or technically as the persistent component of the measured inflation (Blinder, 1997; and Roger, 1998). This means it should be able to provide policymakers as much information about the underlying inflationary trend from the monthly CPI data. In general, the monthly CPI data could be confusing, especially when prices of some items in the CPI basket move in opposite directions. Moreover, prices of certain goods in the CPI basket are volatile by nature such as fresh vegetables and fresh seafood, while some are much more stable, especially for goods whose prices are controlled by the Government. Hence, policymakers may need to decipher the monthly CPI data in order to look for the persistent element of headline inflation that represents the process of continuously rising general prices and tends to incorporate future price directions and expectations. The success of identifying this element would be useful for policy deliberations, as it allows for near-term and long-term forecast of headline inflation. As Bernanke et al. (1999) noted:

*"The core CPI is likely to provide a better guide to monetary policy than other indices, since it measures the more persistent underlying inflation rather than transitory influences on the price level."*

A second concept defines core inflation as the widespread or generalised aspect of inflation (Bryan and Cecchetti, 1993) that is able to describe what is happening to general prices in the current period, while ignoring temporary intermittent changes in prices. According to Clark (2001), at any given point of time, prices of some items will rise above a certain trend-rate, while others will increase at a pace below it. Hence, core inflation should be able to isolate the common component in these price changes that corresponds to the underlying trend in prices.

## Properties of Core Inflation

Both Roger (1998) and Silver (2006) discuss at length on several desirable properties of core inflation as a useful indicator for monetary policy. First, it must be able to disentangle the persistent component of inflation from the transient movements, permitting for a better signal extraction process. This would prove useful in the conduct of monetary analysis and forecasting of future inflation.

Second, it must be credible. Having an independent body to compute and release measures of core inflation, instead of the central bank, would contribute towards enhancing public confidence and avoid controversies. Moreover, such public confidence would help to strengthen the central bank's credibility, especially if these measurements have some policy bearing.

The third quality is that it must be timely. Delayed information could compromise policy deliberations and hamper effective communication and monetary operations. In addition, such timeliness also promotes accountability on the part of the central bank, as it allows the monetary authority to explain deviations of headline inflation from its target to the public. Bernanke et al. (1999) note:

*"...use of a core CPI measure also helps the central bank to communicate to the public that not every shock that raises prices will lead to a permanent increase in the inflation, and that short-term changes in inflation resulting from supply shocks will be treated differently from changes driven by aggregate demand."*

Finally, these measures must be forward looking, especially when monetary policy works with a lag. Such delayed response will have significant repercussion on future levels of output and inflation. Without some bearing on the future, policy mistakes can be very costly and difficult to unwind.



### Why Should Monetary Policy Focus on Core Inflation?

There are several answers to the above question. At the very top is the recognition that monetary policy works with a considerable and variable lag, and is unable to respond to short-term supply shocks or control temporary price deviations. As a result, headline inflation could be polluted by temporary price changes (noises) and may not reflect the underlying inflation that monetary policy aims to contain. More importantly, given the time lag, monetary authorities would be much more interested in the outlook for inflation over some future horizon (Mankikar and Paisley, 2004). Removing these transient noises from the headline inflation allows one to have a better grasp of the underlying inflation and permits one to compare it to an explicit or implicit long-run target for price stability (Rich and Steindel, 2007).

Another important fact is that relative to the overall inflation, changes in core inflation are very unlikely to reverse within a short time frame. This suggests that over time headline inflation would revert to core inflation. One could see this from the preceding aggregate supply equation proposed by Roger (1998) where short-term deviations would cause headline inflation to move away from core inflation. Over time, once these shocks dissipate, headline inflation would converge to core inflation. Various studies have been conducted to test whether the divergence between the headline inflation and core inflation is temporary or otherwise, and the results have been mixed. For instance, Rich and Steindel (2007) find significant reversion of headline CPI inflation to core CPI inflation over 12 quarters from 1978 to 2004. Their earlier work in 2005 using PCE<sup>5</sup> price inflation for the 1978-2004 and 1959-2004 periods also yield similar results. Armour (2006) studies the CPI inflation and core inflation for Canada and concludes core inflation measurements do provide unbiased forecast for future headline inflation and are useful indicators although forecast results are not entirely robust.

Mankikar and Paisley (2004) conducted tests to check for convergence in the UK CPI inflation and core inflation series using a standard method proposed by Marques et al. (2000). They find that only three (out of 13) of the measures of core inflation pass all the necessary tests. Finally, papers by OECD (2005) finds headline inflation tends to revert to core inflation in the United States, Canada and Japan but not in the Euro Area and the results were somewhat ambiguous for the UK.

Core inflation could also act as a useful short-term operational guide for the conduct of monetary policy to achieve price stability (Armour and Lafèche, 2006; Hogan et al., 2001; Rich and Steindel, 2005). The resulting core inflation could be regarded as a measure of inflation that is the outcome of monetary policy. Hence, some measures of core inflation could be considered to be more controllable by the central bank. If the use of inflation targets implies the central bank is willing to assume responsibility for inflation ex-post, it makes sense to define the target as a measure of inflation for which it has the most ex-ante control.

Focusing on core inflation may also help to limit potential policy mistakes (Armour and Lafèche, 2006; and Mishkin, 2007). Suppose in the past, monetary policy was tightened following higher headline inflation due to some adjustments in fuel prices. With some degree of certainty, headline inflation would trend downwards once the effect of the price adjustments wear off after a year. However, the same cannot be said of the effects from a tighter monetary policy stance. Given the time lag, higher interest rates would affect both consumption and investment decisions by households and firms. This could result in a lower overall output and increase unemployment in the short run, while raising inflation levels in the medium term. As the economy reacts to correct these imbalances, such swings could lead to more price and output volatility and run contrary to the central bank objectives of price stability and maximum attainable growth.

<sup>5</sup> Personal consumption expenditures (PCE) price index is compiled by the Bureau of Economic Analysis, USA.

Finally, core inflation could be a good measure of inflation for policy formulation and Wayne (2008) gives a good account of this. For example, some central banks, especially those that have adopted the inflation targeting<sup>6</sup> framework, do adopt some measurements of core inflation in their policy deliberations and communication with the public. The Bank of Canada, for example, adopted inflation targeting in 1991. An agreement signed in 2006 between the Government of Canada and the Bank of Canada, reaffirms the inflation target at 2 percent, with a “target range” of 1 to 3 percent. The central bank noted:

*“...measures of core inflation, along with indicators of capacity pressures, have been shown to be useful indicators of underlying infatuation and, hence, or where total CPI inflation could be in the future. For this reason, core inflation provides a useful guide for the conduct of monetary policy”.*

Another example is the Reserve Bank of Australia, which regularly publishes a number of measures of core inflation in its quarterly Statement on Monetary Policy. In its Statement on the Conduct of Monetary Policy released in December 2007, the central bank highlighted that in its pursuit of medium-term price stability<sup>7</sup>, some recognition must be given for the natural short-run variation in inflation over the cycle. And finally, the Sveriges Riksbank (the Bank of Sweden), which adopted inflation targeting in 1993, routinely publishes measures of core inflation in its Monetary Policy Report. The CPIX, for instance, is defined as the CPI inflation

excluding household mortgage interest expenditure, and direct effects of changes in indirect taxes and subsidies.

In the final analysis, core inflation has an important role in the deliberation and conduct of monetary policy. Besides being a forward indicator of headline inflation, core inflation could assist policy makers in communicating their monetary stance to the public. It could also provide the necessary check and balance to the macroeconomic analysis undertaken by the central bank, while safeguarding it from potential damages arising from costly policy mistakes.

### Inflation in Malaysia

For most periods, inflation has remained low and relatively stable with an average of 2.9% over the past 56 years (1956-2012).<sup>8</sup> There are, however, bouts of high and low inflationary periods, as highlighted in the following table. The first episode of high inflation took place in the 1972-74 period following the first global oil price shock.<sup>9</sup> This reflects the impact from rapid world inflation, sharp increases in import prices, rapid growth of domestic aggregate demand and supply constraints (Bank Negara Malaysia, 1979). Annual headline inflation rose to a record level of 17.3% in 1974 (1973: 10.5%, 1972: 3.2%). In the aftermath of the first oil price shock, the global economy grew at a modest pace of 2.8% in 1974 (1973: 6.9%, 1972: 5.5%), while the impact on the Malaysian economy was felt a year later when it slowed to a mere 0.8% (1974: 8.3%, 1973: 11.7%).

<sup>6</sup> Inflation targeting is a framework for monetary policy characterised by the public announcement of official quantitative targets (or target ranges) for the inflation rate over one or more time horizons, and by explicit acknowledgement that low, stable inflation is monetary policy's primary long-run goal. Among other important features of inflation targeting are vigorous efforts to communicate with the public about the plans and objectives of the monetary authorities, and, in many cases, mechanisms that strengthen the central bank's accountability for attaining those objectives (Bernanke et. al. 1999, pg: 4).

<sup>7</sup> Medium price stability is defined as keeping consumer price inflation between 2 and 3 percent, on average, over the cycle.

<sup>8</sup> Prior to February 1987, headline inflation in Malaysia is proxy by the CPI for Peninsular Malaysia (Ministry of Finance, 1985, p. 125).

<sup>9</sup> The first global oil shock saw price for WTI crude oil rose from an average of USD3.27 per barrel in 1973 to USD11.50 per barrel or at a shocking annual growth of 252%.

**Table 1: Consumer Prices<sup>1</sup>**

Year	Average annual growth rate (%)					
	1956-65	1966-75	1976-85	1986-95	1996-05	2006-12
1	0.8	1.0	2.6	0.7	3.5	3.6
2	4.5	4.6	4.8	0.3	2.7	2.0
3	-1.4	-0.1	4.9	2.6	5.3	5.4
4	-2.0	-0.4	3.7	2.8	2.7	0.6
5	0.0	1.9	6.7	2.6	1.5	1.7
6	-0.2	1.6	9.7	4.4	1.4	3.2
7	0.1	3.2	5.8	4.8	1.8	1.6
8	3.1	10.5	3.7	3.5	1.0	
9	-0.4	17.3	3.9	3.7	1.5	
10	-0.1	4.5	0.4	3.5	3.0	
Average	0.4	4.4	4.6	2.9	2.4	2.6

<sup>1</sup> Data up to 1986 refers to Peninsular Malaysia only  
Source: Department of Statistics, Malaysia

In 1979, the world economy suffered its second energy crisis in the wake of the Iranian Revolution which resulted in lower crude oil production in the affected oil producing countries.<sup>10</sup> Prices for global crude oil rose sharply by an annual rate of 133% from USD12.78 per barrel to USD29.83 per barrel.<sup>11</sup> As a result of the supply shock, world inflation rose sharply from 9.9% in 1978 to 12.5% and 16.9% in 1979 and 1980 respectively.<sup>12</sup> As Malaysia is a highly open economy, domestic prices were also affected by these external developments. In anticipation of the higher inflation in the latter part of 1979 and the following years, the Government reactivated the Standing Committee of Officials on Anti-Inflation in April 1979 to review the price situation and recommended measures to restrain inflation, with special emphasis given food production and agriculture productivity (Ministry of Finance, 1979, p.143). Headline inflation rose steeply from 3.7% in 1979 to 6.7% and 9.7% in 1980 and 1981 respectively. The latter reflected the compounding effect of higher domestic prices due to the oil price shocks, supply shortages of essential items and the increase in domestic fuel prices.<sup>13</sup>

Notwithstanding the preceding two episodes of high inflation, Malaysia also experienced a period of very low inflation at the height of the economic recession in 1985-86 (Bank Negara Malaysia, 1994, p.23). During that period, headline inflation rose marginally by 0.4% and 0.7% in 1985 and 1986 respectively (1984: 4.6%). To some extent, this reflected lower prices for international commodities such as crude oil and non-oil products. Furthermore, the relatively stable prices in the OECD countries resulted in lower import prices and coupled with Government led measures which limited the pass-through effect to domestic prices (Ministry of Finance, 1985, p.126).

Domestic headline inflation rebounded higher in the early 1990s following the build-up of inflationary pressures arising from five consecutive years of strong economic growth in excess of 8% in 1988-92 (Bank Negara Malaysia, 1994, p. 23). Externally, the outbreak of the Gulf War following the invasion of Kuwait by Iraq in August 1990 pushed prices of global crude oil sharply higher by an annual rate of 28.4% in 1990.<sup>14</sup> Consequently, this led to a build up in inflationary pressures in both

<sup>10</sup> Iran's daily crude oil production fell from 5.24 million barrels per day in to 3.17 and 1.66 million barrels per day in 1979 and 1980 respectively (Annual Energy Review 1995, Energy Information Administration, July 1996. p. 312).

<sup>11</sup> *Ibid.*

<sup>12</sup> *Ibid.*

<sup>13</sup> Domestic fuel prices were raised by an average of 9.1% and 9.9% in June and August 1979 respectively (Ministry of Finance, 1979. p 140).

<sup>14</sup> *Ibid.*

developed and developing countries. With some time lag, the impact from this external development, coupled with buoyant domestic demand, low unemployment and high capacity utilisation contributed to higher domestic inflation (Bank Negara Malaysia, 1999, p.18). Nevertheless, the impact of the higher global crude oil prices was not fully transmitted into domestic prices given the existence of Government's subsidy on the pump petrol prices (Ministry of Finance, 1990, p.209). Other measures, both monetary and fiscal in nature, were also taken to moderate the increase in inflation (Ministry of Finance, 1991, p.211).

Inflationary pressures began to build up towards the end of 1997, as the ringgit weakened to successive lows in light of higher volatility following the onset of the Asian financial crisis. This resulted in higher import prices and contributed towards higher inflation, which increased by 5.3% in 1998 (1997: 2.7%). The impact of the exchange rate depreciation, however, was not passed through to consumer prices as some producers, in an environment of weaker domestic demand, absorbed part of the higher cost of production to protect their market share (Bank Negara Malaysia, 1998, p.72). Furthermore, the tighter monetary stance and fiscal prudence, coupled with lower global inflation and commodity prices, also had a dampening effect on the overall price level (Ministry of Finance, 1998, p.144).

During the 2007-08 global commodity prices shock, headline inflation began to rise in the third quarter of 2007 following higher prices for global commodities such as crude oil and food products. Indeed, global prices for these major commodities have been increasing for quite a while and it was a matter of time before the effect was transmitted to local prices. Food prices, which increased steadily in 2007, were higher in 2008 following the global shortage of essential supplies of rice and wheat. Moreover, adjustments to retail fuel prices by the Government in June of 2008 also contributed to higher inflation, which rose to 8.5% in the following month. In response, the Government introduced several short and long-term measures to deal with the domestic food crisis. These include increasing the

purchase of rice from the global market and the opening up of more agricultural land. It also stepped up its surveillance and enforcement activities to weed out indiscriminate price increases by unscrupulous traders. Furthermore, a Special Cabinet Committee on Anti-Inflation was established in April 2008. It was tasked with looking into measures to ease the burden of the poor and vulnerable groups in coping with rising costs of food and energy. It was later replaced by the Economic Council in August of the same year, which acts as an advisory body to recommend measures to sustain economic growth, in light of the global economic slowdown and to identify approaches to contain inflationary pressures (Ministry of Finance, 2008, p.86).

Subsequently, inflation also increased but at a more moderate pace in 2011 at 3.2% (2010:1.7%) due to the surge in global commodity prices. Global crude oil and food prices increase by 35% and 26% respectively between January 2010 and September 2011 with a notable increase of 94% in the global price of corn due to disruption in supply and low stockpiles. There were also adjustments in price administered items in line with the introduction of subsidy rationalisation program by the Performance Management & Delivery Unit (PEMANDU) under the Prime Minister's Department. Nevertheless, as the price adjustment was gradual and paced, the knock-on effects on other goods and services were relatively contained as businesses were better able to cope with the rise in costs.

## Measurements of Core Inflation

### Statistical-based Measurements

The measurements of core inflation are divided into two classes. In the following sub-section, we will survey the statistical-based approach to computing core inflation. To accomplish this, we relied on the 4-digit consumer price index (CPI) data, which were sourced from the Department of Statistics, Malaysia. CPI data at the 3-digit level are classified into 12 main categories and can be further divided into 51 sub-categories (see Appendix 1). The data starts from January 1992 until December 2012 and are re-based to the latest base year (2010=100). Meanwhile, the annual

growth of the CPI inflation is computed from January 1993. We begin the statistical-based approach with the exclusion-based method and end it with the exponential smoothing technique. Corresponding charts comparing each measure of core inflation with headline inflation are displayed in the appendix.

#### Exclusion-based Method

The exclusion-based method of calculating core inflation is by far the most widely used technique to date and often receives the most public attention. In this case, some components of the CPI such as selected food items, price volatile items or prices of goods controlled by the Government are permanently excluded from the calculation of core inflation.<sup>15</sup> The economic rationale for excluding certain items from the calculation of core inflation is because they are most likely to be affected by supply-side disruptions, which are expected to be temporary and would wane after a certain time period. As discussed, monetary policy should instead focus on factors that affect aggregate domestic demand and not on temporary disturbances.

This method is often cited for its advantages, namely timeliness, clarity and easily understandable by the public. However, critics often argue that it lacks clear economic reasoning and involves the subjective exclusion of certain items, especially food and energy prices. The exclusion of such information could be a disadvantage given that these information could contain important signals for policymakers. For example, Bean (2006) noted that the exclusion of high energy prices, while retaining falling goods prices, from the calculation of core inflation may render it misleading. Mankikar and Paisley (2004) argue the exclusion of energy prices such as the price of retail fuels could leave out valuable information about the underlying inflation since the former could also be driven by persistent global demand conditions.

For our purpose, we have selected certain items which would be excluded from the core CPI computation. These items were excluded due to their volatile prices (such as fresh seafood and vegetables) or are susceptible to supply shocks or are controlled either directly or indirectly by the Government (rice, petrol and diesel). Specifically, price-volatile goods include items that have high degree of price volatility (high variance) that are predominantly influenced by supply shocks. For our purpose, items that are assumed to be subjected to supply shocks are excluded from the computation of core inflation. Meanwhile, price-controlled goods refer to controlled items that are under the Price Control Act, 1946 and Control of Supplies Act, 1961, are also excluded from the construction of core inflation. Finally, prices of goods that require the Government's approvals with the following characteristics are also excluded:

- Public goods such as public transport and utilities
- Items of which changes in Government tax would have a direct impact on its prices (cigarette and alcoholic beverages)

Thus, in all, 27 items from the CPI basket are excluded, accounting for 33.5% of the total CPI weight.

#### Trimmed Mean

Trimmed mean is a limited influence estimator<sup>16</sup> proposed by Bryan and Cecchetti (1993), which refers to the weighted-average inflation rate of the components of the CPI basket, excluding inflation rates at the extreme of the range – the lowest and highest end. The basis for trimming is that changes in prices at the extremes of the distribution may contain less information about current underlying inflation than those lying towards or at the centre of the distribution. Another way to look at it is based on a proposition that items that have extremely low inflation rate are presumably subject to administered or control items, while items

<sup>15</sup> In the UK, mortgage interest payments and effects of indirect taxes are excluded (Mankikar and Paisley, 2004), while in Canada eight sub-indexes plus effects of indirect taxes are removed from the calculation of core inflation (Hogan et al, 1999).

<sup>16</sup> *Limited influence estimators emphasise greater weight on the price trend or tendency of prices, and less or no weight on extreme or "outlier" price movements (MAS, 1998).*

that have extremely high inflation rates are presumably subject to supply shock. By excluding these items, the re-computed inflation rate would be more reflective of monetary inflation, which is influenced largely by changes in demand conditions. For our purpose, each month, the CPI items are re-arranged, ranking items with the lowest inflation first and items with the highest inflation last. The cumulative weight is then computed. For the computation of trimmed-mean, items in the first and the last 15% of the distribution are excluded from the original CPI basket, so that we maintain only 70% of total weight.<sup>17</sup>

#### Weighted Median

The weighted-median inflation is another member of the limited influence estimator, where the median is the 50th percentile inflation rate at which half of the components in the CPI basket have higher inflation and the other half, less. One clear advantage of this and the previous method is that both are rule-based and this eliminates any arbitrary exclusion of the CPI items (MAS, 1998). Moreover, these two techniques remove the impact of extreme or outlier price changes (both positive and negative) from the overall inflation.

#### Double Weighted

This method hinges on the notion that one should assign a lower weight to highly volatile CPI items and more weight to items that are not volatile (OECD, 2005; Khong, 2006). Effectively, instead of removing volatile items, this method minimises or mutes their effects on headline inflation. Its advantage over other statistical methods is that all the CPI items are included in the derivation of core inflation. This would address concerns over the possibility that some excluded CPI items may contain signals that are important to monetary policy.

#### Exponential Smoothing

Finally, Cogley (2002) proposes an exponentially smoothing measure of core

inflation designed to track sudden and persistent movements in inflation, such as those arising from changes in monetary policy. In brief, this technique involves the exponential smoothing of current and past aggregate price changes.

Formally:

$$\pi \approx g_o \sum_{j=0}^{\infty} (1 - g_o)^j \pi_{t-j}$$

where core inflation is defined as a one-sided geometric distributed lag<sup>18</sup> of current and past inflation ( $\pi_t$ ). According to the author, this particular technique can be applied in real time and has only one free parameter ( $g_o$ ), which could be calibrated up front. As a consequence, the filter coefficients will remain unchanged as new data are available and the historical core inflation series need not be revised. In the original paper, the author suggests a parameter setting of 0.125 for ( $g_o$ ).

#### Model-based Approach

In recent years, many researchers have developed core inflation measures based on econometrics modelling due to its unobservable nature. This improves the robustness of these measures since they are usually constructed based on sound economic theory. We could use multivariate analysis by using non-price variables to derive core inflation. But one must always remember the pertinent constraints related to this approach. Even though a model is grounded on economic theory, it is not within the grasp of the general public. One can also argue that the assumptions and restrictions imposed are rarely uncontroversial. This makes these models sensitive to their exact specifications and identification schemes. Early work on modelling core inflation has been carried out by Quah and Vahey (1995), Coimbra and Neves (1997) and Velde (2006).

<sup>17</sup> In New Zealand and Australia, the trimming rate is 5% & 15% on each side of the price distribution (RBNZ & RBA technical notes).

<sup>18</sup> An example of a geometric distributed lag is the Koyck lag.

### Quah and Vahey - SVAR Model<sup>19</sup>

Quah and Vahey SVAR model is known as the output-neutral core inflation model. It is based on the proposition that inflation is a result of perturbations<sup>20</sup> to the economy over time. These perturbations can be separated into those that do not affect real output in the long run such as nominal demand shocks and those that do. Core inflation is defined as the function of long-run trend inflation rate plus the cyclical excess demand pressure that has long-run impact on real output. Inflation as defined by these authors:

$$\pi_t = \pi^{LR} + g(X_{t-1}) + v_t$$

where core inflation is defined as:

$$\pi_t^c = [\pi_t - v_t] = \pi_t^{LR} + g(X_{t-1})$$

In their model, Quah and Vahey tried to capture the inflationary pressure that feeds into inflationary expectations (Mankikar and Paisley, 2002). This is reflected via core inflation which is a component of inflation that is attributed to nominal demand shocks and thus, is consistent with the long-term view of a vertical Phillips curve. These mean monetary policy shocks have no lasting impact on real output but will ultimately affect inflation. Hence, monetary policy should avoid responding to price changes arising from supply-side shocks (Monetary Authority of Singapore, 1998).

### Principal Component Analysis

Principal component analysis is a vector space transformation which is often used to reduce multidimensional data sets to lower dimensions for analysis purposes. These techniques have been used quite commonly in multivariate analysis. Coimbra and Neves first introduced the concept of using principal component analysis to measure core inflation in 1997. This approach was further explored by Machado et al (2001) and Maria (2004).

By using this method, core inflation is derived from information contained in the main components of the CPI. The main idea behind this method is to have a technique that could estimate price developments in the CPI main components and categorise them as the trend inflation indicator. The problem with this method, however, is the non-stationary behaviour of CPI main components. There are a few remedial measures that have been proposed to counter this problem such as running an OLS regression between inflation rate and the principal component, stacking lagged variables to the original datasets (Stock and Watson, 1998) and including more principal components in the derivation of core inflation.

<sup>19</sup> An alternative interpretation of core inflation is given by Eckstein (1981). He defines core inflation as the trend increase of the cost of factors of production originating from the long-term expectations in households and businesses. Inflation, according to him, is defined as  $\pi = \pi_c + \pi_d + \pi_s$ , where  $\pi_c$  is the core component that is related to the steady-state factor price growth,  $\pi_s$  is the shock component that captures the effects of exogenous changes and  $\pi_d$  is the demand component, which reflects the effects of deviation of unemployment from its neutral rate.

Hence, core inflation is defined as:

$$\pi_t^c = \pi_t^{LR} = \pi_t - g(X_{t-1}) - v_t$$

Where

$\pi_t^c$  is the aggregate inflation in period  $t$ ,  $\pi_t^{LR}$  is the long-run or trend inflation rate,  $g(X_{t-1})$  represents a measure of cyclical excess demand pressure and  $v_t$  is a measure of temporary disturbances to inflation. The core inflation components are a function of trend inflation or the aggregate inflation minus the cyclical excess demand pressure and the temporary disturbances to inflation.

One should note the difference in core inflation definitions between Eckstein's model and Quah and Vahey's model. The main difference between the two models is the former stresses that core inflation should not be cyclical where else the latter argues that core inflation should be cyclical and correlated with output in the short-run. This subtle difference is important. If the policy horizon is in the short to medium term, then policy makers can make use of the Quah and Vahey model. On the other hand, if the policy horizon is in the long-run, then the Eckstein's model is more suited.

Laidler (1990) consider Eckstein as the person who coined up the term core inflation.

Given data unavailability, we are unable to construct a core inflation series based on this model. The model is presented for completeness.

One should note the difference in the definition of core inflation between Eckstein and Quah and Vahey. The main difference between these two models is Eckstein's model stresses that core inflation should not be cyclical where else Quah and Vahey argue that core inflation should be cyclical and correlated with output in the short run. This subtle difference is important. If the policy horizon is in the short to medium term, then policy makers can make use of Quah and Vahey model. On the other hand, if the policy horizon is in the long run then the Eckstein's model is more suited.

<sup>20</sup> Perturbation refers to an alteration of the function of an economic system, induced by external or internal mechanisms (Monetary Authority of Singapore, 1998).

### Kalman Filter

In brief, the Kalman filter is a recursive filter that estimates the state of a dynamic system from a series of noisy measurement. This means only the estimated state from the previous time step and the current measurement are needed to compute the estimate for the current state. In contrast to batch estimation techniques, no history of observation or estimates is required.

Velde (2006) introduces the concept of Kalman filter as an alternative measure of core inflation. He applies the Kalman filter state space modelling, consisting of the latent inflation<sup>21</sup>, as an unobservable variable to simultaneously affect a collection of individual price series. From his results, the latent inflation and the core inflation<sup>22</sup> series have similar movement. He finds out that the latent inflation reduces the out-of-sample forecasting error<sup>23</sup>, thus making it useful for forecasting purposes.

### Hybrid Model

The hybrid model is a new line of study to measure core inflation. We call it a hybrid model because we cannot classify this new breed of core inflation measure as the statistical approach or model based approach due to its unique nature. There are two measures under the hybrid model namely the Domestically Generated Inflation (DGI) and Wavelet Analysis.

### Domestically Generated Inflation Model

Domestically Generated Inflation (DGI) is a measure of core inflation that would prevail absent of external shocks to the economy, such as a large movement in the exchange rate. This method was first introduced by Buiter in 1998. For the purpose of this paper, we derived the equation of DGI as:

$$\pi_t = \pi_{t-1} + \beta_1 (y_{t-i}^p - y_{t-i}^p) + \beta_2 (\Delta y_{t-i}^p - \Delta y_{t-i}^p) - \beta_3 (\dot{e}_{t-i}^w + \pi_{t-i}^w) + \beta_4 (s_{t-i}^k + \pi_{t-i}^k) + \beta_5 (wg_{t-i} + pd_{t-i}) + \varepsilon_t$$

where;

$\pi$	= Headline Inflation,
$(y_{t-i} - y_{t-i}^p)$	= Output Gap,
$e$	= NEER (Nominal Effective Exchange Rates),
$s$	= Spot Exchange Rates (RM/USD),
$\pi_w$	= World Inflation,
$\pi_k$	= World Commodity Price,
$wg$	= Wages,
$pd$	= Productivity,
$\varepsilon_t$	= Residual term.

We exclude the impact of exchange rate and world inflation to core inflation and project the underlying domestic generated inflation.

DGI is useful in providing information on the pressures being exerted on prices by domestic conditions. If DGI has strong inertia, it would be a leading indicator to the actual headline inflation during an external shock. However, this measure is sensitive to the precise assumptions underlying its construction.

### Wavelet Analysis

The wavelet analysis can be defined as a “waveform of effectively limited duration that has an average value of zero” (Misiti et al., 2000). This method was tailor-made for de-noising (or signal extraction from) non-stationary time series and is commonly used in applied science and engineering field such as earthquake predictions. The wavelet analysis was first brought to the economic mainstream by Schweitzer (2002) from the Bank of Canada. In his paper, he uses the wavelet for frequency domain analysis, non-stationary and complex function, long-term processes, time-scale decomposition and forecasting. He also discusses the time-scale decomposition by Ramsey and Lampart (1998), which uses the wavelet analysis to study the relationship between money and income.

<sup>21</sup> Latent inflation here refers to core inflation measure by using Kalman filter.

<sup>22</sup> Core inflation here refers to core PCE by U.S. Bureau of Economic Analysis.

<sup>23</sup> This is because the Kalman filter eliminates the noise in individual price series.



Cotter and Dowd (2006) use the wavelet analysis to estimate core inflation. They obtain the core inflation rate by extracting the signal from the inflation series. By doing this, they applied an approximation to remove noises and reveal the underlying signal of inflation. To ensure that the amount of noise removed is optimal (not too much or too little), we checked for normality of details<sup>24</sup> and minimum entropy<sup>25</sup>.

In choosing the type of wavelet to use, it is desirable to limit the choice to a wavelet that will generate the most optimal outcome (i.e. smooth core inflation series). Once the type of wavelet to be used has been decided, the Jarque-Bera estimation could be tested on each wavelet. Wavelets with unreasonable Jarque-Bera probabilities values are eliminated. Estimates of the entropies for the remaining wavelets are carried out and wavelets with the least permissible criteria are removed. In case one needs to further eliminate more wavelets, there might be a need to examine the trend of each wavelet and eliminate those that look similar to each other (Cotter and Dowd, 2006).

#### Evaluating the Measures of Core Inflation

The different nature and methodology of each measure of core inflation begets the question: how best do they explain and forecast headline inflation. Our prognosis at this juncture is that some measures of core inflation are more

suited at forecasting headline inflation, while the others may be more useful at explaining current developments. This thesis needs to be corroborated and in this section, we propose a standardised methodology to check which measure of core inflation provides the most information about future headline inflation and which could help us to better understand current developments. The first test considers the volatility of each core inflation measure. This is followed by tests for the absence of biasness and finally, we test the predictive power of each measure to forecast future headline inflation at different time horizons.

#### Volatility of Core Inflation Measures

The purpose of measuring the volatility is premised on the principle that in order for core inflation measures to properly capture trend inflation, they should be less volatile than headline inflation (Armour, 2006). The relevant means and standard deviations are presented in the following table. For the sample period, January 1993 to July 2013, the trimmed mean have the smallest standard deviation, with exponential smoothing and Kalman filter recording the smallest coefficient of variation. For robustness, we also present the mean absolute deviation (MAD) for each measure, which shows the trimmed mean and weighted median having the smallest MAD compared to other measurements. To further augment this finding, we proceed to check for the presence of biasness in the core inflation series.

**Table 2: Summary Statistics for Core Inflation Measures**

Measures	Mean	Standard deviation	Coefficient of variation	Mean Absolute Change
Headline Inflation	2.7	1.6	0.6	1.2
Exclusion-based Method	2.7	1.6	0.6	1.4
Trimmed Mean	1.7	0.9	0.5	0.7
Double Weighted	1.9	1.1	0.6	0.8
Weighted Median	1.7	1.0	0.6	0.7
Exponential Smoothing	2.7	1.0	0.4	0.9
Kalman Filter	2.7	1.0	0.4	0.9
Principal Component Analysis	2.7	1.6	0.6	1.2
SVAR	2.6	2.0	0.8	1.4
Wavelet Analysis	2.6	1.2	0.5	1.0
DGI	1.2	1.2	1.0	0.9

Sample period: Jan 1993 – July 2013

<sup>24</sup> Normality of details here means that, the process of removing the noise should stop before it becomes normally distributed.

<sup>25</sup> Entropy is signal at various frequency levels. Minimum entropy here means that we would opt for the lowest entropy.

### Unbiasedness

According to Bryan and Cecchetti (1993), Heath et al. (2004) and Silver (2006), headline inflation could be decomposed into the following form:

$$\pi_t = \pi_t^c + u_t$$

where in any period  $t$ ,  $\pi_t^c$  is a measure of core inflation and  $u_t$  is a temporary disturbance term. This equation highlights the potential for headline inflation to deviate from core inflation over a certain period due to short run supply shocks. In the absence of such shocks, there should not be any significant difference between headline inflation and core inflation, implying unbiasedness of the latter.

We test for unbiasedness of each core inflation measure by estimating the following equation  $\pi_t = \alpha_0 + \beta\pi_t^c + u_t$  and testing the joint null hypothesis that  $\alpha = 0$  and  $\beta = 1$ , via the Wald Coefficient Restriction test.

The p-values indicate that we have to reject the null hypothesis and conclude that all of the core measures, with the exception of the exponential smoothing, are bias with respect to headline inflation. One plausible reason for these bias results, as suggested by Armour (2006), is the presence of high skewness and kurtosis relative to a normal distribution in the CPI data. Hence, it is possible that the CPI data are inherently biased upward from the start.

### Predictive Ability

Finally, we test the predictive power of each core inflation measurement with the aim at identifying which of these measures forecast headline inflation best. It is worth noting that many researches have undertaken this task, with mixed results.<sup>26</sup> The univariate approach, based on Bryan and Cecchetti (1993), requires one to regress headline inflation on different core inflation estimates at various time horizons and calculating the root mean square error (RMSE) for the in-sample forecast of the model.<sup>27</sup> This simple model can be described by the following notation:

$$\pi_t^k = \alpha + \beta(\pi_t^c - \pi_{t-12}^c) + \varepsilon_t^{k,m}$$

where the left hand side is the average inflation over K horizon, set at 12 and 24. Our interest is in the RMSE deviation between average inflation and core inflation. The above equation was regressed from the start of the sample period to December 2006 and the results were used to build an in-sample forecast for the January 2007-November 2008 sub-period.

In general, all measures of core inflation have smaller RMSE in the 12-months forecast horizon compared to the two-year window. However, the double weighted measure and wavelet analysis have the smallest RMSE for the shorter forecast horizons, while the trimmed mean performs better over the 24-months window. The latter's nature of minimising the impact of extreme price inflation in the computation of core inflation could lend support for a better predictor of headline inflation over a longer policy horizon.

**Table 3: Test for Unbiasedness**

Measures	$\alpha$	$\beta$	p-value
Exclusion-based Method	1.02	0.64	0.0000*
Trimmed Mean	0.39	1.43	0.0000*
Double Weighted	0.53	1.22	0.0000*
Weighted Median	1.06	1.03	0.0000*
Exponential Smoothing	0.75	0.89	0.7038
Kalman Filter	-0.47	1.14	0.0018*
Principal Component Analysis	0.48	0.82	0.0004*
SVAR	1.32	1.05	0.0000*
Wavelet Analysis	-0.38	1.12	0.0413*
DGI	0.77	0.67	0.0000*

\*Significant at 10% level

<sup>26</sup> Bryan and Cecchetti (1993), Blinder (1997) and Cogley (2002).

<sup>27</sup> Bryan and Cecchetti (1993) conduct an out-of-sample forecast for a few candidates of core inflation such as weighted median, 15% trimmed mean and CPI excluding food and energy components, as well as, headline inflation.

**Table 4: Predictive Ability\***

Predictive Ability	RMSE	
	12-months	24-months
Measures		
Exclusion-based Method	0.84	2.02
Trimmed Mean	0.62	1.39
Double Weighted	0.60	1.52
Weighted Median	0.97	2.11
Exponential Smoothing	0.67	2.11
Kalman Filter	0.80	1.63
Principal Component Analysis	1.01	2.29
Wavelet Analysis	0.58	1.50
DGI	0.69	2.14
SVAR	0.68	1.57

\*In sample forecasting

As a check to the method above, we performed a second test for predictive power based on Lafèche (1997). In notational form:

$$\pi_t = \alpha + \beta_1 \pi_{t-12} + \beta_2 \pi_{t-12}^* + u_t$$

where,  $\pi_t$  is the year-on-year percentage change of total CPI and  $\pi_t^*$  is a candidate measure of core inflation. In similar fashion to the previous method, we performed a regression based on the above equation from January 1993 to December 2006 and performed an in-sample forecast for the January 2007-November 2008 sub-sample period. We follow Lefèche (1997) by assessing the predictive power of each core inflation measure based on the adjusted coefficient of determination  $R^2$ , where one could see the Kalman filter and wavelet analysis methods have the highest adjusted

coefficient of determination followed by the double weighted measure.

The results from the previous three sub-sections seem to point us towards a single but important conclusion that no single technique is superior to the other. While some measurements may exhibit lower volatility, it does not guarantee they make good candidates for forecasting future headline inflation. Furthermore, the presence of biasedness in the CPI data requires one to be extra careful when interpreting these results. Nevertheless, this brief deduction does not negate either of the techniques. What is more important for all users is to utilise all available measurements of core inflation to support their analysis of price developments and buttress their deliberations and

**Table 5: Predictive Ability\***

Predictive Ability	$R^2$
Exclusion-based Method	0.12
Trimmed Mean	0.02
Double Weighted	0.17
Weighted Median	0.01
Exponential Smoothing	0.01
Kalman Filter	0.47
CPI	0.01
Principal Component Analysis	0.11
Wavelet Analysis	0.31
DGI	0.07
SVAR	0.01

conclusions with a thorough understanding of the economy and comprehensive macroeconomic surveillance. Frictions within the economy could easily lead to price pressures and could signal higher headline inflation in the future. Monetary policy must be on guard against signs of second round effects which could lead to increasing demand for higher wages and un-anchoring of inflation expectations.

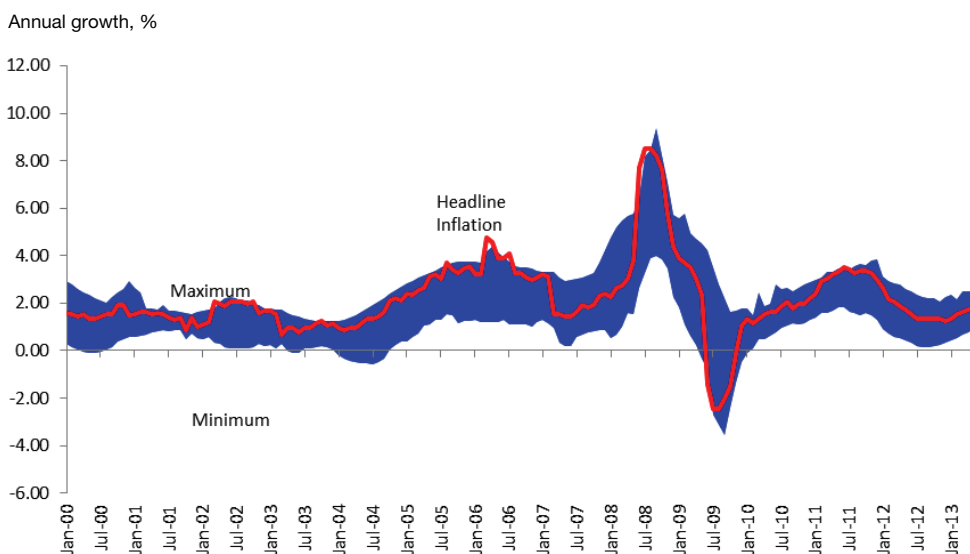
#### How Data from Core Inflation are Analysed?

The contribution of these core inflation series to policy deliberations can be seen from the following two contrasting episodes of high inflation, e.g. February 2006–March 2007 and January–November 2008. In the first instance, various measures of core inflation seem to indicate that the underlying inflation was lower than headline inflation during this period. Headline inflation rose sharply to 4.8% in March 2006, in contrast to the simple average for all core inflation measures which stood at 2.2%. In retrospect, the higher headline inflation was largely due to the increase in prices of fuels and lubricants in the transport category of the CPI following the sharp upward momentum in the international oil prices in early 2006. The absence of second round effects at that time supported the belief most firms were able to

absorb the extra production cost so as not to lose their market share.

Nevertheless, between January–November 2008, the general movement in the core inflation series, as shown in the following chart, seem to corroborate the trajectory of headline inflation. As prices for major global commodities, such as crude oil and food cereals rose sharply, headline inflation began to creep upward fuelled by higher domestic food prices. This reflected the pass-through from higher external food prices to domestic food prices, as firms passed on the higher cost of production to domestic consumers. Given such an inflation outcome, a key policy consideration for the central bank was to ensure that such price adjustments did not translate into a demand-driven inflationary pressure. This was supported by indicators of inflation expectations that gave the impression that inflation expectations have remained anchored. Notwithstanding this, realising that the root cause of higher inflation was supply-related, the Government announced several immediate and long-term measures to address inflationary pressures and potential supply bottlenecks. These measures are beginning to bear some fruits as both headline and some measures of core inflation have begun to decline in the recent period.

**Figure 1: Core Inflation - Interval of Uncertainty**



## Conclusion

Recognising the fact that future movements in headline inflation could be influenced by current core inflation, it is important to ensure measures of the former are available and robust to aid policy deliberations. In this research paper, we have highlighted the concept of core inflation, its qualities and evaluated several possible measures. We found that each measure of core inflation performs differently when tested. How can one rationalise this conclusion? In some ways, this conclusion alludes to the possibility that some measures of core inflation could act as good predictors of future inflation,

while others are best at describing current development in headline inflation. Another way to look at it is that not a single measure of core inflation is superior to the other and thus, it would be wise for policymakers to consider all available information before coming to a conclusion. Therefore, we would like to reiterate our stance that it is important for one to be careful when making deductions about the underlying inflation. Moreover, policymakers should recognise the need to support their analysis with an array of supporting proofs in order to maximise the usefulness of these underlying measures of inflation in corroborating their policy analysis.

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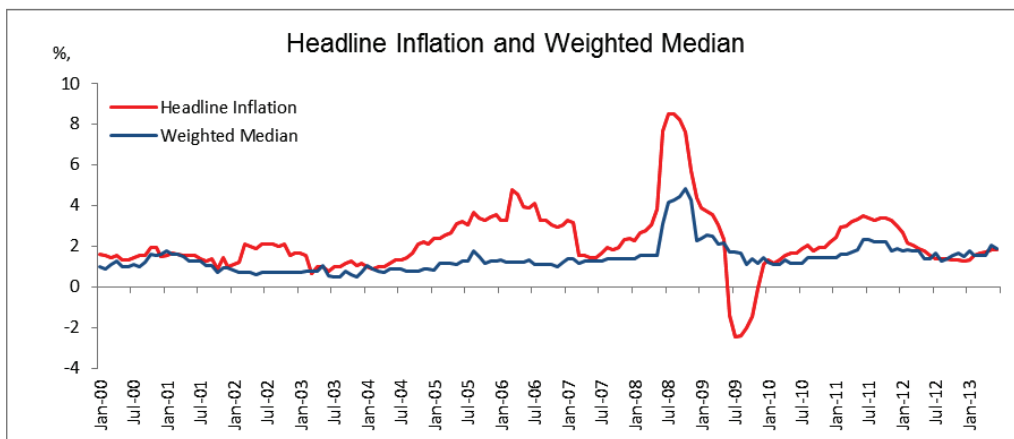
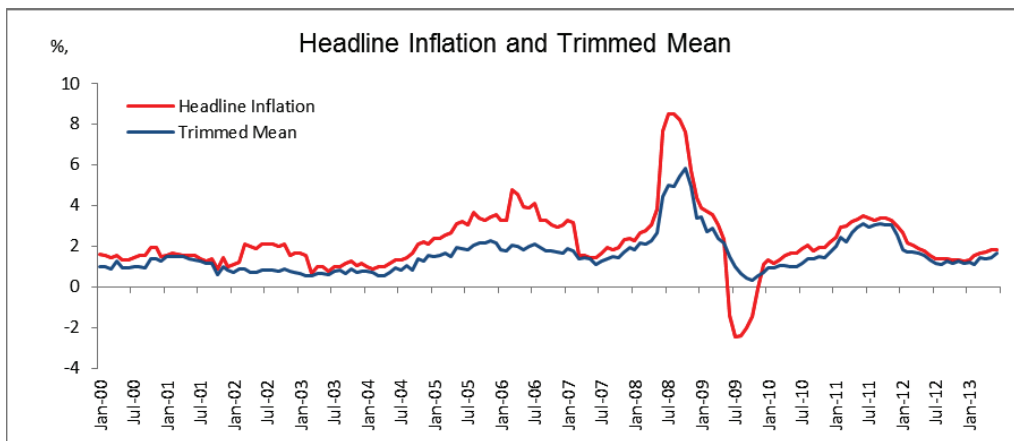
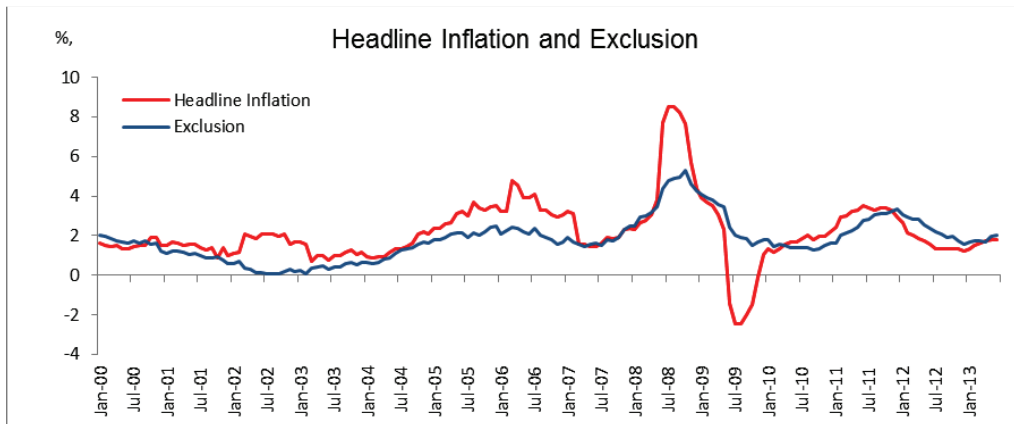
## Appendices

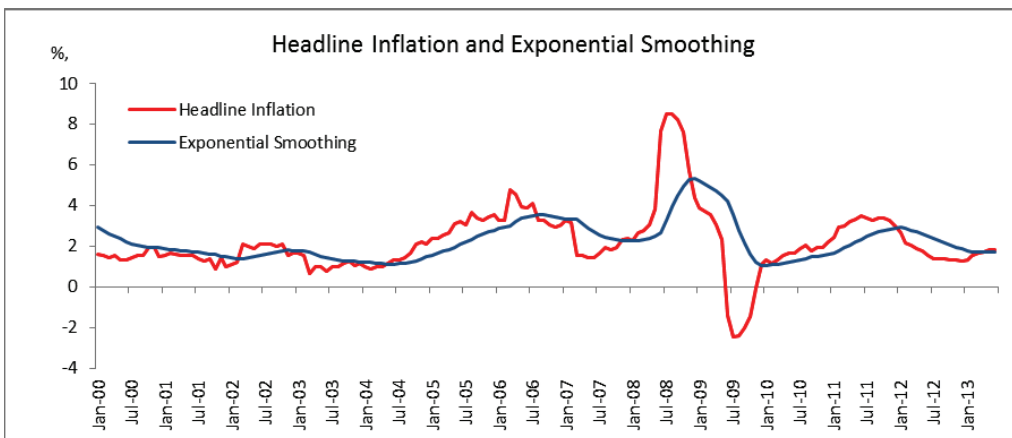
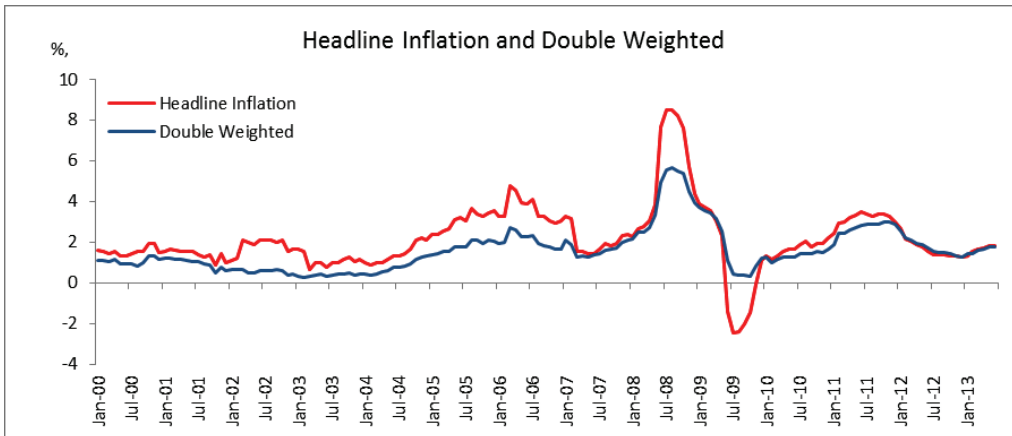
### I. Group and Subgroups in Malaysia CPI (2010=100)

GROUPS AND SUBGROUPS  
IN CONSUMER PRICE INDEX MALAYSIA  
(2010 = 100)

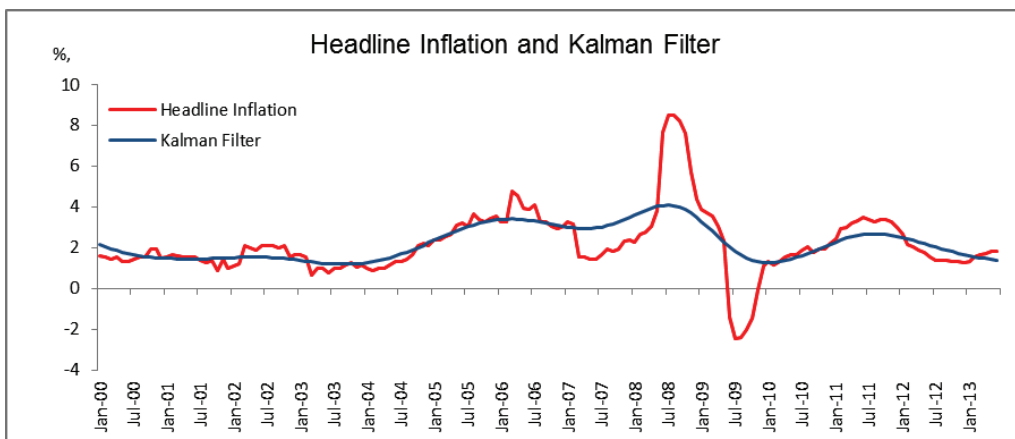
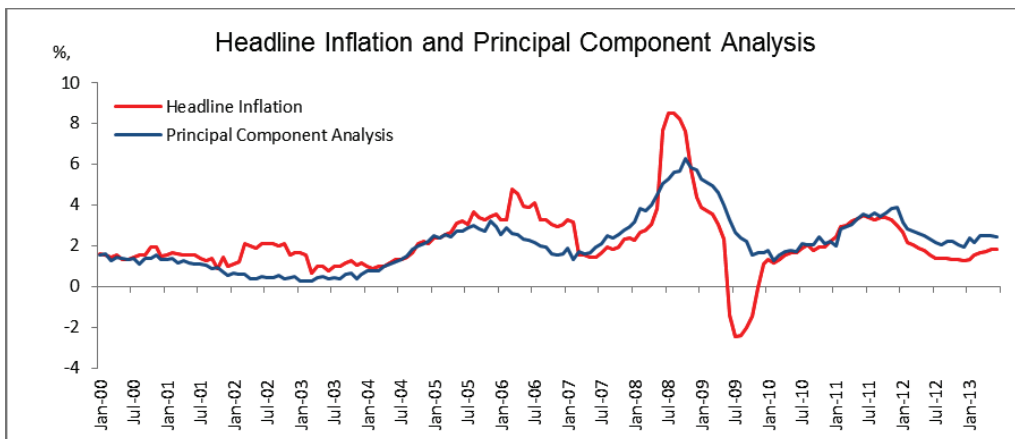
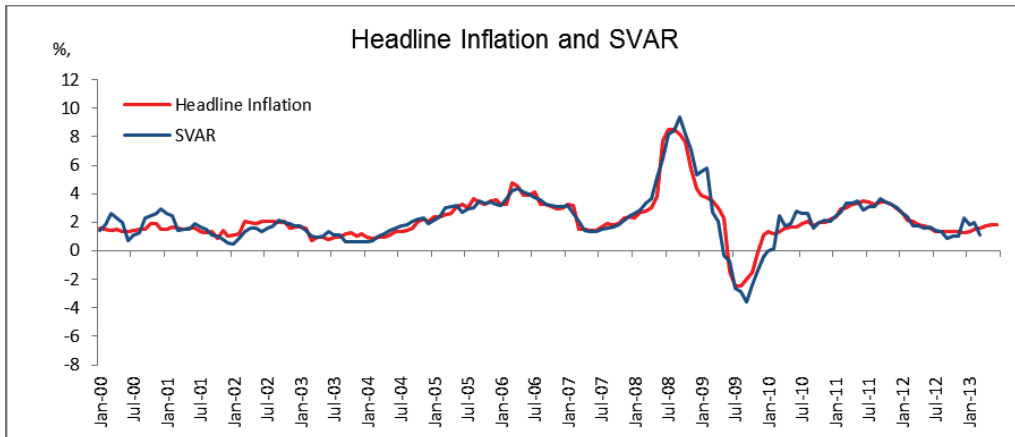
GROUP DESCRIPTION	Weight	GROUP DESCRIPTION	Weight	GROUP DESCRIPTION	Weight
<b>01 FOOD &amp; NON ALCOHOLIC BEVERAGES</b>	<b>30.3</b>	<b>044 WATER SUPPLY &amp; MISNEOUS SERV.</b>	<b>1.3</b>	<b>09 RECREATION AND CULTURE</b>	<b>4.6</b>
001 FOOD AWAY FROM HOME	10.0	0441 WATER SUPPLY	1.1	091 AUDIO VIS.P'GRAPIC&INFO PRE/EP	0.9
0011 FOOD AWAY FROM HOME	10.0	0443 SEWAGE COLLECTION	0.0*	092 TV, VIDEO CASSETTE RECORDERS	0.3
<b>011 RICE BREAD &amp; OTHER CEREALS</b>	<b>4.4</b>	0444 OT.SERV RELATING DWELLING NEC	0.2	093 PHOTOGRAPHIC & CINEMATIC EQP	0.2
0111 RICE	1.9	<b>045 ELECTRICITY,GAS &amp; OTHER FUELS</b>	<b>3.3</b>	094 INFOR, PROCESSING EQUIPMENT	0.3
0112 FLOUR & OTHER CEREALS GRAINS	0.4	0451 ELECTRICITY	2.9	095 RECORDING MEDIA	0.0*
0113 BISCUITS	0.5	0452 GAS	0.5	096 REPAIRS OF AUDIO VIS'L_PGRAPIC	0.0*
0114 BREAD & BAKERY PRODUCTS	1.2	<b>05 FURSHING, HH EQUIP &amp; MTENCE</b>	<b>4.1</b>	092 OT.MAJOR DURABLE REC'& CULTURE	0.0*
0115 OTH PROD MADE FRM CEREAL GRAIN	0.4	051 FTURE&FURSHING,C'PET&FLR COV	1.0	0921 MAJORURABLES - OUTDOOR RTION	0.0*
<b>012 MEAT</b>	<b>2.9</b>	0511 FURNITURE AND FURNISHINGS	0.9	0922 MUSICAL INSTRUMENTS	0.0*
0121 FRESH MEAT	2.3	0512 CARPETS & OTHER FLOOR COVERING	0.1	093 OT REC' ITEMS & EQP,ODENS & PETS	0.6
0122 FROZEN MEAT	0.3	<b>052 HOUSEHOLD TEXTILES</b>	<b>0.2</b>	0931 GAMES TOYS AND HOBBIES	0.0*
0123 PROCESSED MEAT	0.3	0520 HOUSEHOLD TEXTILES	0.2	0932 SPORTS EQUIPMENT	0.0*
<b>013 FISH AND SEAFOOD</b>	<b>4.5</b>	<b>053 HOUSEHOLD APPLIANCES</b>	<b>0.6</b>	0933 GARDEN, PLANTS AND FLOWERS	0.2
0131 FRESH FISH	2.8	0531 COOKING APPLIANCES	0.1	0934 PETS AND RELATED PRODUCTS	0.2
0132 FRESH SEAFOOD	1.1	0532 AIR CONDITIONING	0.1	0935 VETERINARY & OTHER SERVICES FOR PET	0.0*
0133 PROCESSED FISH AND SEAFOOD	0.7	0533 WASHING MACHINES	0.1	0936 OTHER NON DURABLES	0.2
<b>014 MILK &amp; EGGS</b>	<b>1.8</b>	0534 REFRIGERATORS & FREEZERS	0.1	<b>094 ENTERTAINMENT, REC' &amp; CUL SERV</b>	<b>2.1</b>
0141 FRESH & RECONSTITUTED MILK	0.1	0535 OT MAJOR HH APPL	0.1	0941 ENTERTAINMENT, REC' & CUL SERV	0.2
0142 EVAPORATED/CONDENSED MILK	0.3	0536 SMALL ELEC HH APPL	0.1	0942 CULTURAL SERVICES	1.6
0143 MILK POWDER & OTH DAIRY PROD	0.9	0537 REPAIR OF HOUSEHOLD APPLIANCES	0.1	0943 LOTTERIES & OTH GAMBLING	0.3
0144 EGGS	0.5	<b>054 GLASSWARE T-WARE&amp; HH UTENSILS</b>	<b>0.1</b>	<b>095 NEWSPAPERS, BOOKS &amp; STATIONERY</b>	<b>0.8</b>
<b>015 OIL &amp; FATS</b>	<b>0.6</b>	0540 GLASSWARE T-WARE& HH UTENSILS	0.1	0951 BOOKS	0.4
0151 BUTTER,FATS & PRED ANIMAL OILS	0.0*	<b>055 TOOLS,EQUIP FOR HOUSE &amp; GARDEN</b>	<b>0.0*</b>	0952 NEWSPAPERS	0.4
0152 OILS	0.5	0551 MAJOR TOOLS AND EQUIPMENT	0.0*	0953 MAGAZINES AND PERIODICALS	0.1
0153 MAGARINE, PEANUT BUTTER ETC	0.1	0552 SMALL TOOLS & MISS ACCRIES	0.0*	0954 WRITING & DRAWING EQUIPMENT	0.2
<b>016 FRUITS</b>	<b>1.2</b>	<b>056 GDS &amp; SRV.FOR HH MAINTENANCE</b>	<b>2.0</b>	<b>096 PACKAGED TOUR</b>	<b>0.2</b>
0161 FRESH FRUITS	0.9	0561 NON DURABLES HHOLD GOODS	1.0	0960 PACKAGE TOURS	0.2
0162 PRESERVED FRUITS	0.1	0562 DOMESTIC SERV AND HHOLD SERV	1.0	<b>10 EDUCATION</b>	<b>1.4</b>
0163 COCONUT AND NUTS	0.2	<b>06 HEALTH</b>	<b>1.3</b>	101 PRE PRIMARY & PRIMARY EDUCAT'N	0.6
<b>017 VEGETABLES</b>	<b>2.1</b>	061 MEDICAL PROD.APPLIANCES& EQUIP	0.8	1010 PRE PRIMARY & PRIMARY EDUCATION	0.6
0171 FRESH VEGETABLES	1.6	0611 PHARMACEUTICAL PRODUCTS	0.7	102 SECONDARY EDUCATION	0.4
0172 PRESERVED VEGETABLES	0.2	0612 OTHER MEDICAL PRODUCTS	0.0*	1020 SECONDARY EDUCATION	0.4
0173 POTATOES AND OTHER TUBERS	0.2	0613 THERAPEUTIC APPLIANCES & EQUIP	0.1	103 POST-SECONDARY NON-TTIARY EDU	0.1
<b>018 SUGAR,JAM,HONEY,CHOC &amp; CONF</b>	<b>0.6</b>	<b>062 OUTPATIENT SERVICES</b>	<b>0.3</b>	1030 POST-SECONDARY NON-TTIARY EDU	0.1
0181 SUGAR	0.3	0621 MEDICAL SERVICES	0.2	104 TERTIARY EDUC (DIP.LEVEL ABOVE)	0.1
0182 CHOCOLATE,SWEETS AND ICE CREAM	0.3	0622 DENTAL SERVICES	0.0*	1040 TERTY EDUC(DIP.LEVEL & ABOVE)	0.1
0183 JAM HONEY ETC	0.1	0623 PARAMEDICAL SERVICES	0.1	<b>105 EDUCATION NOT DEFINABLE BY LEV</b>	<b>0.2</b>
<b>019 FOOD PRODUCTS NEC</b>	<b>0.8</b>	<b>063 HOSPITAL SERVICE/INPATIENT</b>	<b>0.2</b>	1050 EDU/TION NOT DEFINABLE BY LEVL	0.2
0191 SPICES	0.3	0631 GOV. HOSPITAL	0.0*	<b>11 RESTAURANTS AND HOTELS</b>	<b>3.2</b>
0192 OTHER FOODS	0.5	0633 PRIVATE HOSPITAL	0.1	111 EXP IN RESTAURANTS AND CAFES	2.9
<b>010 COF,TEA,COC &amp; N-ALCOHOLIC BEV</b>	<b>1.4</b>	<b>07 TRANSPORT</b>	<b>14.9</b>	1111 EXPENDITURE IN RESTAURANT CAFE	2.9
0101 COFFEE	0.2	071 PURCHASE OF VEHICLES	2.9	<b>112 ACCOMODATION SERVICES</b>	<b>0.3</b>
0102 TEA, COCOA, ETC	0.5	0711 MOTOR CARS	2.6	1120 ACCOMMODATION SERVICES	0.3
0103 MIN WTER,SOF,DRKS,FR/VEG,JUICE	0.6	0712 MOTOR CYCLES	0.3	<b>12 MISC. GOODS AND SERVICES</b>	<b>6.3</b>
<b>02 ALCOHOLIC BEVERAGES &amp; TOBACCO</b>	<b>2.2</b>	0713 BICYCLES	0.0*	121 PERSONAL CARE AND EFFECTS	2.9
<b>021 ALCOHOLIC BEVERAGES</b>	<b>0.4</b>	<b>072 OPERATION OF PERS.TRANS. EQUIP</b>	<b>11.1</b>	1211 HAIR SALONS & PERS.GRMING	0.4
0211 SPIRITS AND LIQUORS	0.1	0721 PARTS & ACCESSORIES PERS.TRANS	0.4	1213 OTHER PRODS. FOR PERS.CARE	2.6
0212 WINES	0.0*	0722 FUELS & LUBR.PER.TRANS EGT	8.8	122 PERSONAL EFFECTS NEC	0.7
0213 BEER	0.3	0723 RPAIR & MNANCE P.T.(INCL PTS)	1.4	1231 JEWELLERY RINGS & PRECIOUS ST	0.4
<b>022 TOBACCO</b>	<b>1.7</b>	0724 OT SERV IN RESPECT OF P.T. EGT	0.6	1232 WATCHES	0.2
0221 CIGARETTES CIGARS ETC	1.7	<b>073 TRANSPORT SERVICES</b>	<b>0.9</b>	1233 OTHER PERSONAL EFFECTS	0.2
<b>03 CLOTHING &amp; FOOTWEAR</b>	<b>3.4</b>	0731 PASS'GER TRANS - RAIL	0.0*	<b>125 INSURANCE</b>	<b>1.8</b>
<b>031 CLOTHING</b>	<b>2.8</b>	0732 PASS'GER TRANS - ROAD	0.7	1251 LIFE INSURANCE	0.4
0311 CLOTHING MATERIALS	0.1	0733 PASS'GER TRANS - AIR	0.1	1252 INSURANCE FOR DWELLING	0.0*
0312 GARMENTS	2.4	0734 PASS'GER TRANS - SEA	0.1	1253 INSURANCE ACCIDENT AND HEALTH	0.1
0313 OT ACLES OF CLOTHING & ACCESS	0.2	0735 OTHER TRANSPORT CHARGES	0.0*	1254 INSURANCE FOR MOTOR VEHICLES	1.2
0314 CLEANING,REPAIR & HIRE CLOTHES	0.1	<b>08 COMMUNICATION</b>	<b>5.6</b>	<b>126 FINANCIAL SERVICES</b>	<b>0.4</b>
<b>032 FOOTWEAR</b>	<b>0.6</b>	082 TELEPHONE AND TELEFAX EQUIP	0.5	1261 FINANCIAL SERVICES	0.4
0321 SHOES AND OTHER FOOTWEAR	0.6	0820 TELEPHONE AND TELEFAX EQUIP	0.5	<b>127 OTHER SERVICES NEC</b>	<b>0.5</b>
<b>04 HOUSING,WTER,E'CTY,GAS,FUELS</b>	<b>22.6</b>	083 TELEPHONE AND TELEFAX SERVICES	5.1	1270 OTHER SERVICES	0.5
041 ACTUAL RENTAL FOR HOUSING	17.2	0830 TELEPHONE & TELEFAX SERVICES	5.1	<b>Total</b>	<b>100.0</b>
0411 ACTUAL RENTAL PD BY TENANTS	17.2				
043 MTENANCE & RPAIR OF DWELLING	0.7				
0431 MAT.FOR MNANCE,REPAIR DWEL'NG	0.4				
0432 SERV MNANCE & REPAIR DWELLING	0.3				

## II. Plot of Headline Inflation against Statistical based Core Inflation Measures

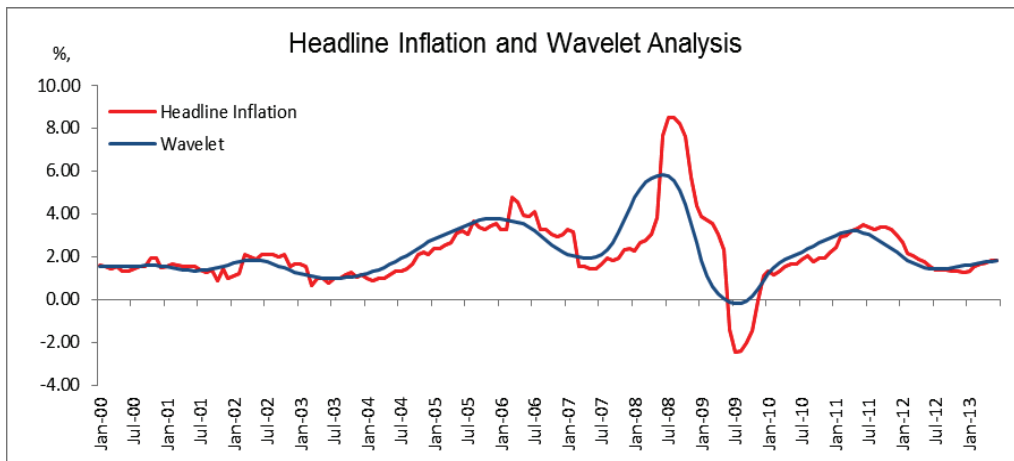
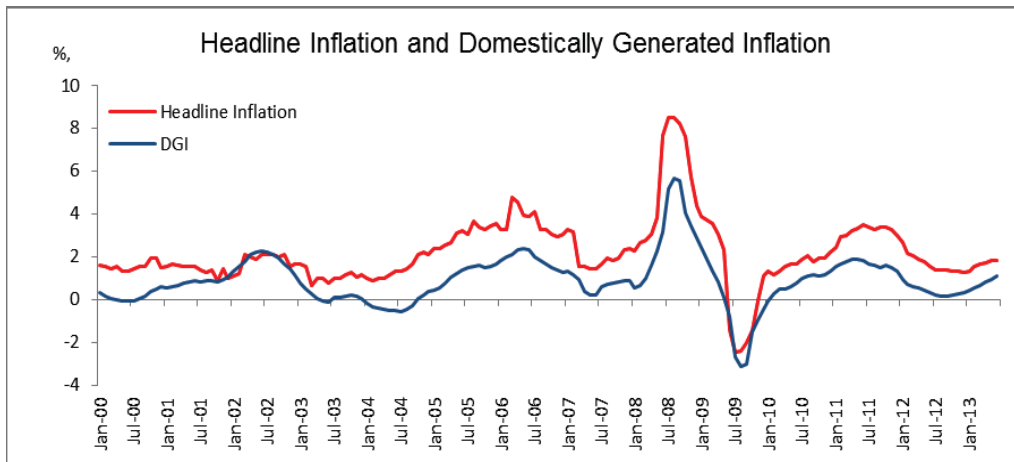




III. Plot of Headline Inflation against Model based Core Inflation Measures



IV. Plot of Headline Inflation against Hybrid Model based Core Inflation Measures







# AN OVERVIEW OF STATISTICAL METHODS FOR ECONOMIC RESEARCH AND RISK ASSESSMENT

Dr. Lau Wee Yeap<sup>1</sup>

## Abstract

From the perspective of epistemology, statistics has been used as part of scientific approaches to study data. In the realm of empirical research, statistics is used widely to unravel the relationship among variables. The first part of this paper will provide an overview on the statistical methods used in research, namely regression, Capital Asset Pricing Model (CAPM) and time series models. The second part of this paper will focus on statistical methods used in modelling volatility and risk. In this respect, the widely used Value-at-Risk will be discussed together with recent advances in risk measures after the 2008 credit crisis.

## Introduction

Economics, as a branch of social sciences, has started to follow the scientific approach like natural sciences in 1970s. The idea of hypothesis testing comes from Sir Karl Popper which states that as a scientific approach, any statement is subjected to falsification if it is to be known as Science. The Black Swan event is one such good example when the null hypothesis "all swans are white" is rejected if one can find a black swan. As per Wikipedia<sup>2</sup>,

*"... The classical view of the philosophy of science is that it is the goal of science to prove hypotheses like "All swans are white" or to induce them from observational data. Popper argued that this would require the inference of a general rule from a number of individual cases, which is inadmissible in deductive logic. However, if one*

*finds one single black swan, deductive logic admits the conclusion that the statement that all swans are white is false. Falsificationism thus strives for questioning, for falsification, of hypotheses instead of proving them...."*

Hence, the hypothesis testing -- the principle falsification of which is based on empirical work has gained its importance in economics.

What are the main characteristics of a scientific approach? Among the main features include systematic, objective, reproducible, relevant and control. These principles entail that the methodology used in any research or scientific endeavour must be clearly stated so that subsequent work can produce results similar to the predecessors. This also means that the methodology must be clearly recorded and transparent so that the community at large or subsequent generations can improve the method through time.

## Principle of Falsification

Generally, a scientific test involves a persevering search for negative, falsifying instances. A hypothesis which is tentatively assumed to be a true statement is subjected to attempts to falsify it through empirical data. If a hypothesis survives such tests, it can be provisionally accepted, but it can never be established conclusively. Subsequent corroboration with other evidences will enable a number of hypotheses to be turned into a scientific theory. Hence, a scientific hypothesis must have the capability of being proven false.

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<sup>2</sup> <http://en.wikipedia.org/wiki/Falsifiability>, accessed on 1 Nov 2013.



## The Use of Statistics

It is clear that a research work done in economics, as a piece of scientific enquiry needs to be supported by statistics. At its core, a research needs to have a sample, whether it is a time series, cross-sectional or a combination of both. Referring to Table 1, one needs to equip oneself with some ideas of basic statistics before embarking on a scientific work.

In fact, most recent advances in statistics come from the areas of Statistical Inference as shown in Table 2. Our ability to conduct statistical analysis has improved our standard

of living by way of improvements in product quality, decision making and predictions which come with better control and use of information derived from statistical modelling.

Moving from univariate analysis, which always centres around the mean, median, mode and other descriptive statistics, the more interesting aspect, is to uncover the relationship between two economic variables or among a group of variables. Hence, multivariate analysis is more useful as the techniques shown in Table 3 are more widely used. For example, factor analysis and principal component analysis are among the more popular techniques in data analysis conducted using survey data.

**Table 1: The Basics of Statistical Analysis**

- Data collection and Sampling
- Probability
- Sampling design (important for the collection of primary data)
- Random Variable and Discrete Probability Distribution
- Continuous Probability Distribution (Z, student-t table)
- Parametric versus Non-parametric

**Table 2: Statistical Inference**

- Estimation
- Hypothesis Testing
- Inference about a population
- Comparing two populations
- Analysis of Variance (ANOVA) one-way
- ANOVA two-way (randomized block design) ➡ Followed by Bonferroni post-hoc test
- Chi-squared tests for contingency table

**Table 3: Multivariate Analysis**

- Correlation
- ANOVA, Multivariate Analysis of Covariance (MANCOVA)
- Multiple Regression
- Factor Analysis
- Principal Component Analysis
- Discriminant Analysis

### Non-Parametric Techniques

Researchers occasionally encounter data sets which are either not normally distributed or originate from a small sample size (less than 30). In such instances, the corresponding non-parametric techniques as shown in Table 4 can be used. One of the drawbacks in using such techniques is the loss of information as in most analysis because the data is first transformed in another number known as rank before analysis is carried out.

### Regression Model

Most analysis in economic research uses regression analysis. Among the objectives of regression models is to estimate the coefficient or beta of the RHS factors as shown in the equation below:

$$\hat{\beta} = (X'X)^{-1} X'Y$$

**Table 4: Non-Parametric Techniques**

- Two-way contingency table (cross tabulations)
- The Man-Whitney U Test (two independent samples test)
- Kruskal-Wallis and the Median Tests (K independent samples test)
- Sign test, Wilcoxon Test (two related sample test)
- The Friedman Test (K related sample test)

**Table 5: Regression Model**

- Ordinary Least Square (OLS) Estimator
- Gauss-Markov Theorem  $\Rightarrow$  Assumptions under Classical Linear Regression Model (CLRM)  $\Rightarrow$  BLUE
- Three good characteristics  $\Rightarrow$  Unbiasedness, Relative Efficiency and Consistency
- Issues: Model Misspecification, Multicollinearity, Heteroscedasticity and Autocorrelation

Regression analysis based on the ordinary least squares (OLS) methods requires the fulfilment of a number of assumptions as shown in Table 5. These assumptions are known as the Gauss-Markov Theorem. The theorem ensures the validity, reliability and consistency of the estimators (beta) obtained from OLS.

However, if these assumptions are not fulfilled, issues such as Model Misspecification, Multicollinearity, Heteroscedasticity and Autocorrelation will occur thus giving rise to the need for different estimation techniques such as Generalised Least Squares or Feasible Generalised Least Squares.

Looking at the history of statistical methods in economics, there has been significant developments in the field of Econometrics.

### Advanced Econometric Models

The development of Information and Communication Technology (ICT) in late 1980s and 1990s resulted in the phenomenal growth of new models. As shown in Table 6, new breakthroughs were made in the areas of asset pricing models, time series models, microeconometrics and panel data.

### Volatility Models

One of the assumptions in the Classical Linear Regression Model (CLRM) is that the variance of the residuals is constant. However, in 1982, Nobel Laureate Engle discovered Volatility Clustering – heteroscedasticity which occurs in the variance of the error terms. He further refined

this discovery and subsequently developed the “Autoregressive Conditional Heteroskedasticity (ARCH)” model. The idea is to regress the squared residuals against the constant and lagged terms of squared residuals. The number of lags are determined by the hypothesised order of the ARCH effects. The model suggests that the variance of the residuals at time  $t$  depends on the squared error terms from past periods.

### GARCH Model

Tim Bollerslev (1986) expanded the work of Engle and developed a new model known as the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. The GARCH model includes the lagged conditional variance terms as autoregressive terms.

**Table 6: Advanced Econometric Models**

#### Asset Pricing Models

- Capital Asset Pricing Model, or CAPM (Sharpe, WF, 1965)
- Fama French Three-factor model (1992,1993)
- Arbitrage Pricing Theory, or APT Model (Ross, 1993, 1994)
- Carhart Four-factor model (1997)

#### Time Series Models

- Autoregressive Integrated Moving Average, or ARIMA (Box and Jenkins, 1970)
- Macroeconometrics (testing for unit root, cointegration, dynamics model) (Granger, CWJ, 2001; Stock, JH., 2001)
- Vector Autoregression models (Sims, 1980)
- Error Correction Model (Engle & Granger, 1987)

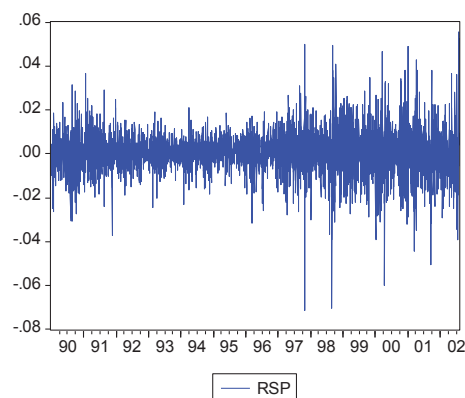
#### Microeconometrics

- Labour economics (Heckman, JJ, 2000 Nobel Laureate)
- Health economics (McFadden, DL, 2000 Nobel Laureate)
- Discrete Choice Model, Nested model, Ordered, Model for Count Data

#### Panel data

- Macro Panel and Micro Panel
- Bound Testing Approach (Pesaran et. al., 2001)
- Dynamic Panel data models (Bond, SR, 2002)

**Figure 1: Volatility Clustering**



### VaR Model

The idea of GARCH model has been used by JP Morgan in 1994 to develop the Value-at-Risk (VaR) model using Riskmetrics®. VaR is a user determined loss quantile of a portfolio's returns distribution. For example, if a bank chooses to use 99% VaR, this represents the minimum loss a bank is expected to incur with 1% probability. In 1995, the Basel Committee of Banking Supervision has decided that VaR be used as internal modelling approach for market risk.

### Conclusion

Statistics is a tool used to obtain reliable and valid results through deduction, hypothesis

testing and experimental design. The field has developed due to the continuous search for better models to further understand the relationship between variables and the data generating process. Statistical methods are the means for understanding, measuring, monitoring and predicting the economic series. In the era of big data, users of statistics are faced with another challenge of understanding the ramifications of data analysis. Amidst this development, it also important to remember the idea of Scientific Evolution proposed by the American physicist, historian, and philosopher of science, Thomas Kuhn (1962), which states that scientific research provides a paradigm shift for people to better understand the phenomena of the world.

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# AGGREGATE FINANCING TO THE REAL ECONOMY

Dr. Sheng Songcheng<sup>1</sup>

## Abstract

Aggregate Financing to the Real Economy (AFRE) describes the total financing from the financial system to the real economy during a certain period, may it be a month, a quarter, or a year. It is a flow indicator. In this paper, the financial system refers to the financial sector as a whole. In terms of institutional coverage, it covers all financial institutions, such as banks, security firms and insurance companies. In terms of market coverage, it includes among others, the credit market, debt security market, equity market and insurance market. In terms of geographic coverage, it focuses on domestic financial activities between the financial system and the real economy.

Components of AFRE could be classified into four groups: loans on financial institutions' balance sheets, off-balance sheet financial instruments of financial institutions, direct finance instruments, and other financial instruments.

AFRE is a pilot project at the People's Bank of China (PBC), aiming to dealing with the information gap highlighted by the financial crisis. Credit views of the monetary transmission mechanism and the complete liquidity position provide theoretical support to AFRE. Using data from China, the study shows that there is a higher correlation between AFRE and major economic indicators, including GDP growth, CPI, retail consumption, and fixed asset investment.

## Introduction

The financial crisis made it clear that development in financial statistics lags that of financial innovation; as a consequence, it creates a substantial information gap, prompting countries to find ways to close the gap. Proposals include extending the coverage of monetary aggregates, establishing a broad measure of liquidity and collecting data on

credit aggregates.

Much change has taken place in the Chinese financial system during the past decade such as the ongoing innovations in financial markets and products, rapid expansion in direct finance, the enhanced role played by non-bank financial institutions, and the increase in off-balance sheet items in commercial banks. This change challenges the ability of RMB loans to provide a comprehensive picture of the interactions between the financial system and the real sector. Moreover, the analysis of RMB loans is also incapable of providing sufficient information on the overall finance obtained by the real economy.

Against this background, the AFRE was introduced by the PBC in the last quarter of 2010. Since its introduction, quarterly data have been released since 2011, and monthly data have been released since 2012. Historical data from 2002 were also provided to support research and analysis in relevant fields. AFRE has functioned as a monitoring and analytical tool in macro-economic and financial management. Since it was put into use, in each year's Government Report, as well as in the Central Meeting on Economic Affairs, it has been repeated that AFRE should be at a reasonable scale.

## Definition and Components of AFRE

AFRE is a flow. It describes the total financing from the financial system to the real economy during a certain period, may it be a month, a quarter, or a year. Here, the financial system refers to the financial sector as a whole. In terms of institutional coverage, it covers all financial institutions, such as banks, security firms, insurance companies, etc. In terms of market coverage, it includes markets such as the credit market, debt security market, equity market and insurance market. In terms

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of geographic coverage, it stresses domestic financial activities between the financial system and the real economy.

Components of AFRE can be classified into four groups, comprising 10 items. The first group is loans on financial institutions' balance sheets, which covers RMB loans and loans in foreign currencies. The second group is off-balance sheet financial instruments of financial institutions, which include entrusted loans, trust loans, and bankers' acceptance not yet discounted. The third group is made up of instruments used in direct finance, specifically, they are debt securities and equities issued by domestic non-financial companies. And the last group is other finance, such as indemnity paid by insurance companies, real estates owned by financial institutions not for own use, and loans issued by loan companies.

There are two guiding principles in compiling AFRE, both come from the Monetary and Financial Statistics Manual of the IMF. The method for compiling AFRE is based on the methods in compiling Financial Survey and Flow of Funds Accounts recommended by the Manual. This forms the basis for the two major principles adopted by the PBC in calculating AFRE: consolidation and accrual. Consolidation applies when transactions take place within the financial system, to avoid double counting. The accrual principle means that AFRE is a flow. It is the difference between the beginning and the end of a certain period, or in other words, the funds raised during the period minus the funds repaid. The following are two examples. The first example relates to RMB loans. The part of RMB loans included in AFRE is not its ending balance, but newly issued loans minus the loans paid back to banks during the period. Specifically, it is the amount of net RMB loans issued during a month, a quarter, or a year. The second example relates to debt security issued by non-financial companies. Here, the amount included in AFRE is not the amount of debt securities outstanding at the end of the period, but the incremental portion, which equals to the amount issued minus the amount repaid.

### Issues Related to AFRE Compilation

The first is the relationship between AFRE and monetary aggregates. They are different, but complementary, just as the two sides of a coin. Monetary aggregates, or M0, M1 and M2, originate from the liability side of financial institutions, and contain information on how much liquidity and purchasing power the financial system provides to the economy. In contrast, AFRE is derived from the asset side of balance sheets of financial institutions and issuers in the financial markets. It is also an aggregated indicator comprehensively depicting the financial resources channelled through the financial sector to the real economy. Therefore, AFRE does not conflict with monetary aggregates, in fact they are compatible.

Another issue is the relevance between AFRE and the monetary transmission mechanism. Depending on which side of the balance sheet the focus is on, theories on monetary transmission mechanism can be categorised into the monetary view and the credit view. The former focuses on the liability side, and argues that monitoring the liability side is adequate in the analysis of the monetary transmission mechanism and its effects. However, since the 1950s, some economists began to realise the usefulness of the asset side of the balance sheet in understanding the monetary transmission mechanism. Such economists include Bernanke and Nobel Laureates such as Tobin, Stiglitz and Modigliani.

According to Bernanke and Stiglitz, the information from the liability side is insufficient to fully depict the monetary policy transmission mechanism and its effects. Moreover, major items on the asset side, such as loans, could be useful in providing some information. The credit view was meant to improve the monetary view, not to negate it.

Developments in the credit view shows that monetary policy could affect bank loans and the value of assets such as debt

securities and equities. This in turn affects output. For instance, Tobin's Q is defined as the ratio between the market value of a firm and capital reallocation cost. When monetary policy expands, interest rates fall, equity prices rise, resulting in a larger Q, as the prices of equities grow faster than the capital reallocation cost. In such circumstances, it is lucrative for firms to issue equities. As a result, equity finance rises, investment expands, and output increases accordingly.

Modigliani's life-cycle theory points out that current consumption is a function of both current income and expected future income. Such income, or wealth, includes wages, as well as income from debt securities, equities and real estates. Monetary policy changes interest rates, which in turn, lead to changes in the market value of such assets. Through this channel, monetary policy influences households' wealth, their decisions on consumption and saving, and finally, output.

AFRE also finds theoretical support in the complete liquidity position proposed by the *Radcliffe Report*, as well as in Gurley and Shaw's analysis on financial intermediation. In the late 1950s, the *Radcliffe Report* made it clear that it is not traditional money supply that matters to economic activities, but the complete liquidity position that includes money supply. It also argues that it is not only commercial banks that are critical in money supply, but also all non-bank financial institutions that make up the whole financial system. According to Gurley and Shaw, financial intermediaries include banks and all non-bank financial institutions. As such, monetary authorities should go beyond supervising money and commercial banks, and extend their coverage to include all financial assets and all financial institutions.

Empirical evidence supports these views. Many quantitative tools have been used to explore the relationship between financial aggregates and major economic indicators. The results are summarised in Table 1.

**Table 1: Correlation coefficient between AFRE and major economic indicators**

Indicator		Correlation coefficient	Granger causality tests
GDP	AFRE	0.82	Mutual
	RMB loans	0.66	Mutual
	M2	0.75	Mutual
Fixed asset investment	AFRE	0.75	Mutual
	RMB loans	0.58	Mutual
	M2	0.62	Mutual
Retail consumption	AFRE	0.86	RC is the Granger cause of AFRE
	RMB loans	0.71	RC is the Granger cause of RMB loans
	M2	0.72	RC is the Granger cause of M2
CPI	AFRE	0.89	Mutual
	RMB loans	0.77	Mutual
	M2	0.76	CPI is the Granger cause of M2
External trade	AFRE	0.82	Mutual
	RMB loans	0.67	Mutual
	M2	0.70	Mutual

Source: The PBC



The analysis above utilised quarterly data between 2002 and the second quarter of 2013. This analysis tested the empirical relationship between AFRE, M2 or RMB loans, and major economic indicators. As Table 1 shows, compared to M2 and RMB loans, AFRE and major economic indicators exhibit a higher correlation. The correlation coefficients between AFRE and such economic indicators, on average, are 0.1 higher than those between M2 (or RMB loans) and real economic indicators. Also, there exists a long and stationary co-integration, as well as a strong causal relationship between AFRE and GDP (or other economic

indicators, such as investment, price, etc.). The findings support that AFRE is an effective tool in monitoring and analysing macro-economic situations.

#### AFRE in Practice

Comparing the data between 2002 and 2012, it is evident that there are significant changes in both the scale and the composition of AFRE. The AFRE was at a historical high in 2012, nearly RMB16 trillion Yuan, 7.8 times that in 2002. Four major changes in the composition of AFRE could be identified, as summarised in Table 2.

**Table 2: Composition of the AFRE**

Scale: RMB100 million Yuan

Item	2013. 1-9	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
AFRE	139,596	157,631	128,286	140,191	139,104	69,802	59,663	42,696	30,008	28,629	34,113	20,112
RMB loans	72,787	82,038	74,715	79,451	95,942	49,041	36,323	31,523	23,544	22,673	27,652	18,475
Loans in foreign currencies (in RMB)	5,165	9,163	5,712	4,855	9,265	1,947	3,864	1,459	1,415	1,381	2,285	731
Entrusted loans	18,200	12,838	12,962	8,748	6,780	4,262	3,371	2,695	1,961	3,118	601	175
Trust loans	15,841	12,845	2,034	3,865	4,364	3,144	1,702	825	-	-	-	-
Banker's acceptance not yet discounted	6,359	10,499	10,271	23,346	4,606	1,064	6,701	1,500	24	-290	2,010	-695
Domestically issued debt securities by NFCS	15,280	22,551	13,658	11,063	12,367	5,523	2,284	2,310	2,010	467	499	367
Real estates held by FIs not for own use	97	50	166	46	23	16	-	-	-	-	-	-
Indemnity paid by insurance companies	2,629	3,132	2,455	1,827	1,640	1,481	1,084	848	715	607	507	432
Other items	1,614	2,008	1,936	1,204	769	-	-	-	-	-	-	-

**Note:**  
 "-" indicates missing data or the number is not significant.  
 Data for 2013 is provisional.

Source: The PBC

First, the share of RMB loans dropped. RMB loans accounted for 92% of AFRE in 2002, but the share fell to 52% in 2012. Second, direct finance grew fast, and the market played a more significant role in allocating resources. Debt securities and equities issued by non-financial companies amounted to RMB2.5 trillion Yuan in 2012, 24 times higher than that in 2002. Direct finance accounted for 16% of AFRE in 2012. It was 11 percentage points higher compared to that in 2002. Third, off-balance sheet finance increased rapidly. Entrusted loans, trust loans and undiscounted bankers' acceptance amounted to RMB3.6 trillion Yuan in 2012. This figure was small in 2002. Fourth, non-bank financial institutions played a bigger role in financing the real economy.

In the first seven months of 2013, AFRE was nearly RMB11 trillion Yuan, RMB2 trillion Yuan more compared to the same period in 2012.

## Conclusion

The AFRE is a pilot exercise for establishing a comprehensive financial statistical framework. In terms of institutional coverage, such a framework is comprehensive. It includes banks, security firms, insurance companies and other kinds of financial institutions. In terms of content, it should cover statistical information on assets, liabilities, profits and losses, as well as risks. The comprehensive financial statistical framework designed and undertaken by the PBC in recent years, should facilitate monetary policy decisions by providing information on the quantity and prices of financial instruments, and complements macro-prudential management by providing information on asset quality, cross market risks, and cross sector risks. At the macro level, it should meet the needs arising from macro-economic management; at the micro level, it should meet the needs of financial institutions. It is the PBC's vision to develop a consistent, compatible and comprehensive financial statistical framework with a broader coverage.

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# MEASUREMENT AND CONTRIBUTION OF TOTAL FACTOR PRODUCTIVITY TO ECONOMIC GROWTH

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## Abstract

This paper examines total factor productivity (TFP) growth of the Malaysian economy from 1971 to 2007. By using the Data Envelopment Analysis method, this study estimates the contribution of technological progress and technical efficiency to TFP growth and identifies the determinants of TFP. The results from this study show that between the years 1971 and 2007, the contribution of technological progress to TFP was higher than technical efficiency. This is similar for the periods 1971-1985 and 1999-2007. Only for the period 1986-1998, the contribution of technical efficiency exceeded that of technological advancement. The study found that TFP is a significant contributor to the economic growth, but it is still less important relative to capital and labour input. In contrast, capital input is the most important contributor to the economic growth of Malaysia. The result of TFP determinants shows that manufacturing output growth had the highest contribution to the growth in TFP, followed by the percentage of foreign-owned companies, while the percentage of workers with tertiary education was not a significant contributor despite having a positive and the highest coefficient.

## Introduction

Malaysia's rapid economic growth between the years 1960 and 1990 led to economists and analysts dubbing it as one of the "East Asian Miracles" [World Bank, 1993]. The rates of economic growth rate achieved during some periods were impressive, notwithstanding the low growth rates experienced during periods of economic crises. Malaysia's economy grew at an average rate of 6 percent per annum during the 1960s and rose to 7.3 percent for the period 1970-1975. In fact, its economic performance continued to improve during the

1976-1980 period with 8.6 percent annual growth rate. A slower growth rate of 5.1 percent per annum ensued for the 1981-1985 period and from 1986 until 1990, the growth rate picked up to 6.7 percent per year. Further improvements were recorded for the period of 1991-1995 as the growth rate of the Malaysian economy increased at 8.7 percent a year. However, the pace moderated for the period 1996-2000 as the economy grew at only 4.6 percent.

The term *East Asian Miracle* inspired many researchers to debate on the factors contributing to the economic growth of East Asian countries. These researchers agreed that physical and human capital accumulation were the key determinants of economic growth. Countries that invest heavily on these two forms of capital have experienced faster economic growth, a fact that is in line with the neoclassical growth model. However, the question arises on whether input or productivity influenced growth more. It questions the relative significance between quantity and quality. An input-driven growth is not sustainable since the returns to input naturally diminishes. This is followed by increased production costs.

Total Factor Productivity (TFP) is an increase in the overall efficiency of input use. This means that using the same input, production can be increased while reducing production cost. There are a number of factors which can influence efficiency. Factors such as technological level, socio-demography, development and management of human resource as well as the restructuring of institutions can affect efficiency in different ways and at varying degrees (Bhatia 1990, Rahmah & Idris 2010). Many researchers relate TFP growth to technological advancement (Kartz, 1969, Pickles, 1990). However, in addition to

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technological improvements, TFP growth also involves enhancements in the quality of input through the development and management of human capital.

The experiences of different countries have demonstrated the significance of TFP to their respective countries. Baier et al. (2002) studied the importance of physical capital development, human capital and TFP on the economic growth of 145 countries. The study concluded that TFP played an important role in the economic growth of the countries' studied. It must be noted that the role of TFP is not identical for every country and the degree of its influence on economic growth varies for different countries. TFP growth contributed about 25 percent of output growth in Western countries including America; 20 percent for Southern Europe and 18 percent for the Newly Industrialised countries. Conversely, in Central Africa and South Africa, Central Europe and East Europe as well as the Middle East, TFP growth was negative.

In another study, Young (1995) found that Singapore's economic growth over the last 30 years was not contributed by TFP growth but by the intensity of input use. Annual TFP growth for the entire economy of Singapore was only 0.2 percent between 1966 and 1990. Ikemoto (1986) estimated the TFP growth for the period 1970 to 1980 for a number of Asian economies. He found that the contribution of TFP to economic growth in China, Taiwan and South Korea were high. On the other hand, the contribution of TFP growth was lower for the other countries in his research, such as Hong Kong, Malaysia, Philippines, Singapore and Thailand.

#### Growth of TFP and the Malaysian Economy

The role of TFP growth to the growth of the Malaysian economy has been gaining more attention. Initially, the growth of the Malaysian economy was driven more by input such as capital, labour and raw materials. To accelerate this growth rate, the government had to shift its growth strategy towards the importance of the contribution of input quality and productivity, including TFP. Malaysia's economic growth strategy has shifted from

an input-driven growth to one driven by productivity and knowledge. These two aspects are becoming increasingly important contributors to Malaysia's economic growth.

This change of strategy by the government aims at accelerating economic growth to facilitate the achievement of a developed nation status by 2020. It is to ensure that production processes are supported by quality input and advanced technology. These factors will drive output growth and reduce the dependence on low-skilled labour. The contribution of TFP is important because it signifies efficiency which can lead to reduction in costs because the same amount of input can be used to produce more output when there is an increase in TFP.

TFP growth is closely associated with technological change and they are mutually affective. Technological advancement is essentially a part of TFP growth since technology is an input in the production process and TFP measures total productivity. Hence, an improvement in the levels of technology naturally leads to an increase in TFP growth.

In Malaysia, the concept of TFP growth is relatively new. It was first mentioned in the Sixth Malaysia Plan (RMK-6) as part of the strategy of having productivity-driven output growth. Nonetheless, the concept of achieving technological improvements through technology transfer or technology development has been discussed in the past. Discussions on the role of technology transfer in Malaysia's growth and development dates back to the 1980s when Malaysia began liberalising its economy and experienced an influx of foreign capital into the country. When Malaysia introduced policies to augment secondary export and heavy industries in the 1990s, the emphasis on technological development intensified. Such emphasis was evident with large allocation of funds for research and development (R&D) activities.

The current economic growth strategy is to find new sources of economic growth based on the strategies outlined in the New Economic Model (NEM). The contribution of TFP growth is much more relevant in this approach. The main objective of this model

is to identify new sources of economic growth for Malaysia. This includes measures to improve the efficiency of input used in production. Given that the services sector has been identified as a major contributor to growth in the NEM, it must seek to reduce production costs by improving input efficiency.

### The Concept of TFP and its Measurement

#### The Concept of TFP

TFP refers to production input efficiency including capital and labour. TFP is often regarded to be relatively more significant than the productivity of separate inputs since TFP measures the efficiency of inputs in a composite manner, taking into account the quality of input. In other words, in measuring the contribution of input to output, elements other than the quantity of input are included in the contributions of the growth in TFP. This includes labour quality, capital quality, efficiency of input management etc.

#### The Measurement of Total Factor Productivity Growth

There are a number of methods used to measure TFP such as the growth accounting method, Data Envelopment Analysis (DEA) and Stochastic Frontier. These different methods have their advantages and shortcomings depending on the availability and nature of the data.

#### The Growth Accounting Method

Researchers were initially more comfortable using the growth accounting method introduced by Solow (1957) to obtain the value of TFP growth. This method is also known as the balance approach (residual approach), in which the residual value is obtained after the contribution of physical inputs is calculated. This balance is the value of TFP growth. According to the growth accounting method, there are three elements contributing to the production of goods and services – labour, capital and technology (also known as TFP). Labour and capital refer to workers and capital goods (buildings, machines, vehicles, etc.).

Technology or TFP refers to methods used by labour and capital to produce goods and services more quickly and efficiently. These three elements are essential to economic growth. A neoclassical production function is usually written as:

$$Y = F(K, L, t) \quad (1)$$

Where:

Y = output/domestic production  
K = capital  
L = labour  
t = time

By applying Solow (1957) and Gillis et al. (1996), the production function above can be divided into several parts based on the contribution of each production factor. The equation below is obtained by differentiating equation (1) by time:

$$\frac{dY}{dt} = \frac{\partial F}{\partial K} \cdot \frac{dK}{dt} + \frac{\partial F}{\partial L} \cdot \frac{dL}{dt} + \frac{\partial F}{\partial t} \cdot \frac{dt}{dt} \quad (2)$$

When equation (2) is divided by Y and then timed with respective factors, then the equation below is obtained:

$$\frac{1}{Y} \cdot \frac{dY}{dt} = \frac{1}{Y} \left( \frac{\partial F}{\partial K} \cdot \frac{dK}{dt} \cdot K \cdot \frac{1}{K} + \frac{\partial F}{\partial L} \cdot \frac{dL}{dt} \cdot L \cdot \frac{1}{L} + \frac{\partial F}{\partial t} \right) \quad (3)$$

or

$$\frac{dY/dt}{Y} = \frac{(\partial F/\partial K)K}{Y} \cdot \frac{dK/dt}{K} + \frac{(\partial F/\partial L)L}{Y} \cdot \frac{dL/dt}{L} + \frac{\partial F/\partial t}{Y}$$

Where:

$$\frac{dY/dt}{Y} = G_Y = \text{output growth rate or domestic production}$$

$$\frac{dK/dt}{K} = G_K = \text{capital growth rate}$$

$$\frac{dL/dt}{L} = G_L = \text{work force growth rate}$$

$$\frac{(\partial F/\partial K)K}{Y} = W_K = \text{returns to capital}$$

$$\frac{(\partial F/\partial L)L}{Y} = W_L = \text{returns to labour}$$

$$\frac{(\partial F/\partial t)}{Y} = \alpha_t = \text{the variables that cannot be explained or TFP growth}$$

Therefore, equation (1) can be written as  $G_Y = W_K \bullet G_K + W_L \bullet G_L + \mathbf{a}$ . If  $G_Y$ ,  $G_K$ ,  $G_L$ ,  $W_K$  and  $W_L$  are known, then the contribution of each factor of production can be calculated. Variable  $\mathbf{a}$  is the residual which is not included in the factors of input – capital and labour. It is known as TFP growth which can represent changes in technology, improvements in quality of labour or human capital etc.

The limitation of this approach is when data inputs such as wages and profit are not available. To overcome this problem, the growth accounting approach is modified by estimating the output growth model to obtain the coefficients of selected input. If the estimated function is in the form of logarithm, the produced coefficient is the elasticity value of the input. In calculating the contribution of each factor to the growth of the output, elasticity values are multiplied with the growth rate of the inputs. If the estimated function is not in the form of logarithm, then the elasticity of the input should be calculated on the average value of the input. According to this approach, TFP growth is the difference between the growth of output and total input contribution. This approach is more convenient since it does not require information on the return of the factors of production. This is especially applicable to the Malaysian economy, given that it does not adopt the income approach in calculating gross domestic product.

Through this approach, the residual factor is obtained when physical input contribution is known. For instance, for the output growth model with two factors of production i.e. physical capital and the quantity of labour, these two are included in the regression equation, but the quality of these inputs are not included. The quality of labour, for example, can be represented by educational attainment, health and training and they can be included in the growth model directly. Past studies showed that when more inputs are included in the estimated equations, the residual factor becomes smaller (Denison 1962, 1967; Jamison & Lau 1982; Hector Correa 1970; Hicks 1980; Walter & Robinson

1983; Otani & Villanueva 1990; Lau, Jamison, Liu & Rivkin, 1993).

However, this output growth estimation method requires a long time series and an accurate choice of production model. For example, by choosing Cobb-Douglas production function, the estimated regression model is as follows:

$$\ln Y_t = \beta_0 + \beta_1 \ln K_t + \beta_2 \ln L_t + \mu \quad (4)$$

with Y being the output, K the capital value and L the labour quantity. To obtain TFP growth, the value of capital growth rate ( $G_K$ ) and labour growth rate ( $G_L$ ) has to be available. Elasticity value of capital ( $\beta_1$ ) and elasticity value of labour ( $\beta_2$ ) when multiplied with capital growth rate and labour growth rate will result in the value of the contribution of each of these two inputs to the output growth. The residual from the contributions of the two inputs will give the TFP growth or:

$$\text{Growth in } TFP = G_Y - \beta_1 G_K + \beta_2 G_L \quad (5)$$

#### DEA Approach

DEA is a linear mathematical programming model to evaluate efficiency and productivity. The DEA method allows researchers to use panel data to estimate TFP and divide it into two components - technological change and changes in technical efficiency.

TFP growth measures productivity improvements or deterioration over time. TFP will increase as the industry uses new discoveries such as better design or the discovery of better processing methods. This change is known as technological change (TECHCH). TFP can also increase when the industry uses existing technology and economic inputs more efficiently, i.e. by using the same amount of inputs of capital, labour and technology to produce more output. In this situation, the industry will experience an increase in technical efficiency changes (EFFCH). Thus, TFP growth or change from year to year is comprised of technological change and changes in technical efficiency.

Fare et al. (1994) argue that Malmquist productivity index can be defined as geometric mean of two quotients for output distance function as follows:

$$m_o(y_{t+1}, x_{t+1}, y_t, x_t) = \left[ \frac{d_o^{t+1}(y_t, x_t)}{d_o^{t+1}(y_{t+1}, x_{t+1})} \times \frac{d_o^t(y_t, x_t)}{d_o^t(y_{t+1}, x_{t+1})} \right]^{\frac{1}{2}} \quad (6)$$

The equation above represents productivity for production point  $(x_{t+1}, y_{t+1})$  compared to production point  $(x_t, y_t)$ . This index uses technology during time period  $t$  and technology for time period  $t+1$ . TFP growth is the geometric mean for two Malmquist-TFP indices based on output for time period  $t$  to time period  $t+1$ . Values more than one indicates positive TFP growth for time period  $t$  to time period  $t+1$ . On the other hand, valueless than one indicates negative TFP growth, or a decline in performance compared to the previous period.

Malmquist Index for change in or growth of TFP (TFPCH) is the product of EFFCH multiplied with TECHCH which can be presented as (Cabanda, 2001):

$$\text{TFPCH} = \text{EFFCH} \times \text{TECHCH} \quad (7)$$

Therefore, the Malmquist productivity change index can be presented as:

$$M_o(y_{t+1}, x_{t+1}, y_t, x_t) = \text{EFFCH} \times \text{TECHCH} \quad (8)$$

The change in technical efficiency (catch-up) measures changes in efficiency between time periods of now ( $t$ ) and after ( $t+1$ ), and technological change (innovation) indicates change in the frontier.

As presented by Squires and Reid (2004), technological change is the new production development or new technological development that enables improved production methods and consequently move the production frontier upwards. Specifically, technological change includes new production processes i.e. innovation and the development of new products i.e. product innovation. Through innovation, firms have succeeded in finding more efficient methods to produce existing products, resulting in a higher expansion in output relative to the increase in input.

Innovation also open the doors to new, more efficient methods in production which decreases average cost of production. Changes in technical efficiency, meanwhile, refers to the more efficient use of existing capital, labour and other economic input to produce more output. A good example is improvements in skills. Experience can also help improve efficiency levels.

This method requires the utilisation of firm's data to obtain better results. This is because the aggregate data cannot segregate the difference in technology used by each firm, assuming that firms in the same industry use the same technology. In reality, they are not homogenous as assumed by the DEA. Nonetheless, difficulties in obtaining data have prompted many researchers use aggregated data.

#### Stochastic Frontier Approach

Typically, the stochastic production frontier model is used to estimate technical efficiency. The estimated model is based on either the Cobb-Douglas or translog production function. In general, the Cobb-Douglas production function is as follows:

$$Y = AX_1^\alpha X_2^\beta \quad (9)$$

Assuming that  $\alpha + \beta = 1$  or  $\beta = 1 - \alpha$ . The equation above can also be given a more general meaning, i.e.  $\alpha + \beta = 1$  can also mean  $\alpha + \beta > 1$  or  $\alpha + \beta < 1$ . This function can also take a broader generalisation such that is not limited to only two inputs. For example, with inputs  $X_1, X_2, \dots, X_n$ , this equation can be:

$$Y = AX_1^\alpha X_2^\beta \dots X_n^\sigma \quad (10)$$

In the form of logarithm function (9), it can be written as the following:

$$\ln Y = \ln A + \alpha \ln X_1 + \beta \ln X_2 \quad (11)$$

And equation (10) can be written as:

$$\ln Y = \ln A + \alpha \ln X_1 + \beta \ln X_2 + \dots + \sigma \ln X_n \quad (12)$$



Efficiency of output is attained when a firm produces at a frontier level i.e. by estimating the production function from a sample or from a firm that has the best performance. For samples or firms operating below the frontier, they are regarded as inefficient. This means that increasing efficiency or productivity requires an improvement on the current technology used or enhancements in employee skills through the attainment of higher levels of education to enable existing technology to be used more efficiently. Studies which used the stochastic frontier production model include Farrell (1957), Aigner and Chu (1968), Aigner et al. (1977), Kumbhakar et al. (1991), Greene (1992), Coelli (1992, 1994) and Battese and Coelli (1995).

In general, the stochastic frontier production model is meant to examine the relationship between output and input use. In this approach, a model of inefficiency is also designed to determine the effects of technical inefficiency. Both efficiency and inefficiency models are estimated simultaneously (Coelli, 1996; Coelli, et al. 1998). A stochastic frontier production function model based on the Cobb-Douglas function can be presented as follows:

$$\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \dots + \beta_n \ln X_{ni} + v_i - u_i \quad (13)$$

Where:

- $\beta_i$  is the estimated parameters
- $Y_i$  represents the output for sector  $i$
- $X_{1i}$  represents input 1 for sector  $i$
- $X_{2i}$  represents input 2 for sector  $i$
- $X_{ni}$  represents input up to  $n$  for sector  $i$
- $u_i$  is the random variable and is assumed to be independent and normally distributed,  $N(0, \sigma^2_u)$ .

$u_i$  is the random variable which is not negative and it refers to the effects of technical inefficiency.  $u_i$  is assumed to be independent with truncation (in attribute) for normal distribution with mean,  $\mu_i$  and variance  $\sigma_u$ . The mean value of technical inefficiency for each of these firms,  $\mu_i$  can be represented by the following equation:

$$\mu_i = \delta_0 + \Sigma \delta_i \ln Z_i \quad (14)$$

Where:  $Z_i$  represents the observation value vector for descriptive variable

All coefficients  $\beta_i$  and  $\delta_i$  are unknown parameters to be estimated by both models. The variance parameter for this model is written as follows:

$$\sigma^2_s = \sigma^2_v + \sigma^2 \text{ and } \gamma = \sigma^2 / \sigma^2_s \quad (15)$$

with parameter gamma,  $\gamma$  having values between zero and one (Coelli and Battese, 1995; Coelli, et al. 1998). Next, the technical efficiency (TE) of production for each firm is obtained from the following equation:

$$TE = \frac{Y_i}{\exp(x, \beta)} = \frac{\exp(x, \beta, -u_i)}{\exp(x, \beta)} = \frac{\exp(-u_i)}{\exp(x, \beta)} \quad (16)$$

The technical efficiency index obtained has the value between zero and one and it is conversely related with inefficiency effects. According to Coelli and Battese (1995), inefficiency model estimation can only be done if the inefficiency effects are stochastic and have some distribution specifications (Coelli, 1996; Coelli et al., 1998). Hypothesis testing for the parameters of the stochastic frontier model and inefficiency model can be carried out through a statistical test of *generalised likelihood - ratio*,  $\lambda$ , estimated as:

$$\lambda = -2 \ln [\lambda(H_0) - \lambda(H_1)] \quad (17)$$

with  $\lambda(H_0)$  and  $\lambda(H_1)$  each representing a value of likelihood function below the null hypothesis,  $H_0$  and alternative hypothesis,  $H_1$ . Hypothesis testing is conducted to determine the impact of inefficiency on the model.

The *maximum likelihood (ML)* estimation method is used for simultaneous estimations of the stochastic frontier equation model (13) and technical inefficiency model inequation (14). Estimations can be done using the programme FRONTIER Version 4.1 (Coelli, 1996). To measure efficiency, the value  $\sigma^2$  is in the null hypothesis,  $H_0: \sigma^2=0$  versus  $H_1: \sigma^2>0$ . If the null hypothesis is accepted, then there is no technical inefficiency in the production process. This also means that all firms are operating efficiently. Conversely, if the null hypothesis is rejected, this means that there are firms which are operating in an inefficient manner and that

the production function frontier is better than the average production function in analysing industrial production processes. The value of technological improvement can be obtained by taking the output elasticity value to time. TFP growth is the sum of technical efficiency and technological development.

### Contributions of TFP to the Economic Growth of Malaysia

As we progress towards achieving the vision of being an industrialised country by 2020, the performance of the Malaysian economy needs to be at par with that of other industrialised countries. Table 1 and Figure 1 compare the contribution of TFP growth in Malaysia with that of selected New Industrial Countries (NIC). Based on the results contained in Table 1, Malaysia registered moderate GDP growth rates from 2000 to 2012. Nevertheless, the growth rate remains higher compared to other NICs, such as South Korea and Hong Kong. Singapore registered the

growth rate at 5.8 percent, followed by Indonesia with a growth rate of 5.4 percent. However, in terms of TFP growth, Malaysia recorded a lower percentage (1.6%) as compared to NICs, and Singapore (1.9%), South Korea (1.8%) and Hong Kong (2.5%). Malaysia's TFP growth is only ahead of Thailand (1.5%) and Indonesia (1.10%).

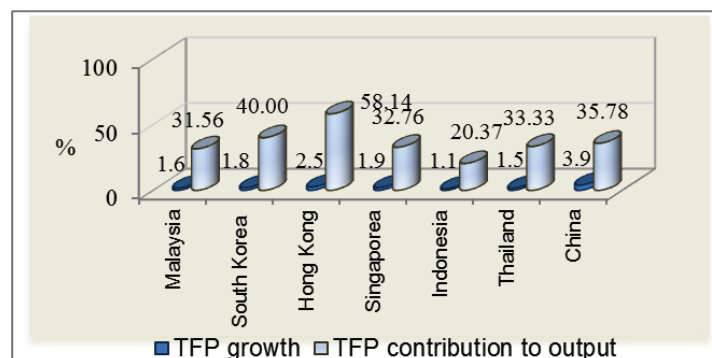
Figure 1 shows that Malaysia is behind in terms of the contribution of TFP growth to output growth, registering only 31.56% as compared to the NICs such as Hong Kong (59.14%), South Korea (40.0%) and Singapore (32.76%). Even countries such as Thailand has a higher contribution of TFP to output growth (33.33%) compared to Malaysia. China as an emerging economy recorded a significant GDP growth rate of 10.90% with a TFP growth rate of 3.90% and TFP contribution to output of 35.78%. Therefore, to achieve its vision of becoming an industrialised country, Malaysia needs to compete with the NICs and outperform regional neighbours in TFP growth.

**Table 1: Comparison of sources of economic growth in selected countries, 2000-2012**

Countries	Period 2000-2012						
	Sources of economic growth (%)				Contribution to GDP (%)		
	GDP	Labour	Capital	TFP	Labour	Capital	TFP
Malaysia	5.07	1.47	2.00	1.60	29.11	39.34	31.55
South Korea	4.50	1.00	1.70	1.80	22.22	37.78	40.00
Hong Kong	4.30	0.80	1.00	2.50	18.60	23.26	58.14
Singapore	5.80	2.70	1.20	1.90	46.55	20.69	32.76
Indonesia	5.40	1.20	3.10	1.10	22.22	57.41	20.37
Thailand	4.50	1.40	1.60	1.50	31.11	35.56	33.33
China	10.90	0.90	6.10	3.90	8.26	55.96	35.78

Source: MPC Productivity Report 2013

**Figure 1: TFP growth and contribution of TFP to output in selected countries, 2000-2012**



The contribution of TFP growth to the growth of the Malaysian economy was addressed in the RMK-6 report. From Table 2, for the period 1999-2003, TFP growth contributed 1.88 percent of GDP growth of 5.24 percent during the period. This contribution increased to 2.14 percent of GDP growth for the period 2004-2008. The largest contributor to the growth of the Malaysian economy is capital input for all of the periods mentioned. However, the contribution of labour input growth remains relatively small at around 1.5 percent, while the contribution of TFP growth dropped to just 0.76 percent for the period 2008-2012.

Between the years 2004-2008, TFP growth in Malaysia was due to five main factors: human capital development, technological progress, economic structure, capital structure and intensity of demand (MPC, 2008). Out

of these, the three most important factors contributing to the growth of TFP are the intensity of demand, followed by capital structure and human capital development. Although technological advancement is among the core elements in national policy, its contribution to TFP growth was lowest among these factors.

## The Results

### Contributions of Technology to the Growth of TFP

According to the DEA and stochastic frontier approaches, two important components contributing to the growth of TFP are technical efficiency and technological change. To observe the contribution of these components to TFP growth, data for Malaysia between the years 1970-2007 were used. Results of the estimations are reported in Table 3 below:

**Table 2: Growth in labour, capital, TFP and output**

Period	Growth in (%)			
	Labour	Capital	TFP	GDP
1999-2003	1.22	2.18	1.88	5.24
2004-2008	1.58	2.27	2.14	6.98
2008-2012	1.49	2.00	0.76	4.25

Source: MPC Productivity Report, 2008 and 2013

**Table 3: Technical efficiency, technological change and TFP growth in Malaysia, 1971-2007**

Period	Technical efficiency	Technological change	Growth in TFP
1971-1985	0.915	1.104	1.011
1986-1998	1.026	0.963	1.018
1999-2007	0.979	1.062	1.061
Overall 1971-2007	0.964	1.042	1.033

Source: MPC Productivity Report, 2008 and 2013

Overall, between the years 1971 and 2007, the contribution of technological progress to TFP is higher than technical efficiency. This applies for the periods 1971-1985 and 1999-2007. It was only for the period 1986-1998 that the contribution of technical efficiency exceeded that of technological advancement. This period contained two episodes of economic crises i.e. 1985/86 and 1997/98. This may explain the difference recorded in this period compared to the other periods. The economic crises hindered technological progress with foreign investors pulling funds out from the country, resulting in fewer purchase of new machinery and equipments. Nevertheless, this compelled the production sector to find ways to operate with greater efficiency by employing new production strategies to reduce input while maximising output. The economic uncertainty has also encouraged producers to intensify their efforts to stem the losses and regain their previous performance levels.

Although the MPC (2008) reported the contribution of TFP growth to Malaysia's economic growth, it lacked statistical facts in

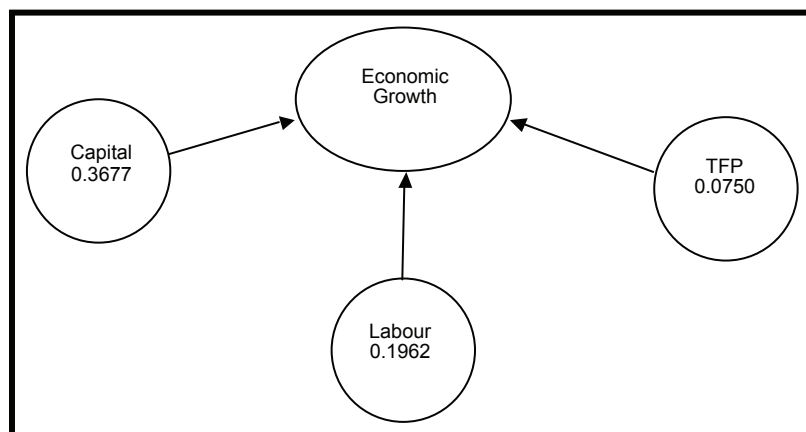
its discussions. The MPC data reports only the percentage contribution of each input including TFP. To fill this gap, the economic growth model of Malaysia was estimated using the TFP value obtained through the DEA approach and the outcomes are as follows:

$$\ln Y = -2.2246 + 0.3677 \ln MOD + 0.1962 \ln BURUH + 0.0750 TFP$$

(-4.1709)\*\*\* (5.4518)\*\*\* (7.0122)\*\*\* (2.0690)\*\*  
 $R^2 = 0.9968$

Where: Y is the GDP, MOD representing capital, labour represents the number of workforce and TFP is the growth of total factor productivity. The study found that TFP is a significant contributor to the economic growth of Malaysia. However, it is still much less influential relative to other inputs of production namely labour and capital. Capital elasticity was found to be the highest, supporting the findings by MPC which indicated that capital is the most important contributor to the economic growth of Malaysia. The contribution of factors including TFP growth towards economic growth of Malaysia is illustrated in Figure 2 below:

**Figure 2: Elasticity of Output to Input**



### Determinants of TFP Growth

To observe the determinants of TFP in detail, a regression model was estimated using annual TFP growth data. This data was obtained from the DEA approach and used as a dependent variable. The estimation result is as below;

$$TFPG = -4.409 + 0.000186MOD + 0.3588MOG + 4.3370EXM + 0.5260TER$$

(-2.5811)\*\* (2.6987)\*\* (2.2888)\*\* (2.9150)\*\* (0.4338)

$$+ 3.9774FOC$$

(3.8222)\*\*\*

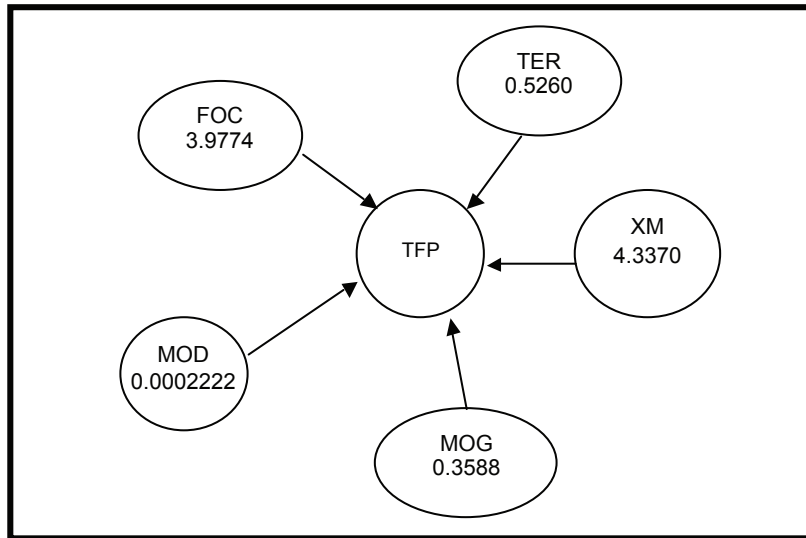
R<sup>2</sup>=0.8118

Where: TFPG being the growth in total factor productivity, MOD is the capital to GDP ratio, MOG is the output growth of the manufacturing sector, EXM is the ratio of export plus import to the GDP, TER is the percentage of workforce with tertiary education and FOC is the percentage of companies with

foreign ownership. The most important factor contributing to the growth of TFP in Malaysia is manufacturing output growth, followed by the percentage of foreign-owned companies. The percentage of workers with tertiary education is not significant despite having a positive and the highest coefficient.

The ratio of trade to GDP and the percentage of foreign-owned companies are highly related to the development and transfer of technology. Technology can develop more rapidly either through transfer of technology or technology development in companies involved in imports and foreign-owned companies. These entities also record higher efficiency in input use due to the presence of local and foreign expertise in these companies. Figure 3 describes the role of each factor in determining TFP growth.

**Figure 3: Determinations of TFP growth**



## Conclusions

Overall, economic growth in Malaysia has been dependent on capital and labour input, while TFP contribution remains small. TFP is determined by various factors with the most important ones being the export-import ratio to GDP and the percentage of foreign-owned companies operating in the country. Output growth of the manufacturing sector is also an important factor in TFP growth.

These findings imply that Malaysia needs to augment TFP growth to increase its contribution to output growth. TFP growth is essential as it involves efficiency in input use and this is related to reducing the cost of production. One of the more important steps is to improve technical efficiency in the usage

of production factors. There are a number of methods to do this. One of the most common measures is to improve labour efficiency which can be done by increasing training. The quality labour input is of great importance since it is more effectual than its quantity.

For capital, its efficiency can be improved through better management. The purchase of more suitable machinery can facilitate this. Efficiency in using machinery and equipment is closely related to the skills of available labour. A worker equipped with better skills can handle machines more efficiently and maximise output. Although acquisition of state-of-the-art machinery and equipment is one of the methods to improve technology, capital input efficiency and technological progress are also needed to increase TFP growth.

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# ESTIMATING MALAYSIA'S OUTPUT GAP: HAVE WE CLOSED THE GAP?<sup>1</sup>

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## Abstract

This paper reviews various methods of estimating the output gap, and applies three different estimation methods to the Malaysian economy – the univariate method, the multivariate method and the structural method. Each competing model has its own strengths and drawbacks. Therefore, the different estimates of the output gap can be used for cross-checking to ensure robustness of the findings and to contribute to a more rigorous understanding of the economy's potential output and output gap. In contrast, the model-based multivariate filter ensures consistency between estimated potential output and observed key values of macroeconomic variables including inflation and non-accelerated inflation rate of unemployment (NAIRU). The findings of the paper show that all the three methods produce similar quarterly time profiles, with output gaps turning marginally positive in 2014. However, model-based multivariate filter suggests that the unemployment gap and capacity utilisation gap to reach their equilibrium level sometime in 2017 in tandem with the closing of the output gap. Furthermore, the inflation equation improves when any of the output gap estimates is included. This suggests that all the output gap estimates helps to predict price trends.

## Introduction

Potential output is the maximum level of goods and services that an economy can produce when it is most efficient or at its full capacity production. The deviation of actual output (GDP) from its potential output is known as output gap or business cycles. Policymakers

closely monitor the potential output and output gap for two main reasons. First, the estimates of potential growth not only inform policymakers of the long-term sustainable growth rate of the economy but also the underlying drivers of growth. Second, the output gap reflects the extent to which economic resources are being overutilised or underutilised, and therefore, provides insights into demand-driven price trends. When the output gap is positive, prices begin to rise as the strong demand in the economy exerts an upward pressure on prices. Since the economy is now operating above its full capacity, the unemployment rate will be lower than its non-accelerated inflation rate of unemployment (NAIRU). In contrast, a negative output gap suggests that there is slack in the economy and prices will be weak. Due to the weak demand in the economy, unemployment rate will rise above its NAIRU.

The recent study on Malaysia's potential output by the Central Bank of Malaysia (2012) estimated potential output using the production function approach.<sup>4</sup> Under such an approach, the growth in the potential output is driven by the factors of inputs such as capital, labour and total factor productivity within a growth accounting framework. An advantage of this approach is that it can identify the sources of medium and long term growth which can help to stimulate policy debates. However, there have been developments of numerous methods in estimating the output gap in literature (Table 1). The estimation of potential output and output gap has since evolved from simple linear trends to more sophisticated estimation techniques which incorporate economic relationships, and thus are able to capture the dynamics and drivers of potential output.

<sup>1</sup> The partial results of these estimation methodologies are published as a box article in Bank Negara Malaysia Annual Report 2013.

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<sup>4</sup> Bautista (2002) specifically used generalised Hamilton method and Lee and Khatri (2001) used cubic spline-smoothing method in estimating Malaysia's potential output.

**Table 1: Various Estimation Methods**

Methods	Estimation Methods
Univariate Methods	<ul style="list-style-type: none"> <li>• Linear Trend</li> <li>• Univariate State Space</li> <li>• Hodrik-Prescott (HP)</li> </ul>
Multivariate Methods	<ul style="list-style-type: none"> <li>• Multivariate Kalman Filter (MVKF)</li> <li>• Multivariate Filter (MVF)</li> </ul>
Structural Methods	<ul style="list-style-type: none"> <li>• Structural Vector Autoregression (SVAR)</li> <li>• Cobb-Douglas Production Function (CDPF)</li> </ul>

The objectives of this paper are three fold: First, to estimate Malaysia's potential output and output gap using three main estimation techniques such as the (i) univariate methods, (ii) multivariate methods and; (iii) structural methods. In doing so, the various estimation results can be used for cross-checking and therefore, contribute to more rigorous understanding of the economy's potential output and output gap. Second, to evaluate the predictive power of these various output gaps in estimating the inflation. The assessment will identify which of the output gap estimates contain useful information for price trends. Third, to exploit the results of Cobb-Douglas production function (CDPF) method in such that we can estimate Malaysia's growth trajectory and optimal level of labor, capital and total factor productivity. In addition, the results of SVAR method can determine the source of inflationary pressure in the economy, either demand pull inflation or cost push inflation.

There are five main conclusions that can be derived from our findings: (i) the output gap profiles produced by the different estimation methods are broadly similar especially in displaying similar time period for troughs and peaks. The main difference is seen in the size of the various output gap estimates, (ii) all the methods show that the economy is growing close to its potential and hence, the size of its estimated output gaps are small in 2014, (iii) the multivariate filter shows that unemployment gap and capacity utilisation gap to reach their equilibrium level sometime in 2017 in tandem with the closing of the output gap. The SVAR method shows that the source of inflationary pressure can be attributed to supply shocks

during Asian Financial Crisis (AFC) and demand shocks during Global Finance Crisis (GFC) and; (iv) the output gap estimates produced by all the methods have predictive power for inflation trends. However, the univariate filter and multivariate filter output gap estimates provide the biggest improvements to the inflation forecast.

The structure of the paper is as follows: Section 2 reviews existing literatures on different techniques used in estimating individual country's output gap. Section 3 describes the data and methodologies used in this paper. Section 4 analyses the results and assesses the predictive power of the competing output gap estimates for inflation and finally Section 5 concludes.

#### Stylised Facts about Malaysia's Growth Trend

Malaysia's growth slowed after the two major Crisis, AFC 1997/98 and GFC 2008/09, from an average of 8.7%, pre-AFC (1996-1997) to an average of 5.1% post-GFC (2011-2013) (Figure 1). Looking back at past experiences, it appears that growth moves to a lower trajectory after a major economic shock as the shock seems to have a permanent effect on the level of potential output.<sup>5</sup> How large this effect will be is uncertain as it will depend on the amount of growth "lost" during the crisis and the time needed for the economic activity to converge to its long-term path. However, experiences point to a possibility of a permanent loss in output as a result of greater risk aversion in the financial markets or lower investments in research and development (R&D). While growth did not appear to have returned to the pre-2008 growth rates, inflation rates remained broadly stable. Inflation during pre-AFC was an average of 3.2% and has declined to 2.3% post-GFC.

<sup>5</sup> The conclusion is supported by Abiad et al. (2009) and Isnawangsih et al. (2013) who provide evidence suggesting a permanent loss in the output as a result of an economic crisis. Abiad et al. (2009) looks at 88 banking crises over the past four decades across high, middle and low income countries with exception to Malaysia while Isnawangsih et al. (2013) provides output trajectories in the ASEAN-4 (Indonesia, Malaysia, the Philippines and Thailand) after Global Financial Crisis.

Therefore, tentative estimates of the size and the duration of the output gap can provide useful insights for policy makers. The European Central Bank (ECB) uses the output gap as a key indicator to measure inflation, growth of potential output as the point of reference for M3 and potential output to design the short and medium term fiscal policies (Horn et.al, 2007). Benes et al. (2010) stated that central bankers should estimate the size of the output gap so that an appropriate degree of monetary ease can be maintained. Unfortunately, the output gap and potential output are difficult concepts to grasp, both theoretically and empirically. These are unobserved variables that can be estimated using different assumptions and from a range of various competing models.

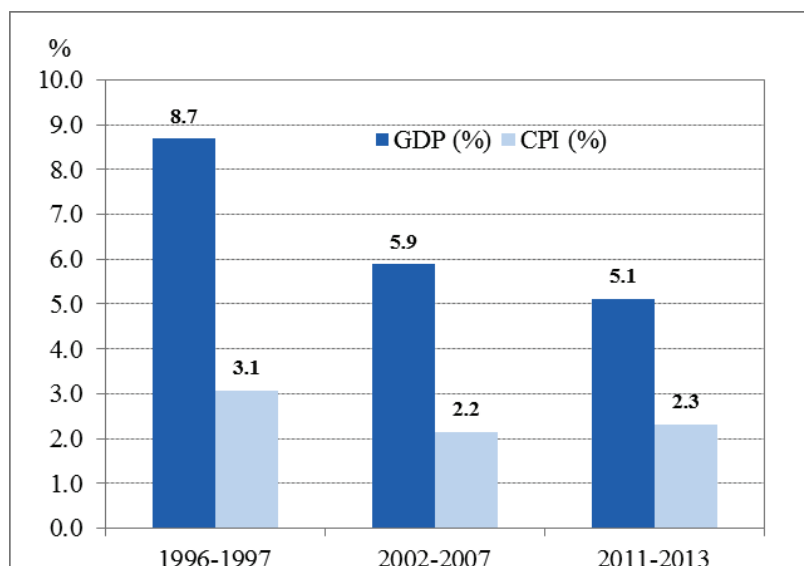
#### Literature Review

Literature shows that there is no ideal method for measuring potential output and output gap. As such, studies usually employ different methods instead of relying on a single measure. They compare the estimation techniques and draw comparisons on the strengths and weaknesses of each model.

Most studies show that the estimation of output gap depends on the choice of the model, the assumptions for the model and the sample period of estimation. As such, the literature survey is consistent in pointing out the differences in output gap estimates produce by different models. This highlights the complexity of the different techniques and underscores the degree of uncertainty surrounding the potential output estimates.

Brouwer (1998) use five techniques to estimate Australia's output gap namely, linear time trend, Hodrick-Prescott (HP) filter trend, multivariate HP filter, unobserved components model and the production function model. His findings show that there are similarities in the patterns of the output gaps but divergence in terms of the size of the output gap estimates. The multivariate HP filter which incorporates economic relationships into the estimation of the output gap provides the smallest output gap estimate while the linear trend model which assumes a constant trend produces the largest output gap estimate. In prediction inflation, he finds that the output gap estimates from the HP filter and the production function perform the best in prediction inflation.

**Figure 1: Gross Domestic Product (GDP) Growth and Consumer Price Index (CPI)**



Cheng, Chung and Yu (2011) also explored four different estimation approaches for the Hong Kong economy. The four estimation methods include the production function approach (structural method); the Kalman filter and the IMF multivariate filter approaches (multivariate filter method) and the Hodrick-Prescott (HP) filter (univariate filter method). Cheng et al. find the IMF filter to perform relatively better compared to the other methods particularly in terms of robustness to data revisions. However, the Kalman filter output gap estimate is more informative about inflationary pressures, while the IMF filter shows no clear advantage over other methods.

Brouwer (1998) and Cheng et al. (2011) conclude that there is no one particular method which is superior to the other in predicting price trends. Consistent with Brouwer (1998) and Cheng et al.'s (2011) findings, Bjornland, Brubakk & Jore (2005) also find both multivariate and structural methods equally good in predicting inflation for Norway. Similarly, Bjornland et al. (2005) finds univariate methods (Hodrick-Prescott filter, band pass filter), structural methods (production function method and structural vector autoregression (SVAR) method) and multivariate unobserved component method (MVUC) all produce the same historical output gap trends with differing magnitudes.

Menashe and Yakhin (2004) focus on structural methods namely, the production function and the structural vector autoregression (SVAR) in estimation of Israel's output gap. They found that output gap estimates of the production function and SVAR methods compared with the HP method are better in providing consistent estimates and in predicting inflation. In addition, the results from the SVAR model show that the business cycle in Israel in 1990s was due to supply shock (influx of immigrants) and the recession in 1996 was due to demand shocks.

While Menashe and Yakhin (2004) presents the merits of the structural models in predicting inflation, Konuki (2008) show that the multivariate Kalman filter explains the historical dynamics of the labour market better and hence, produces a more plausible output gap measure for Slovakia. The more "sensible" estimates produced by the multivariate Kalman filter is due to the construction of the model which takes into consideration the interaction between the output gap and wage pressures in the labour market. In doing so, the model is able to produce consistent estimates of excess demand.

Benes et al. (2010) developed a model estimating the potential output and the output gap in the framework of a small macroeconomic model. This model is built around the economic relationships of actual output and potential output, unemployment, headline inflation and capacity utilisation in the manufacturing sector. In this sense, the model ensures consistency between the estimates of the output gap and the dynamics in the labour and product market. Babihuga (2011), adapting the Benes et al. (2010) model, is able to analyse the dynamics of cyclical unemployment and equilibrium unemployment in Sweden in relation with the country's labour market reforms and potential output growth.

The model has the flexibility which allows the estimated potential output growth to vary with the new information and at the same time taking into account the long-run stable trends in the macro series, adaptable to many countries (Benes et. al, 2010)<sup>6</sup>. To this date, this is the latest dynamic macroeconomic model that was developed to estimate output gap. Cheng (2011), Scott and Weber (2011), Babihuga (2011) and Bokan (2012) have adapted the Benes et al.'s (2010) model for their respective studies.

<sup>6</sup> Details of the macroeconomic-based multivariate filter model will be discussed in Section 3.0 which focuses on data and methodology.

In the context of Malaysia, the Central Bank of Malaysia (2012) adopted the production function method to estimate the output gap. Its findings show that Malaysia's potential output growth in 2013 is estimated to be in the range of 5%-5.5% with the output gap remaining small. Bautista (2002) adopted a generalised Hamilton model for four Southeast Asian countries including Malaysia. The model which decomposes actual growth into trend and cycle assumes that the trend component will evolve according to a two-state Markov process. The output gap profiles estimated are quite similar to the Central Bank's estimates except for the period of the AFC (1998/99) where the output gap remained positive. As such, Bautista's results suggest that the potential output slowed significantly during this period causing the output gap estimates to remain positive. The output gap estimate tested in a simple backward-looking Phillips curve show a positive and significant relationship between the output gap and inflation.

Lee and Khatri (2001) use the cubic spline smoothing method and their findings show that that Malaysia's output gap would close toward end of 2000 or early 2001. Anand, Cheng, Rehman and Zhang (2014) in a more recent study on potential growth in emerging Asia show that the potential growth of ASEAN-5 countries which include Malaysia is significantly below the pre-AFC level. The declines are caused by reasons such as structural impediments which hampers productivity growth. In Malaysia's case, they find that governance and education are areas which could negatively impact the total factor productivity growth in recent years. The estimates of the paper are produced by three different approaches, namely, the model-based filter, univariate filters (Hodrick-Prescott, Baxter-King and Christiano-Fitzgerald filters) and the production function approach. Consistent with the findings in literature, the estimated potential output growth profiles are similar but its magnitude of growth differs.

Examining the differences in the estimates from different models is not an easy task as no exhaustive comparisons have been done in literature. Furthermore, the estimates of certain

models are often unique to a single country. Therefore, a particular model may produce output gap measures that can explain better evolution of an economy and may be less useful for another. While country comparisons may be difficult, what is evident from literature is that most studies adopt a variety of estimation methods to estimate the potential output and its gap. They recognise the benefit of having a set of diverse results as this will provide a greater scope for cross-checking of diagnostics. Also, by construction, different methods have different strengths and weaknesses. Hence, the paper adopts a range of estimation methods in estimating Malaysia's potential output. In doing so, it contributes to literature by extending the research on estimating Malaysia's potential output as well as further stimulates discussions on this area of research.

#### Methodology and Data

The estimation of potential output and its gap can be classified into three broad categories: First, the univariate filters including linear trend, univariate state space and Hodrick-Prescott approaches are purely statistical filters that decompose GDP growth into its trend and cycles. Second, the multivariate filters including multivariate filter and multivariate Kalman filter estimate the long-term growth that is consistent with NAIRU and stable inflation. Third, the structural method of CDPF estimates the potential output growth using factor inputs of labor, capital and total factor productivity. SVAR is also another structural method that breaks down random disturbances into permanent and transitory components.

Data: Quarterly data from 1995Q1-2013Q4: Real Gross Domestic Product (GDP), Consumer Price Index (CPI 2005=100), capital stock and labour force data are obtained from the Department of Statistics Malaysia (DOSM), CEIC Co. Ltd and Haver Analytics. Top 10 trading partners<sup>7</sup> real GDP is obtained from CEIC Co. Ltd. Nominal unit labor cost is from Bank Negara Malaysia database. Commodity prices data is obtained from the International Monetary Fund (IMF) database.

<sup>7</sup> Malaysia's major trading partners are China, Denmark, Hong Kong, Indonesia, Japan, Korea, Singapore, Thailand, USA and others are listed on The Official Portal of Malaysia External Trade Development Corporation, MATRADE.

### Univariate Method

The univariate methods or statistically-based methods are purely statistical procedures that decompose or filter the GDP into its cyclical/ noise and trend components. The advantage of using univariate methods is that it is simple, transparent and uses the information inherent only in GDP time series. However, this method does not impose any economic structure to the trend estimates nor incorporate any economic theory that link potential output or output gap to other relevant variables such as inflation or unemployment. This limits the economic interpretation of its results and the analysis of the underlying behavior in the economy. Moreover, univariate methods suffer from end-of sample bias<sup>8</sup> and structural break problems<sup>9</sup>.

### Linear Trend

Linear trend method is the simplest form of estimation technique to extract the trend. The real GDP is regressed on the time variable component which is assumed to increase at a constant rate throughout the sample period. Hence, this is the drawback of this method since for developing countries in particular; the potential output growth may increase as the economy continues to develop.

$$\text{Real GDP} = \beta_0 + \beta_1 * (\text{Time}) + \varepsilon_{1t} \quad (1)$$

Univariate Hodrick-Prescott (HP) Filter  
This is a widely used smoothing procedure to estimate potential output under the assumption that growth component will vary smoothly over time (Hodrik and Prescott, 1997). In this method, the real output is the sum of a trend (potential output) and cyclical component (output gap).

$$Y_t = Y_t^* + C \quad (2)$$

where  $Y_t = \text{Real GDP}$

$Y_t^* = \text{Potential Output}$

$C = \text{Output Gap}$

The idea is to find the value of potential output,  $Y_t^*$  that minimises the deviation between actual output and its potential subject to a constraint on the extent to which potential output growth can vary.

$$\text{Min } L = \sum_{t=1}^T c_t^2 + \lambda \sum_{t=2}^T (\Delta y_t^* - \Delta y_{t-1}^*)^2 = \sum_{t=1}^T (y_t - y_t^*)^2 + \lambda \sum_{t=2}^T (\Delta y_t^* - \Delta y_{t-1}^*)^2 \quad (3)$$

The advantage of HP filter is that it is widely used, straightforward and simple to implement since the only data needed is the real GDP. Furthermore, it has the flexibility to make the output gap stationary for a wide range of smoothing values and allows trends to change over time. However, it is difficult to choose  $\lambda$ , the smoothing parameter and usually it is arbitrary. In this paper, we will use the international standard of  $\lambda = 1600$  for quarterly frequency observations. Another disadvantage of this filter is that the variations in actual output at the beginning of the period and at the end of the period affect more the level of potential output than the rest of the period due to the end-point bias Bjornland et al. (2005).

### Univariate State Space

The univariate state space is a technical method that estimates the unobserved variables such as trend component and cyclical component from the observed variables. This model needs to be specified in the state space form since it is a dynamic system model whereby, the observed variable is defined as a function of the unobserved state variables and these unobserved state variables are supported by other separate transition equations. The Kalman filter recursive algorithm will take the initial values of these unobserved state variables, guesses its subsequent values and update these guesses based on the prediction errors. This process will continue until all the observations are utilised to produce the best estimators of unobserved state vectors.

<sup>8</sup> The trend is estimated using two-sided-moving averages meaning that the future values are used to estimate the current trend value and this create a problem at the end of the sample when no future value can be inferred (Bjornland et al., 2005)

<sup>9</sup> The structural break problems spread the impact of a break to many other periods which will amplify the magnitude of potential output in these periods instead of restricting the impact only to the period when the break occurs (Almeida et al., 2006)

In this paper, the univariate state space decomposes log of seasonalised real GDP into trend component, cyclical component, and additive noise nested model below. The specification is based on Harvey and Jager (1993).

$$y_t = \mu_t + \psi_t + \delta_t \quad \delta_t \sim NID(0, \sigma_\delta^2) \quad (4)$$

$$\mu_t = \mu_{t-1} + \beta_{t-1} + \eta_{nt} \quad \eta_{nt} \sim NID(0, \sigma_\eta^2) \quad (5)$$

$$\beta_t = \beta_{t-1} + \zeta_t \quad \zeta_t \sim NID(0, \sigma_\zeta^2) \quad (6)$$

$$\psi_t = \rho \cos(\lambda_c) \psi_{t-1} + \rho \sin(\lambda_c) \psi_{t-1} + \kappa_t \quad \kappa_t \sim NID(0, \sigma_\kappa^2) \quad (7)$$

$$\psi_t^* = -\rho \sin(\lambda_c) \psi_{t-1} + \rho \cos(\lambda_c) \psi_{t-1} + \kappa_t^* \quad \kappa_t^* \sim NID(0, \sigma_\kappa^2) \quad (8)$$

Where  $y_t$  is real GDP,  $\mu_t$  is trend component (output potential),  $\Psi_t$  is cyclical component (output gap),  $\beta_t$  is increase in potential output,  $\delta_t, \eta_t, \zeta_t, \kappa_t$  is additive noise and are mutually independent,  $\rho$  is the damping factor,  $\lambda_c$  is the peak of the spectral density corresponding to the period of  $2\pi/\lambda_c$ . In identifying the value of  $\rho$  and  $\lambda_c$  we follow Proietti (2002) in assuming that the reduced form of the cycle,  $\Psi_t$  is the ARMA (2,1) process:

$$(1 - \theta_1 L - \theta_2 L^2) \Psi_t = (1 - \rho \cos \lambda_c L) \kappa_t + \rho \sin \lambda_c \kappa_{t-1} \\ \theta_1 = 2\rho \cos \lambda_c, \theta_2 = -\rho^2$$

Solving these equations, we obtained  $\rho = 0.7$  and  $\lambda_c = 0.52$ . The advantage of this method is that it can be applied to non-linear system and multiple input and output system. However, it is very sensitive to model specifications including the initial values of the unobserved variables, estimation period and the estimated parameters  $\rho$  and  $\lambda_c$  (Anand et al., 2014).

### Multivariate Methods

The multivariate methods or semi structural methods treat the filtering problem as a dynamic system whereby blocks of economic equations that create economic structure are estimated simultaneously using certain statistical specifications. There are two multivariate methods presented here: (i) macro model-based multivariate filter and; (ii) multivariate Kalman filter. The main idea using these methodologies is that the variation in GDP is influenced by the variation in other key macroeconomic variables. For example, the multivariate filter strives to bring consistency between the estimated potential growth with

NAIRU and the stable inflation (Benes et al., 2010). The multivariate Kalman filter exploits information on excess demand in the labor market and product market as conditions to estimating potential output. The advantage of these methods is that it allows the data to talk more freely (Cotis et al., 2013). However, it lacks of transparency in a sense that the estimation process is not straight-forward and we cannot immediately dissect the relationship between various factors and trend growth (Anand et al., 2014).

### Multivariate Kalman Filter

This method follows Konuki (2008) specification that treats the filtering problem as a dynamic system in estimating potential output and the relevant parameters simultaneously. The idea is that the wage hike should give some information on the degree of excess demand in the labor market which is most likely due to the excess demand in the goods market. In this model, the specification of the dynamic system is written in the state space forms in which equation (9) is the signal equation and equations (10)-(13) are the transition equations.

$$Y_t = \bar{Y}_t + ygap_t \quad (9)$$

$$\bar{Y}_t = \bar{Y}_{t-1} + \mu_{t-1} + \bar{\varepsilon}_t^y \quad (10)$$

$$\mu_t = \beta \mu_{t-1} + (1 - \beta) \bar{\mu}_t + \varepsilon_t^\mu \quad (11)$$

$$ygap_t = \alpha_0 ygap_{t-1} + \alpha_1 ygap_{t-1}^f + \varepsilon_t^{ygap} \quad (12)$$

$$\Delta^2 ULC_t = \theta_0 + \theta_1 ygap_t + \varepsilon_t^w \quad (13)$$

Where  $Y_t$  is the log of seasonally adjusted quarterly real GDP,  $\bar{Y}_t$  is the potential output,  $ygap_t$  is the output gap,  $\mu_t$  is the quarter on quarter growth rate of potential output,  $\bar{\mu}_t$  is the fixed steady state rate of quarter on quarter growth,  $ygap_t^f$  is the export markets output gap,  $\Delta^2 ULC_t$  is the change in the growth rate of nominal unit labor costs. The error terms in Equation (9)-(13) are assumed to be independent and identical normally distributed.

The advantage of this method is the consideration of economic links between output gap and other economic indicators. The disadvantage is that the parameters estimate need to be initialise and the results are sensitive to the choice of starting values.



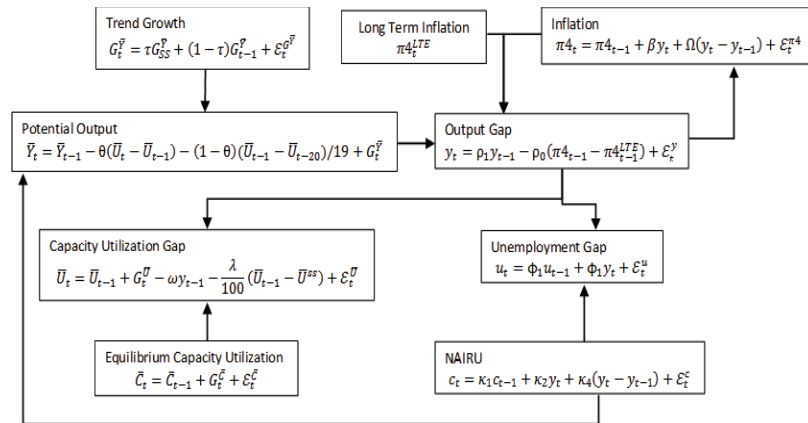
### Multivariate Filter<sup>10</sup>

The multivariate filter developed by Benes et al. (2010) is currently the most comprehensive and favorable method against other methods to estimate potential output and output gap. The model incorporates economic structure in such that the estimation of output gap depends on other blocks of equations specifically the prices block, the unemployment block and the capacity utilisation block (Figure 2). It exploits information from three gaps: output gap (unemployment gap and capacity utilisation gap). The idea is that there are close relationship among these variables specified in

three identifying equations: Inflation equation that relates output gap and future inflation (eq. 2), Okun's law that relates output gap and future unemployment gap (eq.4) and capacity utilisation equation that relates output gap and capacity utilisation (eq.6).

One of the advantages of this filter is that it is more robust to end-point revisions and estimates the potential output and the NAIRU simultaneously (Benes et al., 2010). However, as pointed out in other study, this method cannot be used for estimating the future trend growth since by construction it will converge to the assumed steady-state growth rate.

**Figure 2: The Interactions of Economic Theory to Estimate Output Gap**



Following Benes et al. (2010), we defined the following equations:

The output gap ( $y_t$ ) is defined as the log difference between actual output ( $Y_t$ ) and potential output ( $\bar{Y}_t$ ).

$$y_t = 100 * \text{Log} (Y_t/\bar{Y}_t) \quad (14)$$

The output gap ( $y_t$ ) affects the headline inflation ( $\pi_t$ ) in this augmented Philip's curve.

$$\pi_t = \pi_{t-1} + \beta y_t + \Omega (y_t - y_{t-1}) + \varepsilon_t^{\pi} \quad (15)$$

The unemployment gap ( $\mu_t$ ) = Equilibrium Unemployment/NAIRU ( $\bar{U}_t$ ) - Actual Unemployment.

$$\mu_t = \bar{U}_t - U_{t-1} \quad (16)$$

The output gap affects the unemployment gap.

$$\mu_t = \Phi_1 \mu_{t-1} + \Phi_2 y_t + \varepsilon_t^{\mu} \quad (17)$$

Capacity Utilisation Gap ( $c_t$ ) = Actual Capacity Utilisation ( $C_t$ ) - Equilibrium Capacity Utilisation ( $\bar{C}_t$ ).

$$c_t = C_t - \bar{C}_t \quad (18)$$

<sup>10</sup> See Benes et al. (2010)

The output gap ( $y_t$ ) affects the capacity utilisation gap ( $c_t$ )

$$c_t = K_1 c_{t-1} + K_2 y_t + K_4 (y_t - y_{t-1}) + \varepsilon_t^c \quad (19)$$

The stochastic process for equilibrium unemployment ( $U_t$ ) includes steady state unemployment ( $U^{ss}$ ) and two shocks: pure level shocks ( $s_t^u$ ) and persistent shocks ( $G_t^u$ ).

$$U_t = U_{t-1} + G_t^u - \omega y_t - \frac{\lambda}{100} (U_{t-1} - U^{ss}) + s_t^u \quad (20)$$

The stochastic process for persistent shocks:

$$G_t^u = (1 - \alpha) G_{t-1}^u + \varepsilon_t^{G^u} \quad (21)$$

The stochastic process for potential output ( $Y_t^p$ ) is correlated with changes in equilibrium unemployment and the underlying trend growth rate of potential output.

$$Y_t^p = Y_{t-1}^p - \theta (U_t - U_{t-1}) - \frac{(1-\theta)(U_t - U_{t-ss})}{1\theta} + G_t^p \quad (22)$$

The underlying trend growth rate of potential output ( $G_t^p$ ) depends on steady state growth rate ( $G_{ss}^p$ ).

$$G_t^p = \tau G_{ss}^p + (1 - \tau) G_{t-1}^p + \varepsilon_t^{G^p} \quad (23)$$

The stochastic process for the output gap ( $y_t$ ) depends on the difference of inflation and the perceived long-term target ( $\pi 4_{t-1} - \pi 4_{t-1}^{LTE}$ ).

$$y_t = \rho_1 y_{t-1} - \rho_0 (\pi 4_{t-1} - \pi 4_{t-1}^{LTE}) + \varepsilon_t^y \quad (24)$$

The stochastic process for perceived long-term inflation ( $\pi 4_t^{LTE}$ ) depends on its lag.

$$\pi 4_t^{LTE} = \pi 4_{t-1}^{LTE} + \varepsilon_t^{\pi 4^{LTE}} \quad (25)$$

The stochastic process for equilibrium capacity utilisation ( $\bar{c}_t$ ) consists of two shocks: pure level shocks and persistent shocks.

$$\bar{c}_t = \bar{c}_{t-1} + G_t^c + \varepsilon_t^c \quad (26)$$

The equations (14) – (26) in this model are estimated using Bayesian methodology, specifically by applying Regularised Maximum Likelihood Method. In using this method, we have to specify the priors of the parameters used to avoid these parameters from wandering into nonsensical regions (Table 1). However, as pointed out by Benes et al (2010), the choice of the prior has minimal significant impact on the final estimates since the data are uninformative of several parameters. In this paper, we estimate each equation independently using OLS regression and used the estimated coefficients as the basis in specifying the priors in the model. The steady state growth,  $G_{ss}^y$  value is 5.5% and the steady state unemployment,  $U^{ss}$  is 3.1% following the Tenth Malaysia Plan (10th MP).

### Structural Methods

The structural method is underpinned by economic theory that links the potential output to other macroeconomic variables. Contrary to the univariate and multivariate methods that decompose GDP into its trend and gap at the start of the model, the Cobb-Douglas production function decomposes growth into growth of factor inputs while structural VAR decomposes GDP and price into demand and supply shocks. The potential output and output gap are derived using the information extracted from the output of these models. Instead of just assessing the final values, these techniques give an opportunity to examine the underlying economic factors that drive the changes in potential output which make the interpretation of the results more meaningful. For example, the growth accounting exercise in Cobb-Douglas production function can explain the potential output growth as a function of the growth rate in labor, capital and total factor productivity. In the SVAR approach, the underlying economic theory assumes that the impact of demand shocks will die off in the long run and hence the supply side shocks and its deterministic components are the determinant of potential output.

**Table 1: Maximum Regularised Likelihood (Priors and Posteriors)**

Parameter	Prior		Posterior	
	Mode	Dispersion	Mode	Dispersion
$G_{ss}^Y$	5.50	1.00	5.50	1.00
$U^{ss}$	3.10	1.00	3.10	1.00
$\alpha$	0.10	0.16	0.50	0.17
$\beta$	0.20	0.03	0.17	0.04
$\omega$	0.10	0.03	0.03	0.04
$\Phi 1$	0.90	0.16	0.81	0.08
$\rho 1$	0.20	0.03	0.19	0.04
$\rho 1$	0.40	0.03	0.18	0.04
$T$	0.18	0.03	0.22	0.05
$\delta$	0.10	0.16	0.22	0.16
$\Phi 2$	2.00	0.32	1.00	1.00
$\lambda$	2.00	0.32	1.00	1.00

However, the shortcoming of using the structural method is that its estimation of potential output and output gap depend crucially on the univariate methods to detrend some of the variables used in the computation process such as trended labor and capital stock (Bjornland et al., 2005). Furthermore, these methods utilise large amount of information which could pose a problem in a situation where the data are limited (Almeida et al., 2006).

#### Production Function

The theoretical foundation of this approach is neoclassical model (Solow, 1956). The advantages of the production function approach are its flexibility and ability to decompose growth attributable to factors of production such as capital, labour and total factor productivity. In doing so, we can derive the contribution and the efficiency used of these factors and technological progress on potential output.

The production approach uses the Cobb-Douglas production function with two factors of input, capital (K), labour (L) and technological progress (A):

$$Y_t = A_t K_t^{1-\alpha} L_t^\alpha \quad (27)$$

Where  $Y_t$  is output (GDP),  $A_t$  is total factor productivity,  $K_t$  is capital stock and  $L_t$  is labour. The partial elasticity of labour,  $\alpha$  and capital ( $1-\alpha$ ) coefficients are estimated from using a simple OLS equation. The estimated equation to obtain  $\alpha$  is as follows:

$$\Delta \ln y_t = (1-\alpha) \Delta \ln k_t + \alpha \Delta \ln l_t \quad (28)$$

The partial elasticities with respect to labour and capital can be equated to the wage share and the income of capital respectively. Based on equation (28), we specified the share of labour, is 0.58 and capital is 0.42.

The estimation of the potential output is done in three stages: First, the Solow residual (total factor productivity) is derived as output minus the weighted sum of labour and capital inputs. The trends of capital and total factor productivity are generated using the HP filter. Second, the trend for labour derived from NAIRU equation is estimated using the Kalman filter. The NAIRU model is as follows:

$$\Delta \pi_t = \alpha_1 \Delta \pi_{t-1} + \alpha_2 ugap_t + \alpha_3 Z_t + \varepsilon_{1t} \quad (29)$$

$$u_t = ugap_t + u_t^* \quad (30)$$

$$u_t^* = u_{t-1}^* + \varepsilon_{2t} \quad (31)$$

$$ugap_t = ugap_{t-1} + ugap_{t-1} + \alpha_4 ygap_t + \varepsilon_{3t} \quad (32)$$

Where  $\pi_t$  inflation,  $ugap_t$  is unemployment gap,  $ygap$  is output gap and  $Z_t$  are supply side shock variables such as imported prices, energy prices and the deviation of productivity from its trend. In which case, deviation of productivity from its trend is used in estimating NAIRU. Potential employment is estimated as  $(1 - NAIRU/100) \cdot$  level of employment.

In the third stage of estimating potential output, the trends for the three components of growth, total factor productivity, labour and capital are plugged into equation (1) to obtain potential output.

### Structural Vector Autoregression

This method was first proposed by Blanchard and Quah (1989) who estimated the Structural Vector Autoregression (SVAR) model using GDP and unemployment data. The basic idea is to decompose the random disturbances in the regression equation into two components: a permanent component determined by supply shocks or disturbances and a transitory component determined by demand shocks. The response of output to demand side shocks will neutralise in the long run while its response to supply side shocks will have a permanent effect. This is done in the model by imposing the long term constraints on the transitory demand disturbances. The SVAR approach to estimate output gap was used among others by Bjornland et al. (2005), and Menashe and Yakhin (2004).

### Blanchard and Quah Decomposition in this Framework

Let  $Y_t = (\Delta \ln GDP, Inflation)^T$

Define regular vector autoregression, VAR (p) model:

$$Y_t = A_0 + A_1 L Y_t + V A_p L^p Y_t + V_t \quad (33)$$

$$\text{Var}(V) = \Omega$$

Where  $V_t$  = residuals with covariance matrix  $\Omega$   
 $L$  = lag operator  
 $p$  = number of lags that are included in the model

Invert VAR (p) model into moving average representation.

$$Y_t = V_t + C_1 V_{t-1} + 1 \sum_{j=0}^{\infty} C_j V \quad (34)$$

$$\text{Var}(V) = \Omega$$

Since the innovations  $V_t$ 's are contemporaneously correlated, this implies that  $C_j$ 's will not exhibit independent responses to any innovations. Hence,  $\Omega$  is a full matrix. Next, decompose these innovations into two orthogonal effects: supply innovation and demand innovation, in which equation (34) will become:

$$Y_t = A_0 + A_1 e_{t-1} + 1 w \sum_{j=0}^{\infty} A_j e_{t-j} \quad (35)$$

$$\text{Var}(e) = \Sigma$$

Where  $e$  = uncorrelated shock pair  $(e_d, e_s)^T$   
 $\Sigma$  = diagonal covariance matrix.

The relationship between (34) and (35) are as follow:

$$A_j = C_j \cdot A_0, \quad j = 0, 1, 2, \quad (36)$$

$$A_0 \cdot \Sigma \cdot A_0^T = \Omega \quad (37)$$

$$C_0 = I$$

Therefore, we need to identify  $A_0$  in order to solve for (35). Let  $\omega_{ij}$  and  $\sigma_{ij}$  represent elements in matrix  $\Omega$  and  $\Sigma$  respectively, then equation (37) can be written as:

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \sigma_{11} & 0 \\ 0 & \sigma_{22} \end{bmatrix} \begin{bmatrix} a_{11} & a_{21} \\ a_{12} & a_{22} \end{bmatrix} = \begin{bmatrix} \omega_{11} & \omega_{12} \\ \omega_{21} & \omega_{22} \end{bmatrix} \quad (38)$$

There are three restrictions impose by Equation (37) on the four elements of  $A_0$ :

$$a_{11}^2 \sigma_{11} + a_{12}^2 \sigma_{22} = \omega_{11} \quad (39)$$

$$a_{21} a_{21} \sigma_{11} + a_{12} a_{22} \sigma_{22} = \omega_{21} \quad (40)$$

$$a_{21}^2 \sigma_{11} + a_{22}^2 \sigma_{22} = \omega_{22} \quad (41)$$

We normalise  $\Sigma$  to be identity matrix,  $\sigma_{11} = \sigma_{22} = 1$  implying that . Since we have four unknowns,  $a_{21}, a_{22}, a_{12}, a_{11}$  and three equations (39) – (41), we need to impose another restriction to ensure that  $A_0$  is unique. This is where we redefine our VAR model

into structural VAR using economic theory to identify the elements in  $A_0$ . The long run restriction imposed by Blanchard and Quah stated that there are no long run impact from aggregate demand shock on the growth of output. This implies that aggregate demand shock is a transitory shock and that our output will go back to natural rate of output. Thus, the additional constraint is:

$$\sum_{j=0}^{\infty} c_{11,j} a_{11,0} + \sum_{j=0}^{\infty} c_{12,j} a_{21,0} = 0 \quad (42)$$

Since we define the element  $a_{11,j}$  in  $A_j$  matrix to reflect the impact from demand shock on real GDP growth in period  $j$ . Hence the accumulated effect of demand shock on real GDP in the long run will be  $\sum_{j=0}^{\infty} A_j$ .

Now, we can solve for equation (38) - (42) (with  $\sigma_{11} = \sigma_{22} = 1$ ) that will give the  $A_0$  matrix in which equation (35) can be derived. The decomposition will produce four shocks: responses of output to supply and demand shocks each, responses of price to supply and demand shocks. Output gap is the cumulative of response of output to the demand shocks and potential output is the cumulative of response of output to supply shocks (or actual output minus output gap).

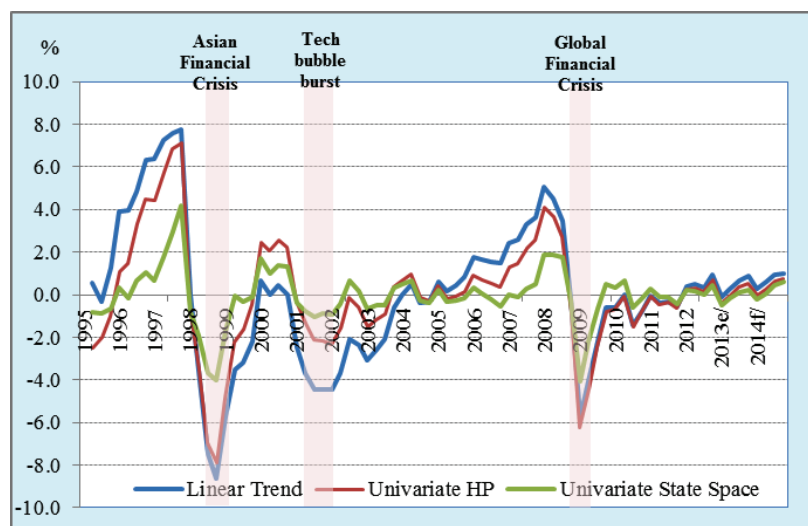
## Results and Analysis

The discussion of the results is divided into three main parts. Subsections 4.1-4.3 discusses the estimation results of output gap and the key findings of the various models. Subsection 4.4 assesses the estimation methods based on (i) consistency over time; (ii) transparency (iii) ability in predicting price pressures. Finally, subsection 4.5 discusses the forecast of potential output and output gap for Malaysia in 2014.

### Univariate Methods

From Figure 3, the largest negative gaps using linear trend, HP filter and univariate state space happened during the periods of the two major economic shocks: the Asian Financial Crisis (AFC) in 1997/98 and the Global Financial Crisis (GFC) in 2007/08. The negative output gap registered during AFC appears to be larger than the GFC and the tech bubble burst in 2001, suggesting that the effects of shocks from AFC are more severe compared to the other two shocks. The potential output growth trajectories using both HP and univariate state space filters shifted lower after each major shocks (Figure 3), for example from an average of 5.2% (1996-1997) pre-AFC to an average of 4.8% (2010-2013) post-GFC.

**Figure 3: Output Gap Estimates Using Univariate Methods, 1995-2014<sup>f</sup>**



While the quarterly output gap profiles are broadly similar throughout the sample, the size of the output gap differs, with the linear trend estimates showing the largest absolute gap for economic up-cycles and down-cycles. The larger gaps estimates from the linear trend approach could be attributed to the assumption that growth trend for potential output is constant through time. For this reason, the univariate state space model may be a better model as it models the evolution of potential output according to the dynamic of the business cycles in the economy. As such, it produces the smallest absolute output gap across all time periods. The output gap estimates using the HP filter lie in between the output gap estimates produced by the linear trend and the univariate state space filter.

Despite producing different output gap estimates, the quarterly time profiles for all the three methods are consistent in picking up the important developments in the economy. For example, the large negative output gaps are evident during periods of economic downturns

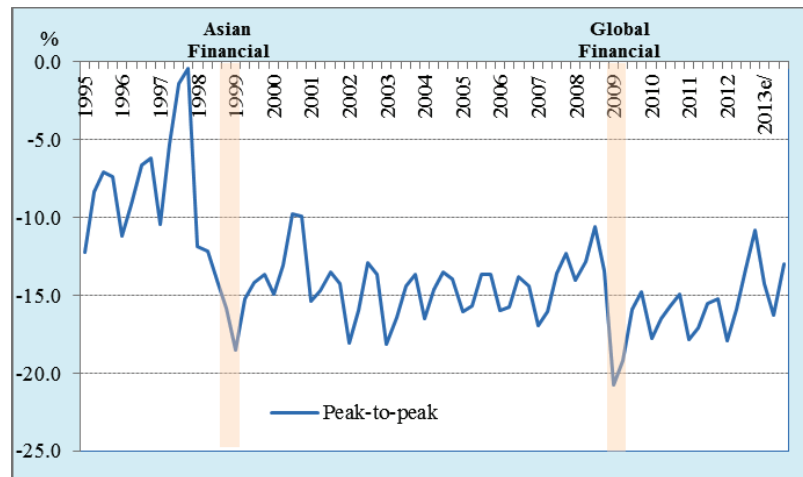
(AFC, Tech bubble burst and GFC) and large positive output gaps during periods leading up to the major economic shocks.

Figure 4 shows the peak-to-peak output gap estimates that are consistently negative, suggesting that the economy is always operating below its potential. The result does not appear to be plausible and shows that this particular trend extraction method is flawed as the mechanistic approach does not seem to be able to capture the dynamics of the economy.

#### Multivariate Methods

An advantage of the multivariate approach is that it explicitly draws on relationships between the output gap and other macroeconomic variables. Wider set of information can be utilised than relying on a single variable, which is predominantly the drawback of the univariate method. As such, Mc Morrow and Röger (2001) find that the HP filter tends to generate larger output gaps than the multivariate Kalman filter for the EU countries.<sup>11</sup> This is consistent with the findings of this paper.

**Figure 4: Peak-to-Peak Output Gap Estimates, 1995-2013**



<sup>11</sup> However, in the case of New Zealand, Claus et al. (2000) finds greater amplitude of output gaps from the Kalman filter compare to those generated from the univariate HP filter.

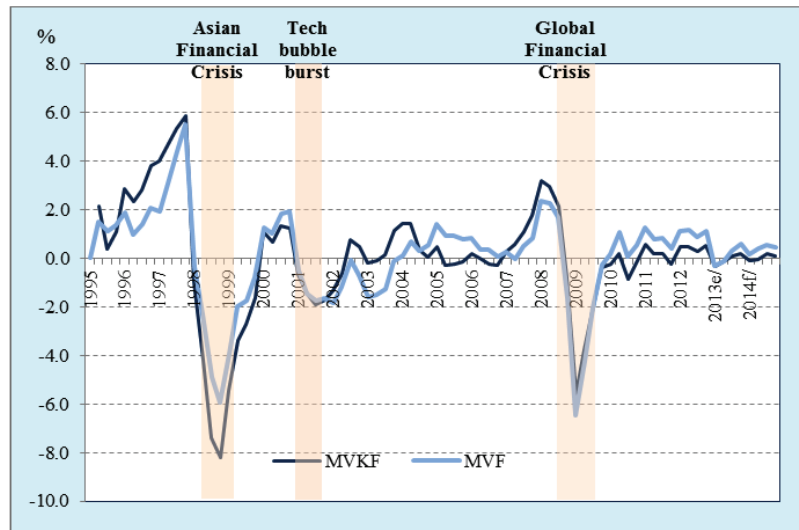
Figure 5 shows that both multivariate filters produce broadly similar output gap time profiles, picking up the troughs during the AFC (1997/98), tech bubble burst (2001) and GFC (2007/08). The peaks are evidenced in periods leading up to both the AFC and GFC. When comparing these two methods, the multivariate Kalman Filter (MVKF) shows a bigger absolute output gap estimates during AFC while the size of the output gap using both measures are almost similar during the tech bubble burst and GFC. The discrepancy in the output gap estimates could be due to the way the MVKF is constructed such that it only uses the information on excess demand in the labor market as a proxy for the excess demand in the product market (Eq. 9-13). In this sense, it takes into consideration part of the available information on the economy to bring consistency between the estimates of output gap and price trends. In contrast, the model-based multivariate filter (MVF) takes a more comprehensive set of information in its estimation. This is because it establishes

links between the output gap with other key macroeconomic variables such as price (Eq. 15), non-accelerated inflation rate of unemployment (NAIRU) (Eq. 16-17) and capacity utilisation (Eq. 19).

Consistent to the univariate output gap estimates, the quarterly time profiles for the MVKF and the MVF are broadly similar except for periods 2003-2004, whereby MVKF estimated the output gap to be a small positive but the MVF estimates show a small negative. As the MVF is anchored to the evolution of prices, the negative output gap estimates during that period is plausible as prices were benign; the average inflation in 2003-2004 is 1.3% (2005: 3%).

Furthermore, both the models are able to pick up the important turning points in the business cycles, upturns for pre-AFC and pre-GFC and downturns caused by the major economic shocks: AFC, the tech bubble burst and GFC.

**Figure 5: Multivariate Filter Output Gap Estimates, 1995-2014<sup>ii</sup>**



### Unemployment and Capacity Utilisation Gaps

In Figure 6, the capacity utilisation gap is negative during AFC and GFC. The equilibrium capacity utilisation rate is seen to shift from above 82% pre-AFC to a range between 78%-82% post-AFC in tandem with the downward shift in potential growth rate of 6.7% pre-AFC to 4.7% post-AFC (Figure 4.10).

In Figure 7, the equilibrium unemployment rate shows a rather smooth trend suggesting that the labor market may not be very responsive to the changes of the economic conditions. Furthermore, it could also be due to inflexibilities in the labor market where hiring and firing of workers is not easy or tendency of firms' to not firing workers during recessions period, instead reduce their number of working hours.

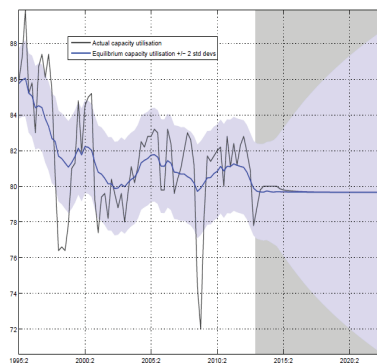
Nonetheless, the results of multivariate filter also indicate that unemployment gap and capacity utilisation gap are closing in 2017. This happens when the potential growth reaches its steady state growth of 5.5%, consistent with the unemployment rate (NAIRU) reaches its specified long term equilibrium rate of 3.1% (Figure 6) and capacity utilisation rate is at 80% (Figure 7). As mentioned earlier, the multivariate

filter strives to bring the consistency between potential output growth and other key macroeconomic indicators such as unemployment rate, price and capacity utilisation rate.

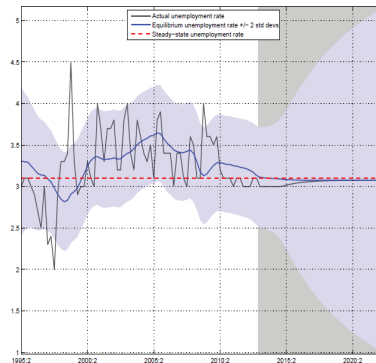
### Structural Methods

While filtering methods generate the potential output estimates by making statistical assumptions on the time series properties of trends and correlation with the business cycles, the structural methods makes assumptions based on economic theory. Epstein and Macchiarelli (2010) argued that purely statistical methods such as the HP filter tend to misidentify boom and bust periods and the extent of the fluctuations in growth that are driven by economic fundamentals. In this regard, the structural method which decomposes growth into factors of production and productivity are useful as productivity levels can determine the non-inflationary growth paths of output and employment. As such, the recent advancements made to the estimation of output gap, such as the macro model-based multivariate filter cannot reduce the importance and usefulness of the structural approach.<sup>12</sup>

**Figure 6: Equilibrium Capacity Utilisation (%)**



**Figure 7: Equilibrium Unemployment Rate (%)**



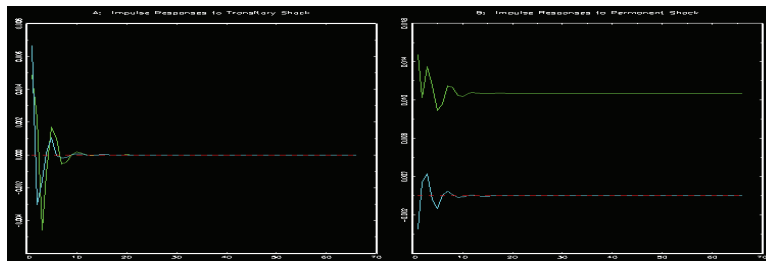
<sup>12</sup> A growing consensus has emerged toward the production function estimation approach, which has strong theoretical foundation (Cotis et al., 2005).



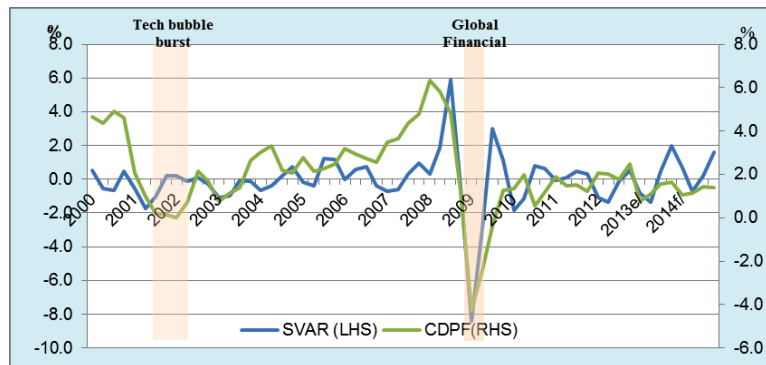
Figure 8 shows that B&Q assumptions in SVAR model hold. In the long run, the response of output to the transitory/demand shocks will eventually dies off. On the other hand, the output response positively to the supply shocks (permanent shocks) while the impact on the price is negligible. The price (blue line) and output (green line) spiked positively in the first quarter when there is a transitory shocks before falling back to negative territorial due to over shooting and eventually dies out to zero.

In Figure 9, the output gaps produced by the SVAR and CDPF methods display similar patterns. While the peaks and the troughs coincide with the turning points of the business cycle, there are evidences of lead-lag effects exhibit by these two models. For instance, SVAR estimate the turning point for downturn associated with GFC to be in the 3Q 2008 but CDPF approach estimated it to be a quarter later, 1Q 2009.

**Figure 8: The Response of Output (green line) and Price to the Demand (Transitory) and Supply (Permanent) Shocks**



**Figure 9: Structural Models' Estimates of Output Gap Estimates, 2000-2014<sup>17</sup>**



### An Assessment of the Estimation Methods

In principle the diversity and the increased sophistication of potential output models is helpful for policymakers as different models give a different perspective of the dynamics of the economy's potential output. The choice of methods for policy involves other considerations especially the reliability of the models. Therefore, Cotis et al. (2003) suggests that models used for policy considerations need to be based on four criteria:

- (i) Consistency with economic priors. This refers to the requirement of the methods to be consistent with theory.
- (ii) Transparency. This refers to the requirement that the assumptions made during the estimation process are clearly identified and justified.
- (iii) Capability in providing information about the precision of the estimates; and
- (iv) Consistency over time refers to the requirement that estimates should not be sensitive to the choice of the sample period.

Assessing the different methods using the four criteria suggest the production function and the macro model-based multivariate filter which are underpinned by economic theory meet the first criteria of consistency with economic priors. Among

the competing models, Cheng et al. (2013) find the macro multivariate filter is the "best" method as it meets three out of the four criteria. In contrast, the HP filter is a transparent method as its estimation process is clearly identified and can easily be replicated, but it only meets one of the four criteria (Cheng et al., 2013).

While there is no independent assessment of the models made, we believe that Cheng et al. (2013) findings can be generalised with the exception on consistency of estimates, for this paper. Instead this paper will focus on assessing the capability of the estimated output gaps in providing information about inflationary pressures.

### Output Gap's Predictive Power for Inflation

To evaluate the performance of output gaps in estimating the inflation, we modified Brouwer and Ericsson's (1995) benchmark model to obtain the reduced form model that is a good fit to Malaysia data. In equation (43), output gap is used as one of the explanatory variables and the results from this equation is benchmarked against the baseline equation that does not include the output gap as an explanatory variable.

$$p_t = \alpha_1 + \alpha_2 p_{t-1} + \alpha_3 ppi_{m,t-1} + \alpha_4 dloil_t + \alpha_5 p_{t-4} + \alpha_6 og_{t-1} \quad (43)$$

Where  $P_t$  is inflation,  $ppi_{m_{t-1}}$  is imported producer's price,  $dloil_t$  is the change in oil price and  $og$  is the output gap (100\*log(actual output - potential output)).

The results of equation (43) and from the baseline equation are in Table 2. The results show that the fit of the baseline equation improves with the inclusion of any of the output gap estimates. All the signs of the various output gap measures are correct and significant, suggesting that an increase in the output gap will increase inflationary pressures. For instance, a 1% increase in output gap produced by SVAR is estimated to result in an increase of 0.3% in prices. For 1% increase in output gap, prices are estimated to increase by 0.1%-0.4%, based on the various output gap measures. From Table 2, the output gap produced by the univariate state space has the largest impact on prices (0.4%) while the output gap produced by the linear trend has the smallest impact (0.1%).

In terms of the explanatory power, the model (Eq. 43) improves with the inclusion of output gaps on the right hand side of the equation. This is reflected in the higher adjusted  $R^2$ , ranging from 5%-13% for all the inflation

equations that include output gap measures. The largest improvements in explanatory power are seen from the inclusion of output gap measures derived from the univariate state space and SVAR methods.

The forecasting performance of the inflation equation also improves with the inclusion of the various output gap measures. This is evidenced from the improvement in root mean square errors (RMSE) values, ranging from 9%-21%. The largest improvements are seen using the output gap estimates from the univariate state space model and the multivariate filter, with improvements of 21% and 18.8% respectively.

This assessment shows that different models are suited for a different purpose. Based on the results, it appears that the univariate state space model suited both current and future estimates of price trends probably due to its better ability to trace the business cycles of the economy using the appropriate cosine and sine functions (Eq. 7-8). On the other hand, the multivariate filter appears to be slightly better in predicting future inflationary trends relative to explaining the current trends.

**Table 2: Output Gap and its Predictive Power for Inflation**

Method	$\alpha_s$	Adj $R^2$	RMSE (8 quarters ahead)
Baseline	-	0.674	0.899
Linear Trend	+0.100*** (0.036)	0.711	0.820
Univariate HP	+0.156*** (0.042)	0.736	0.782
Univariate SS	+0.392*** (0.085)	0.762	0.743
MVKF	+0.166*** (0.050)	0.724	0.802
Multivariate Filter	+0.249*** (0.056)	0.759	0.757
SVAR	+0.324*** (0.073)	0.760	0.764
CDPF	+0.123*** (0.046)	0.707	0.825

\*Indicates significance at 10% level

\*\*significance at 5% level

\*\*\* significance at 1% level.

The standard errors are reported in the brackets

### Decomposition of Inflation to Demand and Supply Shocks using SVAR Methods

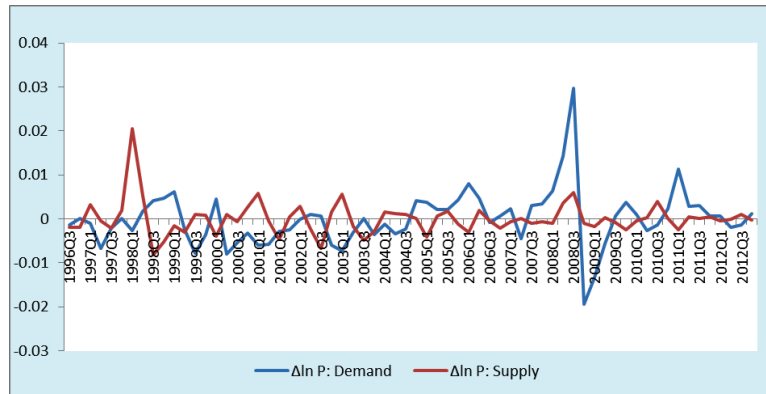
In addition to using the cumulative sum of output to the transitory/demand shocks as an estimate of the output gap, the SVAR method also gives the responses of prices to demand and supply shocks. These responses allow us to identify the sources of inflationary pressure in the economy (Figure 10). During the AFC 1997/98, the inflation was caused by the supply shock as a result of exchange rate depreciation that made the price of imported goods and services more expensive. Producers may pass on these higher costs of imported components and raw materials to consumers. During the

GFC 2008/09, the inflationary pressure was due to the demand shocks. Prior to the crisis in 2009, there was a huge demand for credit due to low interest rate and the credit was limited when the crisis hit before picking up again.

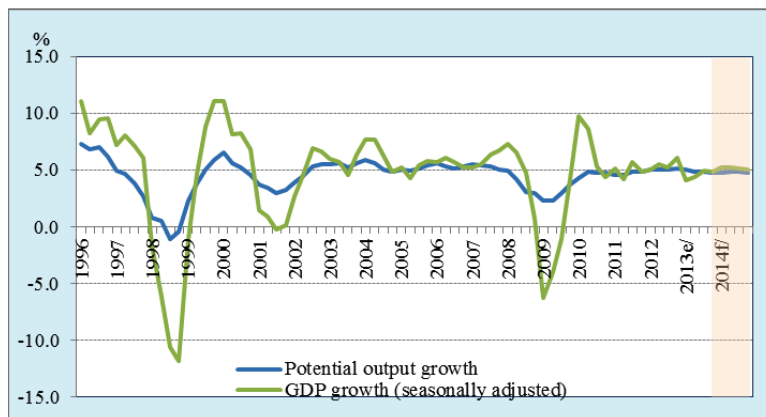
### Outlook for Potential Output

Going forward, we expect the overall potential output to be broadly stable, with growth ranging between 4.6%-5% in 2014. Steady accumulation of capital and stable labour markets continue to support growth. Based on the projected economic growth, the output gap is estimated to be marginally positive in 2014 (+0.5%).

**Figure 10: Malaysia's Price Dynamics due to Demand and Supply Shocks (1996Q3-2012Q4)**



**Figure 11: GDP and Potential Output Growth, 1996-2014<sup>ii</sup>**



In the longer term, the potential output growth is expected to converge to the steady state of 5.5% growth in 2017 (Figure 12). With this convergence, NAIRU will settle to the equilibrium level of 3.1%. However, this evolution of potential output growth and NAIRU precludes any unforeseen shocks to the economy.<sup>13</sup>

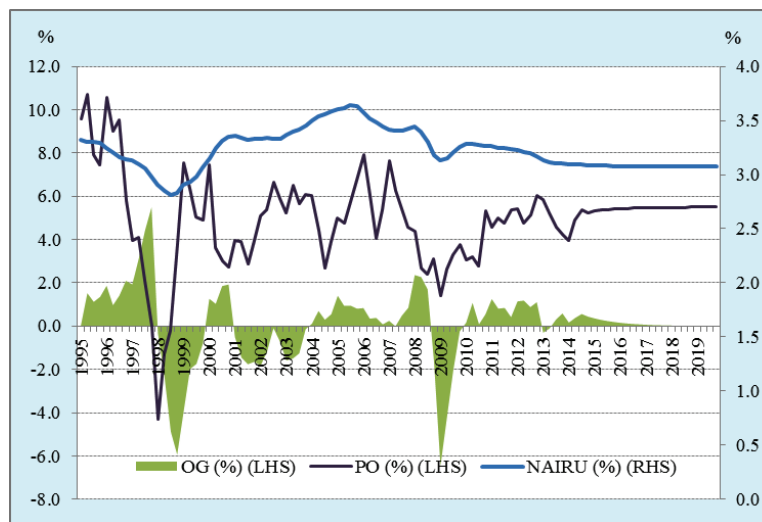
#### The Estimated Contributions to Trend Growth using CDPF

Figure 13 shows the historical decomposition of potential output growth. Capital input growth made a significant contribution to growth in the mid-80s to the mid-90s as the country went through a period where heavy industries such as iron and steel, petrochemicals and motor vehicle industries were promoted. As such, growth during this period was mainly attributed to accumulation of capital. However, investments fell after the AFC 1997/98 and this resulted in a smaller contribution of capital to growth of the potential output.

In addition, the average contribution of productivity growth appears to have weakened during and right after the periods of an economic crisis, both the AFC and GFC. While the recovery of productivity appears to be evident after a crisis, its contribution to growth remains slightly more than a third of the potential output growth. However, it is still below that of a developed country whose productivity accounts for more than half of its average growth (see Table 2). Anand et al (2013) suggests that TFP remains low for a number of reasons, ranging from low research and development (R&D) and difficulty in doing business and stringent regulations in product markets.

In the long run potential output is determined by productivity growth and demographic changes as capital stock settles to its equilibrium rate. This is evidence in the developed economies where the contribution from total factor productivity outpaced the contribution from capital stock by as much as 1.4-4.8 times in 1960-2000.<sup>14</sup>

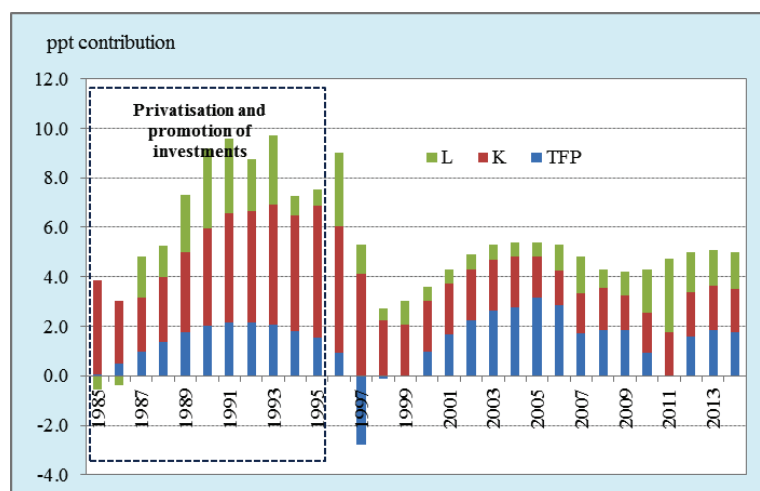
**Figure 12: Potential Output Growth, NAIRU and Output Gap, 1995-2019<sup>17</sup>**



<sup>13</sup> Koopman and Székely argue that the long-run impact of a financial crisis on the potential output is less certain for the European economy, although in the short-run there appears to be non-negligible loss of potential output.

<sup>14</sup> See Aghion and Howitt (2007)

**Figure 13: Contribution to Potential Growth, 1985-2014<sup>ii</sup>**



The evolution of potential output will be determined by the structural features of the economy and the economic environment in which the economy operates. While the dynamics in the model show that potential growth will reach its steady state in 2017 (Figure 6-7), a sustainable long-term growth critically depends on the quality of capital, labour and in TFP. TFP, which is associated with technological innovations and knowledge, is important in determining the country's long-term potential growth. Therefore, the success in alleviating some of the bottlenecks in the system and in promoting a competitive environment through structural reforms are important in ensuring that productivity gains are fully exploited.

### Conclusion

Potential output and output gap plays a central role in policy discussions. The policy maker needs to assess the degree of fluctuation of observed output reflects the economy's adjustment to shocks as oppose to the undesirable deviations of output from its time-varying optimal path of output. Such deviations contain information as to how much more the economy can produce and how many more jobs it can create without exerting upward pressure on prices.

However, the output gap is an unobserved component and therefore its estimation is subjected to uncertainty, assumptions and the use of judgment. Therefore, the benefits of the use of different models that produces a diverse set of results may be significant as this allows for a greater scope for cross-checking of diagnostics.

In this paper, we assess several output gap estimation methods for the Malaysia economy, including (i) univariate methods (linear trend model, univariate state space and HP filters) (ii) multivariate filters (multivariate Kalman filter and macro model-based multivariate filter) and; (iii) structural models (production function approach and SVAR). By doing so, it shows the complexities of each of the estimation methods and also highlights the strengths and weaknesses of each method.

There are four main conclusions derived from this paper:- First, the quarterly time profiles of the output gap produced by the different estimation methods are broadly similar, in particular, in pinpointing the troughs and the peaks of the business cycles. However, the estimated size of the output gap differs; with the structural method appearing to produce slightly larger estimates. Second, output gaps are expected to be a slight positive

for 2014, but the MVF model expects the output gap to close in 2017. Third, the macro model-based multivariate filter, production function method and SVAR models provides additional insights to the dynamics of the potential output and output gap. Specifically, the multivariate filter shows that all activity gaps such as the unemployment and capacity utilisation gap will reach their equilibrium and close in line with the output gap in 2017. The production function approach shows that the capital contribution to growth was affected by AFC. The SVAR model shows the source of inflationary pressure is supply shocks during AFC and demand shocks during GFC. Finally, our results show that all output gap measures contain information about inflationary pressures. No particular model has a distinct advantage in predicting inflationary trends, suggesting that all models are almost equally useful.

Based on these findings, we conclude that the estimation of the output gap from

the various methods remain useful in the formulation of fiscal and monetary policies. The choice of the model for policy involves more stringent tests. Cotis et al (2003) suggested four criteria for model selection which was tested by Chang et al (2013). Consistent with our findings, Chang et al (2013) argues that no one model has a clear advantage over the other in terms of forecasting inflation and hence, it may still be worthwhile using all the estimation methods. In summary, we argue that with uncertainty surrounding the measurement of potential output and output gap, greater diversity and sophistication in estimation approaches should be advantageous for a policy maker. We also show the output gap is especially useful in indicating the degree of excess capacity in the economy which in turn provides information on inflationary pressures in the economy. Furthermore, speed and trajectory of potential output growth may suggest policies that are needed in raising the country's potential output.

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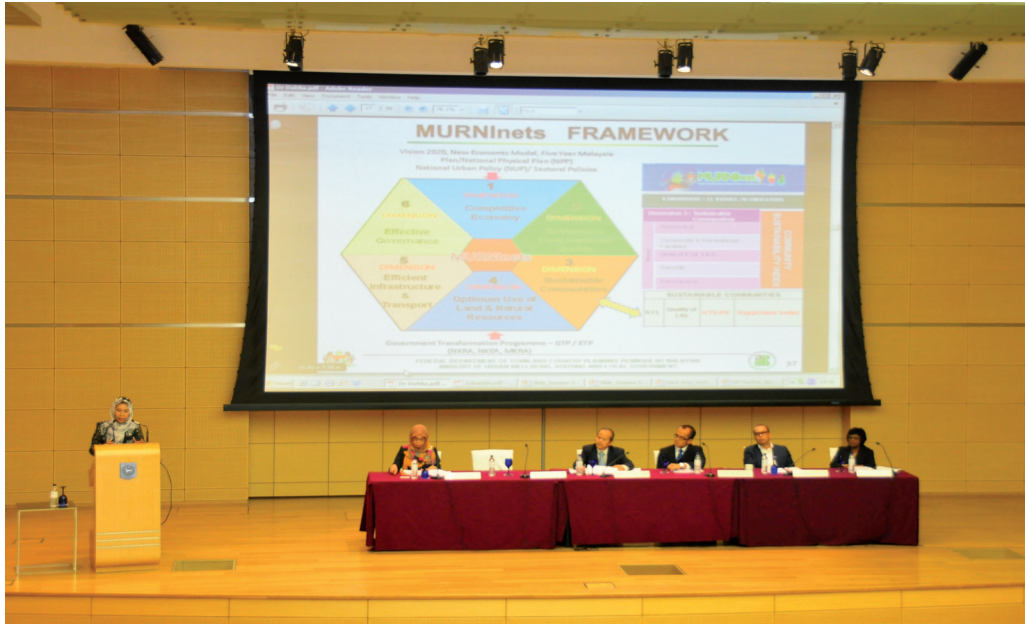
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# TRANSCENDING THE TRADITIONAL APPROACH THROUGH SATELLITE ACCOUNTS

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## Abstract

Complexities in economic structures require the compilation of holistic statistics. Under such circumstances, information classified according to commodity type is needed to analyse the linkages between goods and services within the sectors. In this, Satellite Accounts are able to provide detailed and comprehensive information on the commodities studied and facilitate observation on the relationship of specific economic activity. Acknowledging the importance of Satellite Accounts, Department of Statistics, Malaysia (DOSM) has initiated the compilation of Tourism Satellite Account (TSA) and Information & Communication Technology Satellite Account (ICTSA). This paper focuses on TSA as it is the first Satellite Account developed by DOSM. In this Satellite Account, data on supply, demand and employment were collectively produced to assist policymakers in the formulation of policies and programmes.

## Introduction

The dynamism of the Malaysian economy requires changes in the way statistics are compiled. Current statistics are insufficient to analyse specific activities in the economy. In this regard, statisticians are challenged to explore new methods of compilation.

Thus, in depth studies need to be conducted to understand the impact of various transactions across the various activities in an economy. Traditionally, Gross Domestic Product (GDP) is used to measure the performance of an economy. It only measures ordinary activities at the industry level, while commodities-level information is inadequate such that

the linkages between goods and services within the sectors cannot be distinguished specifically. Limited information derived from the traditional methods has hindered policy makers and analysts in analysing the economy from all aspects. Hence, this has led to the development of the Satellite Accounts as recommended by the System of National Accounts (SNA). Other ways of comprehensively analysing the economy is through the Supply and Use Tables (SUT) and Sequence of Accounts. Nevertheless, Satellite Accounts are recommended as the main tool to be used for the analysis of specific economic activities in line with the SNA framework.

## Literature Review

Satellite Accounts are frameworks that focus on selected fields of economic and social life. These frameworks are parts of the National Accounts which are more flexible in terms of concepts, definitions, accounting rules and classifications that can be tailored according to a country's needs. There are two types of Satellite Accounts. The first type involves the rearrangement and reclassification of information that already exist in the SNA framework such as Satellite Accounts for Tourism, Health, Education, Agriculture and Non Profit Institutions (NPIs). The second type of Satellite Accounts refers to activities beyond the production or asset boundary such as Satellite Accounts for Environment, Household, Human Resources, Research and Development. The Environment Satellite Account for example, uses information on pollution rate which is outside the production boundary and different measurement units are also used in their compilation.

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In the United Kingdom (UK), the government emphasised the development of Satellite Accounts as suggested in the Proposals for Satellite Accounts 2008 by the Office for National Statistics (ONS) UK. The Atkinson Review recommended that the ONS should explore ways of analysing and publishing information about public service output parallel to the National Accounts, such as Satellite Accounts (Atkinson, 2005). Particular recommendations include: *“It would be useful to have a Satellite Account on Human Capital Resource Formation,”* and *“ONS should consider developing the framework for Health Accounts further, developing full Satellite Accounts including Health Production Accounts”*. The purpose of this document is to set out plans for implementing these recommendations in the context of a wider discussion of ONS work on Satellite Accounts.

In addition, the European System of Accounts (1995) suggests that satellite accounts can be used for the analysis of the role of tourism in the national economy; the costs and financing of health care; the importance of research and development and human capital for the national economy; the income and expenditure of households; the interaction between environment and the economy; production within households; and changes in welfare.

Australia also implements the compilation of Satellite Accounts as quoted in the Australian Bureau of Statistics (ABS) website:

*“Information and Communication Technologies (ICT) play an important role in the way in which we live and do business. There is considerable interest in the role of ICT as a significant driver of socioeconomic development, for example, in the way that ICT has allowed businesses to increase productivity. For official statisticians, the measurement of these technologies provides significant conceptual and measurement challenges. A key part of the ABS response to these challenges has been the development of an ICT Satellite Account for Australia for 2002-03. This was preceded by the release of a “pilot” ICT Satellite Account in 2003 for reference year 1998-99”.*

Most National Statistics Offices (NSO) have developed Satellite Accounts according to their countries' needs. Based on 2008 SNA, more than 70 countries have developed the Tourism Satellite Account (TSA). ABS has developed ICT, NPIs and Tourism Satellite Accounts, while Statistics Canada has developed Satellite Accounts for NPIs and Volunteering, and Tourism. Statistics of Norway has established Health, Tourism and Environment Satellite Accounts. In line with other developed NSO, Malaysia has produced TSA and ICT Satellite Account (ICTSA).

In Malaysia, under the implementation of the 10th Plan 2011-2015, the tourism sector has been targeted to improve Malaysia's position in global tourism receipts – to be among the top 10 countries in terms of global tourism receipts. Revenue from the tourism sector is also projected to be 2.1 times higher which will contribute approximately RM115 billion in receipts and is expected to create two million jobs by 2015. TSA statistics were used as a base for projecting tourism receipts and employment in 2015.

Also recorded in the same plan, the ICT sector accounted for 9.8 percent of GDP in 2009. The sector remains as a key focus for Malaysia and is expected to gain greater momentum driven by the convergence of industries due to digitalisation. The contribution of the ICT industry to GDP is targeted to increase to 10.2 percent by 2015. By compiling ICTSA, the real contribution of the ICT sector to GDP can be obtained and the linkages between goods and services of ICT within the industries can be distinguished.

#### [The Establishment of Satellite Accounts in Malaysia](#)

Satellite Accounts enable the development of an integrated set of statistics on specific economic activities that cut across a few activities. This facilitates the measurement of the contribution of certain economic activities such as tourism and ICT that is not well represented by existing national accounts statistics. In line with the cross-sector nature of some statistics on economic activities, Satellite Accounts provide a detailed analysis on the interaction of goods and services from the supply and demand perspectives. These linkages can be observed within the domestic and external economy.

#### Development of ICT Satellite Account

The potential of ICT was seen by many agencies including DOSM as one of the activities to proliferate the economy. DOSM has embarked on the development of ICTSA since early 2000 and this has been documented under the Department's Corporate Plan 2004-2009. The Department is committed to ensure the compilation of ICTSA is carried out as presented in Strategic Plan 2010-2014. The similar idea of having ICTSA was also shared by policy makers particularly Ministry of Finance (MOF).

In achieving this goal, the MOF in collaboration with the Economic Planning Unit (EPU) and Multimedia Development Corporation (MDeC) have been tasked to spearhead the establishment of the Digital Economy Satellite Account (DESA). DOSM has been invited to be a co-member to expedite the development of DESA. In 2009, DOSM initiated ICTSA compilation and the first ICTSA experimental report was published in December 2012. This publication was circulated to the Steering and Technical Committee as well as the relevant stakeholders. In meeting the demand of ICT by households and to have a more comprehensive ICTSA, the Department started conducting a survey on ICT Access and Use by Household and Individuals in October 2013. The survey is aimed at developing ICT demand indicators and obtaining information on the usage of e-commerce by households.

#### Development of Tourism Satellite Account

With the cooperation of the Ministry of Tourism and Culture Malaysia (MOTAC), DOSM set up a Technical Working Group to discuss the input requirements for primary and secondary data used in the development of the TSA. Concurrently, in developing an action plan for TSA, dialogue sessions were organised with related agencies namely Malaysia Tourism Promotion Board (MTPB) and Immigration Department of Malaysia (JIM) to identify the data required and existing data gaps. In ensuring the materialisation of this plan, each agency has been assigned a specific task whereby JIM would be responsible for the provision of data on tourist arrivals and MTPB on inbound tourist receipts.

These collaborations have enabled DOSM to successfully develop seven tables of TSA (from a total of 10 tables) comprising main indicators that measure the contribution of the tourism industry to the economy. These statistics will be a benchmark to evaluate the importance of the tourism industry in Malaysia as compared to other countries. The remaining three tables which consist of monetary and non-monetary indicators are under development.

In ascertaining the production of this account, intensive effort to develop the TSA for Malaysia commenced in 2003 as it was suggested that the tourism industry contributes significantly to the economy. Arising from this, DOSM formed an internal working group to carry out research studies on other countries' best practices. To further enhance the findings of these studies, a study visit to the ABS was conducted in order to understand the practical techniques and training methods as well as to exchange ideas with and learn from the vast experience of Australia in TSA compilation. Subsequently, in 2006, DOSM participated in the International Workshop on Tourism Statistics jointly organised by the United Nations Statistics Division and United Nations World Tourism Organization (UNWTO) Department of Statistics at Madrid, Spain.

Through the implementation of the Economic Transformation Programme (ETP) in 2010 which highlighted 12 National Key Economic Areas (NKEAs), the tourism sector has been identified as one of the focus areas. During the development of ETP for tourism, TSA data were used extensively to support policy formulation for the tourism industry.

#### Framework of Satellite Accounts

This paper emphasises on TSA as it is the pioneer product of Satellite Accounts developed by DOSM. The compilation of TSA is based on recommendations from UNWTO manuals namely the Recommended Methodological Framework (RMF) and International Recommendations for Tourism Statistics (IRTS) 2008 published by the UNWTO.

Based on the SUT framework, the main inputs for the TSA are seen in the primary compilation of SUT as illustrated in the Appendix. This framework gives the dimension of supply and demand of all the commodities including tourism. SUT was previously known as Final National Account – an account which has been compiled by DOSM since 1947 and until 2005, was translated into the National Accounts and Input Output Table (IOT). The SUT is produced once in every five years and the latest compilation of SUT 2010 is still in progress. SUT indicates the supply and demand of tourism products by its components namely accommodation, food & beverages and transport services. Data on these components are also being compiled on a broader scope as part of the annual GDP. The compilation of TSA is possible due to the wide range and detailed primary data collection implemented by DOSM on tourism components and elements such as shopping (retail), travel agent and other services.

In economic census and surveys, not all products can be classified as tourism characteristic products (TCP). For example, transportation services including logistics and cargo services are not related to tourism except for passenger transport services. To enable certain data such as transportation to be included as a tourism product, the list of TCP recommended by UNWTO was used to develop Malaysia's TCP based on SUT and IOT. TCP become the fundamental component in identifying the income for inbound and domestic tourism and also the outflows.

A gap has been observed in domestic tourism expenditure although the SUT has captured information on expenditure items such as food & beverages and transportation. Even though SUT was compiled at household level, the information on domestic tourism expenditure of visitors (tourist and excursionist) cannot be observed in detail. To further support the development of the TSA, DOSM launched the Domestic Tourism Survey (DTS) in 2007 to capture information on domestic tourism expenditure. From the survey, popular spots frequently visited by domestic visitors in each

state in Malaysia can be identified. As the DTS is a main source of information for TSA compilation, this survey is conducted on an annual basis. Meanwhile, secondary data such as inbound expenditure and visitor arrivals are obtained from other agencies.

DOSM has successfully produced the TSA 2000-2010 in February 2012 after years of development. The publication was launched by the Minister of Tourism Malaysia and is available to the public. Malaysia's TSA has been recognised internationally by UNWTO and the methods & outcome of the statistics are published in the Compendium of Tourism Statistics.

### Findings

Inbound tourism has been recognised as a significant contributor to the country's economic growth due to the influx of foreign exchange earnings from tourism expenditure and revenue. Meanwhile, domestic tourism is also important since it also generates value added to the economy.

In the traditional GDP approach, the contribution of tourism is only seen in gross estimates from the amalgamation of food & beverage, accommodation and transportation as the supply or production of the tourism industry. The demand for tourism product is only available for inbound tourist by-products. In the satellite accounts, the products consumed are obtainable for both demand by inbound and domestic visitors. The comparison of supply and demand is indicated in the tourism ratio which will be explained later.

### Contribution of Tourism Expenditure to the Gross Domestic Product

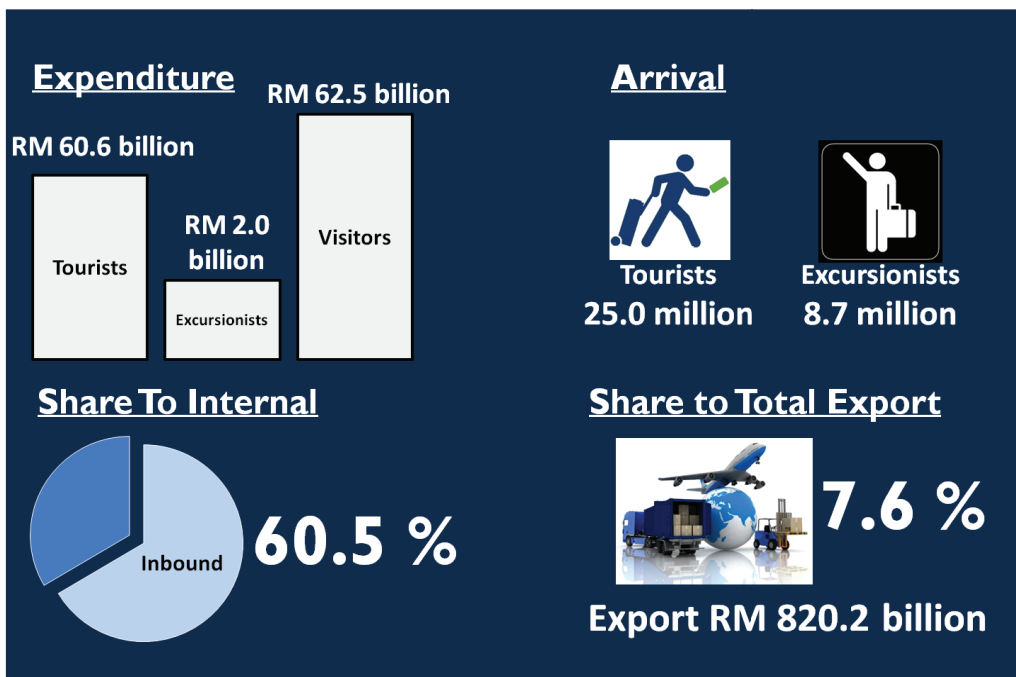
In 2012, total visitor arrivals were 33.7 million which was made up of 25.0 million tourist arrivals and 8.7 million excursionist arrivals. Most of the visitors were from ASEAN countries especially from Singapore, Indonesia and China. With an increase of 2.9 percent inbound visitors; the inbound tourism expenditure has increased by 2.4 billion in 2012.

Total visitor receipts was RM62.5 billion (Figure 1), which comprised of RM60.6 billion tourist receipts and RM2.0 billion excursionist receipts. Given that, the contribution of inbound visitors' expenditure to the GDP was 6.6 percent which has remained constant in the range of 6.1 to 7.7 percent from 2005-2012. In terms of Compounded Annual Growth Rate (CAGR), inbound tourism expenditure grew 9.5 percent annually during the seven years period. Meanwhile, the CAGR for GDP grew 8.2 percent annually. The share of inbound tourists decreased to 60.5 percent of internal tourism consumption in 2012 as compared to 62.4 percent in 2011. In addition, inbound tourism expenditure

accounted for 7.6 percent of total exports (merchandise and services) in 2012. The average per capita expenditure for tourist was RM2,419, while for excursionists it registered RM229.

In 2011 and 2012, inbound visitors spending pattern were the same. In 2012, visitors mostly spent on country-specific characteristic goods (shopping), followed by accommodation and food & beverage serving services. Inbound tourism expenditure showed a similar trend from 2005 to 2010. Inbound visitors spent mainly on accommodation, secondly on shopping and food & beverage serving services.

**Figure 1: Inbound Tourism, 2012**





In 2012, the number of domestic visitors was 141.5 million. Selangor was the most visited state with 17.9 million visitors, followed by Sabah 17.3 million visitors and Perak 13.0 million visitors. The top five destinations visited by domestic visitors in Selangor were I-City, Batu Caves, Sunway Lagoon Theme Park, Pantai Morib and Zoo Negara. Domestic visitors' receipts registered RM40.8 billion and contributed 39.5 percent of internal tourism consumption in 2012.

Domestic tourism expenditure contributed 4.3 percent to GDP which is maintained in the range of 2.3 to 4.3 percent from 2005-2012. Domestic tourism expenditure expanded from RM36.2 billion in 2011 to RM40.8 billion in 2012, which recorded a positive growth of

12.7 percent in 2012. In 2012, the highest expenditure by domestic visitors was on shopping, which registered RM14.9 billion.

Total output of the tourism industry was RM216.2 billion and 47.8 percent of the output has been utilised for the internal tourism consumption in 2012. The contribution of internal tourism consumption to the GDP in 2012 was 11.0 percent.

During the seven years period, the contribution of internal tourism consumption to the GDP was between 8.8 to 11.2 percent. Tourism industry is expected to contribute RM103.6 billion to the total Gross National Income (GNI) by 2020 (with a projection of 36 million tourist arrivals) as outlined in the ETP.

**Figure 2: Domestic Tourism, 2012**

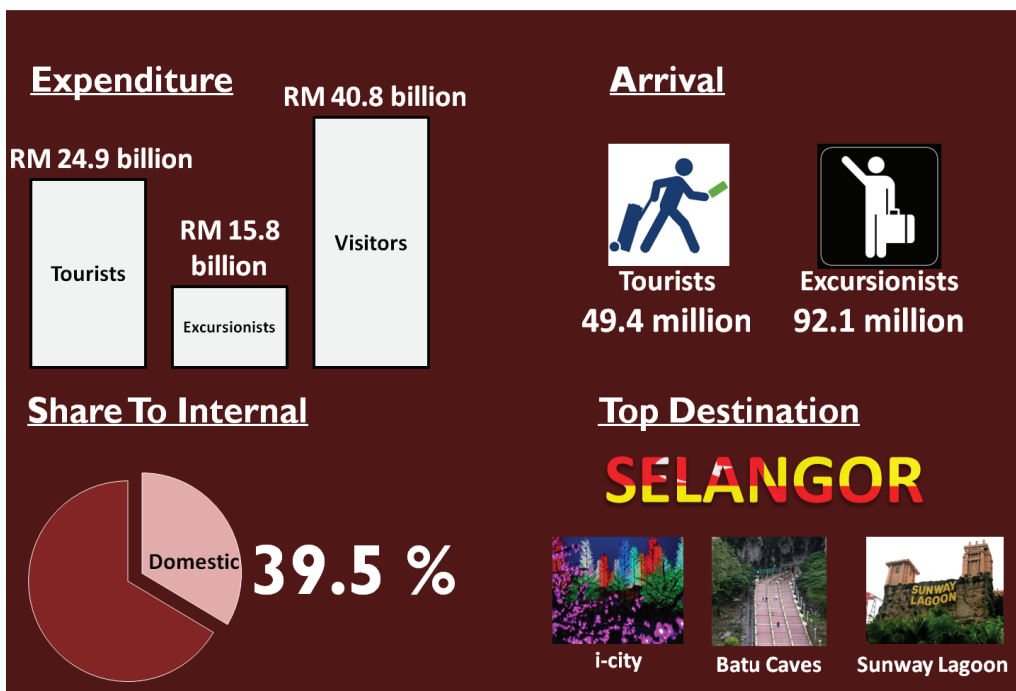


Figure 3: Internal Tourism, 2012

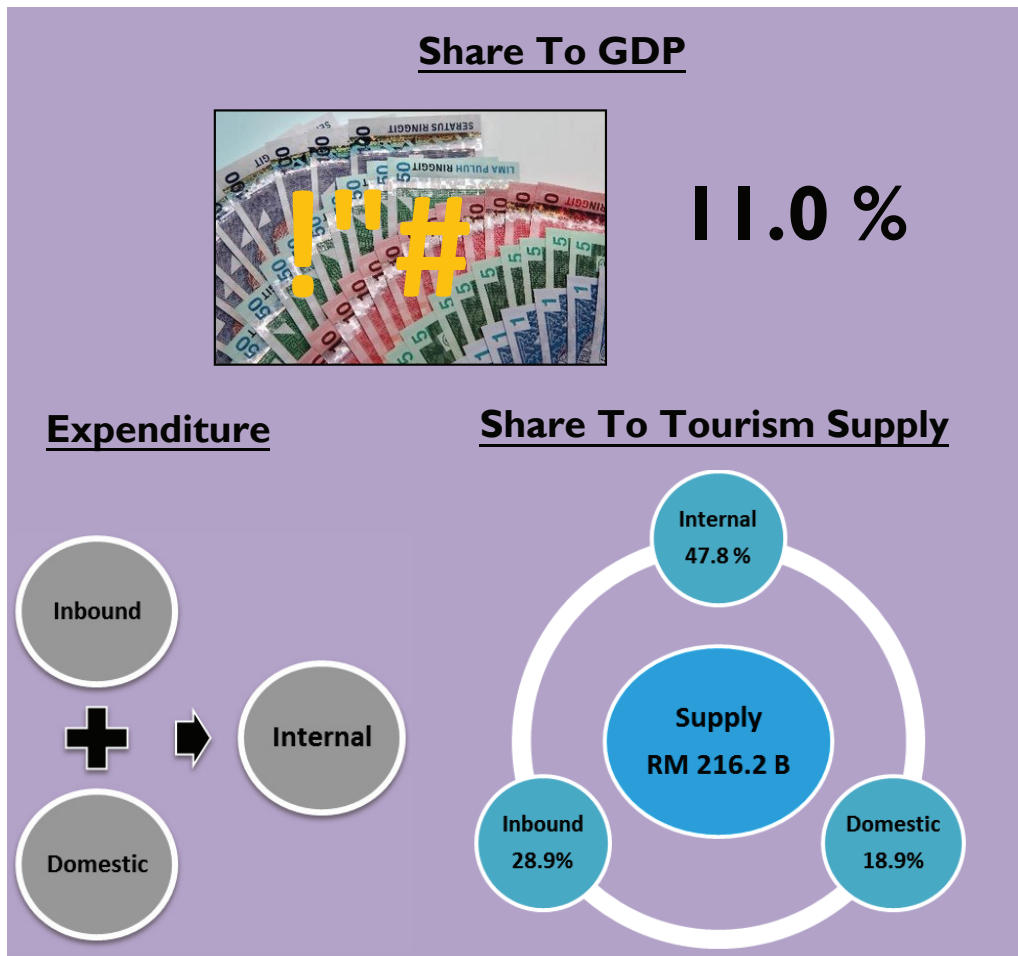
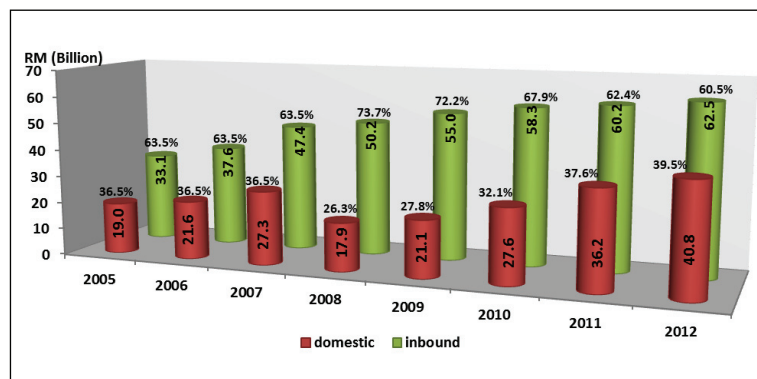


Figure 4: Internal Tourism Expenditure, 2005-2012



Internal tourism consumption is largely dominated by inbound tourism expenditure. Since 2005, the percentage share of inbound tourism expenditure is larger than the percentage share of domestic tourism expenditure as depicted in Figure 4. In 2012, inbound tourism expenditure contributed 60.5 percent to internal tourism consumption. Meanwhile, the share of domestic tourism expenditure has marginally increased from 37.6 percent in 2011 to 39.5 percent in 2012.

#### Impact of Tourism Demand to Related Tourism Industry

The relationship between demand and supply of tourism related goods and services in the Malaysian economy can be observed from the TSA. Total tourism demand was RM103.3 billion, accounting for 47.8 percent of all goods and services supplied in Malaysia economy in 2012.

The tourism ratio provides an estimate of the proportion of each product consumed by visitors as compared to the supply. For the year 2012, accommodation services for visitors posted the highest tourism ratio of 0.92 compared with other tourism characteristic products. This reflects that visitors' demand for accommodation services was 92.0 percent out of total accommodation services supplied and 8.0 percent was consumed by non-visitors. Meanwhile, passenger transport services recorded the second highest tourism ratio at 0.84.

Travel agencies and other reservation services registered a tourism ratio of 0.67 in 2012 as compared to 0.79 in 2011. It indicates that the demand for travel agencies and other reservation services by visitor's decreased from 79.0 percent to 67.0 percent in 2012.

Gross Value Added of Tourism Industries (GVATI) is the total gross value added of tourism industries regardless of whether their output is provided to visitors or non-visitors. GVATI posted a growth of 7.6 percent in 2012 to attain RM117.6 billion as against RM109.4 billion in 2011. The share of GVATI to GDP was 12.5 percent in 2012.

Tourism Direct Gross Value Added (TDGVA) is the part of gross value added generated by tourism industries and other industries which consumed by the visitors. TDGVA recorded RM49.4 billion in 2012, an increase from RM46.1 billion in 2011. It posted a growth of 7.0 percent in 2012 as compared to 8.8 percent in 2011. The share of TDGVA to overall gross value added in 2012 remained at 5.3 percent as compared to 2.8 percent generated by Australia. It shows that tourism industry in Malaysia is performing well and registered a significant contribution to the economy.

Tourism Direct Gross Domestic Product (TDGDP) is the value of TDGVA including net taxes on products and imports. TDGDP attained RM49.4 billion in 2012 as compared to RM46.2 billion in 2011 with a growth of 7.0 percent in 2012. The share of TDGDP to GDP for the period of seven years was in the range of 4.7 to 5.4 percent.

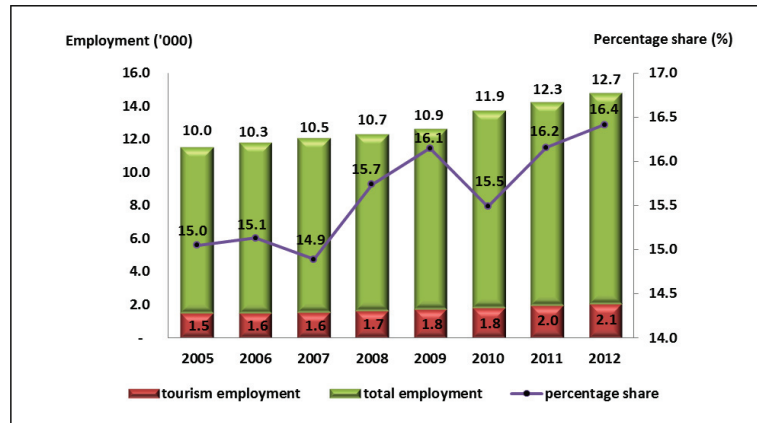
#### Employment Generated by Tourism Industries

The tourism industry has become an important source of employment in Malaysia. Currently, the tourism industry employs a significant number of workers, accounting for 15.9 percent of total employment in 2012 against 15.7 percent in 2011 (Figure 5). Moreover, the UNWTO is expecting the sector to provide 296 million jobs globally by 2019.

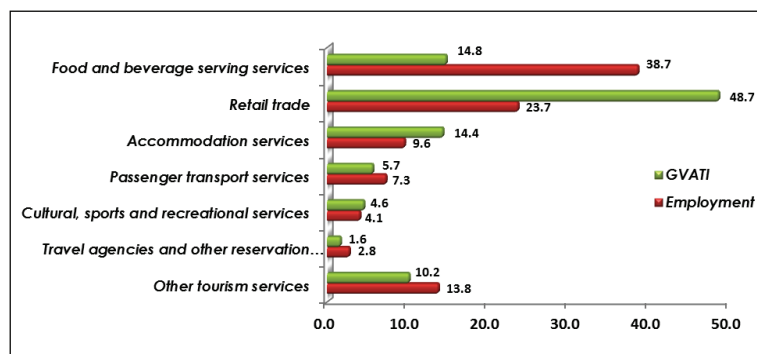
Tourism's share of total employment is greater than its share of gross value added (16.4 percent). This is because the tourism industry such as food and beverage serving services, passenger transport services and other tourism services such as spa & education tends to be more labour-intensive than other forms of economic activities (Figure 6).

The tourism industry employed almost 2.1 million persons in 2012. Employment in tourism related industries recorded a faster growth of 4.7 percent against 3.5 percent growth in total employment. Based on ETP, the tourism industry is targeted to create 497,200 additional tourism jobs by 2020.

**Figure 5: Employment Generated by Tourism Industries, 2005-2012**



**Figure 6: Employment and GVATI, 2012**



### Conclusion

Satellite Accounts provide detailed and comprehensive information on the contribution of a specific economic activity, facilitating the formulation of better focused policies and programmes by policy makers. In addition, the TSA will assist researchers, industry players & citizens to better design their business strategies and in evaluating their effectiveness & efficiency.

TSA provides detailed information that can be used by agencies related to tourism events in improving the current account balance of the country. In addition, the establishment of Satellite Accounts by other countries allows comparability at the international level. The expertise and experience of Malaysia in developing Satellite Accounts will be beneficial towards enhancing the existing concepts and methodology in line with the international guidelines.

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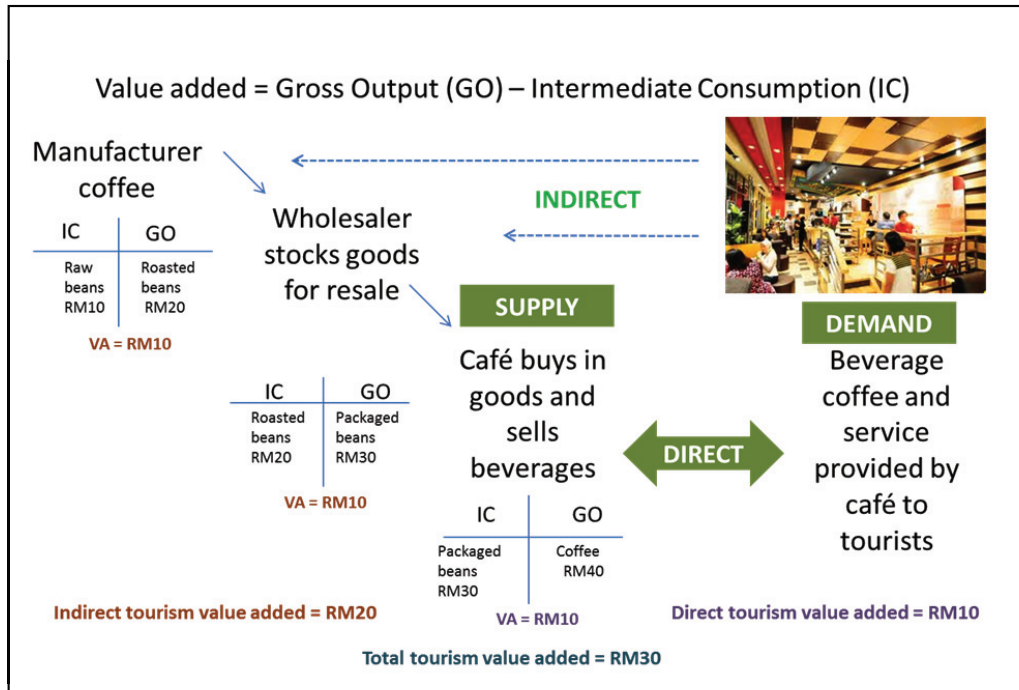
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**Direct & Indirect Supply and use Relationship**





# MONITORING SHADOW BANKING AND ITS CHALLENGES: THE MALAYSIAN EXPERIENCE

Muhamad Amar Mohd Farid<sup>1</sup>

## Abstract

The recent global crisis has shown that greater attention needs to be accorded to the role and scope of institutions operating within the shadow banking system in transmitting risks to the financial system. This paper describes the characteristics and size of credit intermediation activities undertaken by non-bank entities within the financial system in Malaysia and outlines the approach undertaken in monitoring the developments and assessing the potential transmission of risk into the system. The paper also describes the challenges faced in identifying and understanding the shadow banking system; obtaining the necessary information and statistics; and assessing the transmission of risks to the rest of financial system.

## Introduction

The recent global financial crisis (GFC) in recent years was an eye-opening and defining moment for financial regulators around the world in two ways. First, the GFC has taught us that non-bank financial institutions (NBFIs), which existed in the early nineties to complement the traditional banking system, are a major source of systemic risk to the financial system due to its significance as a source of credit and liquidity in the economy and its interconnectedness with the banking system. Second, the GFC shows the failure of regulators and market participants to fully understand and appreciate the strength of the amplifying mechanisms, particularly those of the shadow banking system that exacerbated business and financial cycles in the financial system (Dudley, 2009).

Learning from the crisis, there have been increased efforts by policy makers around the globe to better understand the shadow banking system and to identify information needs to develop a robust monitoring framework. At the 2010 Seoul Summit, the G20 Leaders called for authorities to put greater focus on shadow banking and requested for the Financial Stability Board (FSB) to be the lead organisation, along with other international bodies, in developing recommendations to strengthen the regulation and supervision of the shadow banking system by mid-2011 (FSB, 2011). The FSB has subsequently published a report with broad recommendations to strengthen the oversight and regulation of shadow banking in October 2011. In addition, other jurisdictions have also started to address the policy issues regarding shadow banking, including Malaysia.

While there have been steps forward, challenges abound to unravel the complexity and gain greater understanding of the shadow banking system. The FSB (2011), in its progress report on shadow banking, sets out with seven broad principles in monitoring the shadow banking system but stresses that the working groups on the shadow banking initiatives are in the process of finalising the policy recommendations. The international setting body also highlights that the broad principles act as guidance for authorities in monitoring the shadow banking system and they are not exhaustive given the unique characteristics of the system varies across jurisdictions. This diversity remains as the major challenge for authorities in conducting their surveillance on the shadow banking system.

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This paper aims to shed some light towards a greater understanding of the size and structure of the shadow banking system and its role in the Malaysian financial system. The paper is structured into four sections. The first section reviews the current literature on the shadow banking system. The second section provides a discussion on the shadow banking system in Malaysia. This includes the operational definition adopted by Bank Negara Malaysia (BNM), estimated size of the system according to the definition and a brief overview of the components of the system. Given the structure and focus of the shadow banking system, the third section of the paper discusses an empirical analysis of the growth in financing by NBFIs to the household sector. Next, the paper looks at the current initiatives undertaken by BNM in monitoring the developments in and assessing potential risk of the shadow banking system to the overall financial system stability and the challenges faced by BNM in exercising its surveillance routine on the shadow banking system.

## Literature Review

### Overview of Shadow Banking

The term “shadow banking” was first coined by Paul McCulley in which he defined the system as a “levered-up financial intermediary whose liabilities are broadly perceived to be similar in money-goodness and liquidity as conventional bank deposits” (McCulley, 2008). It is worth noting that the term “shadow banking” does not bring any connotation to it as is the case of “shadow economy”. Pozsar et al. (2010) note that the term “shadow banking” is in fact pejorative for such a large and important part of the financial system.

Similar to traditional banking, shadow banking may also be inherently unstable. This instability is particularly evident in the components of the United States (US) financial system, which was instrumental to the propagation of the GFC (Ricks, 2010). The instability of the shadow banking system is mainly attributable to the credit intermediation provided and facilitated by the institutions outside of the regular banking system, which typically rely on short-term funding from the markets (FSB, 2011). McCulley (2009) is

among the first to discuss this channel of instability by establishing that shadow banking entities fund themselves with uninsured commercial paper, which may or may not be backstopped by liquidity lines from banking institutions. He further stresses that the short-term funding may render the shadow banking system vulnerable to runs, especially when commercial paper investors refuse to invest in new papers when their holdings mature, leaving the shadow banking entities with a liquidity crisis. Ultimately, the shadow banking entities are left with two choices to keep the entities afloat; either relying on credit lines from banking institutions or liquidation of assets at fire sale prices or both.

The FSB has also attempted at providing guidance on the definition of a shadow banking system. The shadow banking system, intentionally defined to be rather broad, encompasses “a system of credit intermediation involving entities and activities in an environment where prudential requirements are not applied or applied to a materially lesser or different degree than those applied to the banking system”. Being the core business of the traditional banking system, participation of shadow banking entities in credit intermediation, which involves maturity, liquidity and credit transformation, can significantly reduce the cost of lending (Pozsar et al., 2010). The reduction of cost of lending via credit intermediation is a contributing factor that explains the significant growth of the shadow banking system in the US prior to the GFC.

The complexity of the shadow banking system warrants authorities to cast their net of macroprudential surveillance wide in order to capture entities or activities involved in credit intermediation outside the regulated banking system. Although it is beneficial for authorities to monitor the shadow banking system from a macroprudential perspective, it may not be necessarily helpful if the authorities are unable to focus on specific activities or components of the shadow banking system that are likely to emit and transmit risks to the financial system. Recognising the complexity, the FSB has urged authorities to narrow their focus on activities that give rise to either or both systemic risk concerns and regulatory

arbitrage concerns.<sup>2</sup> Regulatory arbitrage is another contributing factor that drove the growth of shadow banking. Regulatory arbitrage enables less-regulated shadow banking entities to offer financial products at prices that are cost-inefficient if offered by the regulated banking institutions.

Bakk-Simon et al. (2012) of the European Central Bank (ECB) provides an overview of the shadow banking system in the Euro area. The size of the shadow banking system in the Euro area is relatively smaller in comparison to that of the US, representing less than half of the total assets of the banking sector. Key components of the shadow banking system were studied in this paper. Similar to the US, the shadow banking system in Europe is diverse across countries, reflecting differences in legal and regulatory structure. Securitisation issuance is smaller in volume and remains less developed than in the US. Money market funds (MMFs) in the European countries are almost the same size as MMFs in the US although the former is more heterogeneous. Meanwhile, the repo market is a key source of funding in both the US and Europe. The study also highlights the increase in Euro banks' reliance on funding from the financial sector, with the bulk of the financing originate from other financial institutions (OFIs) that include shadow banking entities. The OFIs are the main driver of the overall increase in banks' leverage before the crisis.

While there are scores of analytical literature on the role and development of NBFIs in the US before and after the GFC, similar studies on NBFIs in Asia are scarce. A study by Shrestha (2007) is among the few that discusses the role of NBFIs in Asia and provides insights on the diversity of the NBFIs in selected South East Asian Central Banks (SEACEN) countries.<sup>3</sup> The study does not deliberate on shadow banking issues as currently debated globally. Instead, it focuses on the developments of NBFIs and their role in the transmission mechanism of monetary policy and financial system. However, no clear

distinction between banks and NBFIs is made due to the different approaches adopted in defining the non-bank financial intermediation system across the countries surveyed. The provisions of credit and other financial services to sections of the population that are normally not served by the banks range from 1% to 27% of the countries' financial system. These institutions also facilitate the growth of selected economic sectors, such as real estate and agriculture through the provision of specialised services. Disbursement by NBFIs in South Korea, Malaysia, Singapore and Taiwan has seen a declining trend for the period between 1995 and 2005. In terms of assets, the market share of NBFIs in Brunei Darussalam, Indonesia, South Korea and Nepal have shown positive growth in the last decade prior to 2005 while the share of NBFIs in Malaysia, Philippines, Singapore and Thailand have shown gradual decline. The evidence led the author to conclude that the NBFIs should be promoted formally in the financial system and the oversight imposed on these entities should not lead to diminished capacity of their intermediary functions.

The size of the shadow banking in Asia, in general, is relatively smaller in comparison to the regulated banking sector.<sup>4</sup> Authorised deposit-taking banking institutions remain the major component of the financial system in most economies in the region (see Appendix).<sup>5</sup> Markets in Asia are also generally less complex. While securitisation has notable presence in a few Asian markets such as Japan, Australia and Malaysia, such activity remains almost non-existent in other Asian economies. Pension funds and insurance companies account for a large portion of assets in the shadow banking system while the remaining components are very much diversified, ranging from traditional lending to fund management. Shadow banking activities in Asia remain predominantly the traditional provision of finance in the form of lending to certain segments of the economy, reflecting the less-complex nature of the shadow banking system in this region.

<sup>2</sup> Systemic risk concerns may arise from maturity and liquidity transformation activities, leverage and flawed credit risk transfer between banks and shadow banking entities. Regulatory arbitrage concerns, on the other hand, arise when shadow banking entities engage in activities that are capable of circumventing banking regulations (FSB, 2011).

<sup>3</sup> The sample countries include Indonesia, Brunei Darussalam, South Korea, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Taiwan and Thailand.

<sup>4</sup> Source: various national authorities' websites.

<sup>5</sup> Based on estimates on the size of the shadow banking system in selected Asia-Pacific countries, namely Australia, People's Republic of China, India, Thailand and Japan. See Appendices for details.

## Data on Shadow Banking System

Coverage of the shadow banking system is critical to facilitate the understanding of the presence of maturity transformation, leverage and the possible channels for systemic contagion to the overall financial system. The lack of data capture for the shadow banking system also poses challenges for effective formulation of appropriate regulatory measures to contain systemic risk.

In the speech “Macroprudential Surveillance and Statistical Challenges” delivered by Dr. Andreas Dombret, Member of the Executive Board of the Deutsche Bundesbank, at the Sixth European Central Bank Statistics Conference 2012, two aspects with regard to shadow banking that are imperative for macroprudential surveillance exercises were highlighted. First is the need to put data gap issue at the top of regulators’ agenda. In this aspect, shadow banking and insurance are particularly challenging from a statistical point of view. Second is the lack of consensus on the operational definition of the shadow banking system and oftentimes, the classification of the entities is left to the discretion of journalists. This has become a concrete reason for Europe to have its own international business register for shadow banking entities. To address these challenges, Dombret (2012) proposes for central banks to be given the mandate to collect data from both banks and shadow banking entities and for Europe to have its own international business register for shadow banking entities. There has been progress on these fronts. The ECB is enhancing its act to facilitate comprehensive data capture and establishing inter-agency cooperation with the Bank for International Settlements (BIS) in terms of data collection (Bakk-Simon et. al, 2012).

Shrestha (2007) also highlights the difficulty in obtaining granular data in his study. Furthermore, data on NBFIs are inconsistent with the data on banking institutions particularly in terms of frequencies, resulting in difficulties in making comparisons between banks and NBFIs.

Given the complexity of the shadow banking system and geo-economic differences in each jurisdiction, there is no standard definition that is applicable across all jurisdictions while the broad definition crafted by the FSB merely acts as a guiding principle. Data availability remains a major challenge, which impedes the effectiveness of surveillance on the shadow banking system (Shrestha, 2007; Dombret, 2012; Bakk-Simon et. al, 2012). Notably, there is little analytical study done on shadow banking in Asia as compared to the growing trend of such studies in the US. This paper attempts to contribute to the discussions on understanding the size of the shadow banking system and the challenges faced in monitoring the development of the system.

## Overview of the Shadow Banking System in Malaysia

In Malaysia, shadow banking is defined as a “system of credit intermediation that involves entities and activities outside BNM’s regulatory capture”. Based on this definition, the Malaysian shadow banking system comprises non-bank entities that engage in (i) loan origination; (ii) purchase of debt securities; (iii) securitisation; (iv) credit guarantee or enhancement exercises; and (v) credit rating or scoring activities (Figure 1), which account for approximately 93% of GDP.<sup>6</sup>

Similar to the structure of the shadow banking system in Asia, the shadow banking system in Malaysia is relatively less complex and smaller than the banking system. Table 1 indicates the size of NBFIs in Malaysia in comparison with the banking institutions. The data used to measure the size of these entities were obtained through the annual Sources and Uses of Funds survey undertaken by BNM, which has been the central bank’s approach in monitoring NBFIs since the early 1990s. The market share of assets held by NBFIs has shown gradual increment in the past decade, with 27% of total assets in the financial system in 2000, rising to 28% in 2010. Unit

<sup>6</sup> Size based on the first four shadow banking activities as a percentage of 2011 Gross Domestic Product (GDP).

trust funds recorded the highest growth at 14.8% in the observed period, indicating an increase in wealth accumulation activities by the household sector. The gradual growth of the Malaysian shadow banking system reflects the increase in the complementary role assumed by NBFIs in deepening the Malaysian financial system. On the other hand, banks' assets market share remains above 50% every year, reflecting the position of banking institutions as the backbone of

the Malaysian financial system. In addition, credit intermediated by banks accounted for 61% of total credit intermediated in 2011 while the remaining was dispersed among various NBFIs.<sup>7</sup> The following summarises the key observations of the main components of the shadow banking system in Malaysia, which include (i) provident and pension funds; (ii) unit trust funds; (iii) securitisation activities; and (iv) other non-bank credit providers.

**Table 1: Assets of Banks and NBFIs in Malaysia**

Institutions	2000 (RM billion)	Share (%)	2005 (RM billion)	Share (%)	2010 (RM billion)	Share (%)	CAGR <sup>3</sup>
Banks	699.5	63.8	958.5	59.2	1,549.8	58.5	8.3
NBFIs	301.0	27.0	456.4	28.2	735.1	27.7	10.2
Unit Trust Funds	32.6	2.9	57.5	3.5	130.1	4.9	14.8
Co-operative Societies	12.3	1.1	34.5	2.1	15.1	0.6	2.1
Provident and Pension Funds	216.9	19.5	319.4	19.7	548.3	20.7	9.7
Other NBFIs <sup>1</sup>	39.1	3.5	45.0	2.8	41.6	1.6	0.6
Total Assets of Financial System <sup>2</sup>	1,114.3	100.0	1,618.5	100.0	2,650.7	100.0	9.0

\*Source: BNM

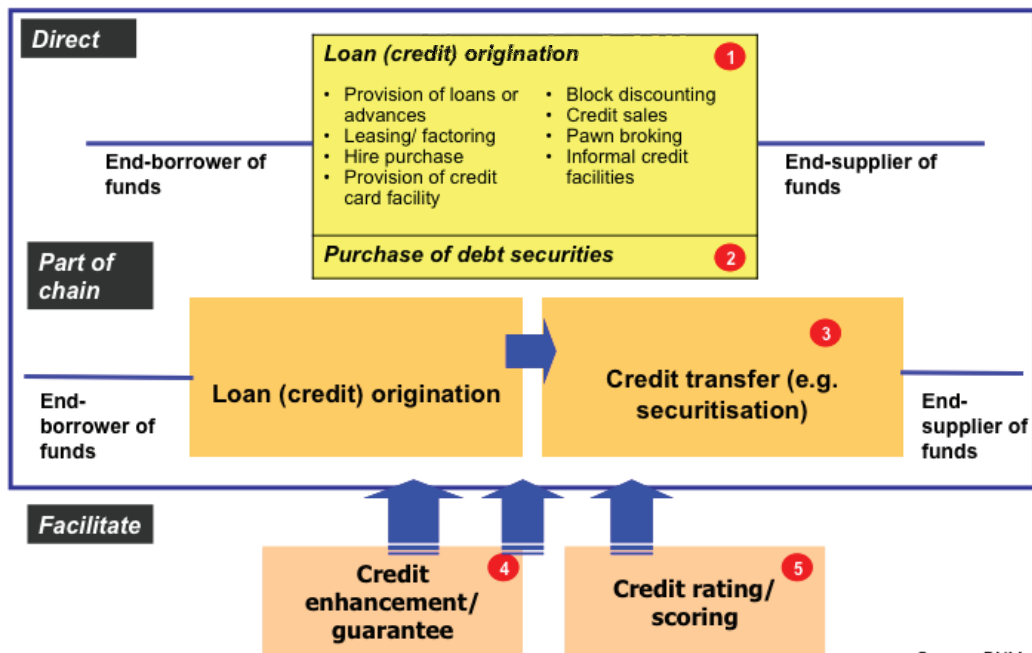
Note:

<sup>1</sup> Other NBFIs comprise leasing companies, factoring companies, Cagamas, and major non-bank credit providers

<sup>2</sup> Total assets of the Malaysian financial system include assets of banks, insurance companies, development financial institutions (DFIs) and NBFIs

<sup>3</sup> Compounded annual growth rate, 2000-2010

**Figure 1: Credit Intermediation by Non-banks in Malaysia**



<sup>7</sup> See BNM's Financial Stability and Payment Systems Report 2011, White Box Article: Non-bank Intermediaries in Malaysia.

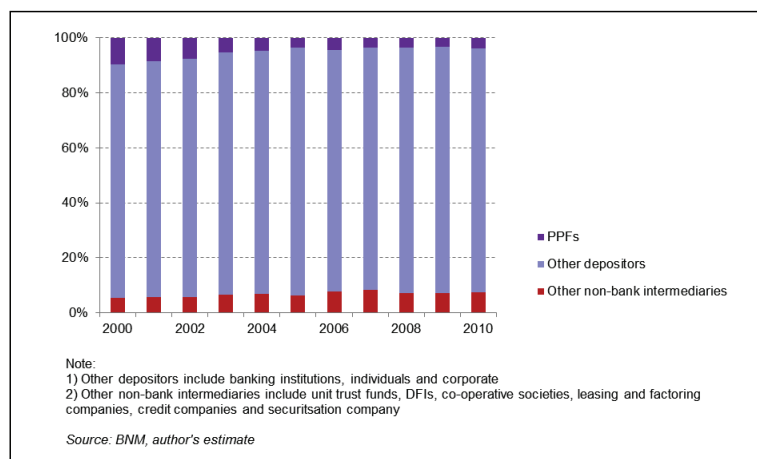
### Provident and Pension Funds

Provident and pension funds (PPFs) are the largest component of the Malaysian shadow banking system, accounting for 41% of total assets of NBFIs in Malaysia and 18% of total financial system assets as at end-2010. PPFs in Malaysia are major providers of liquidity in the financial system, particularly to the banking institutions through their deposit placements. Despite the continuous growth of deposits in the banking system, Figure 2 shows that the deposits by PPFs started to moderate on the brink of the GFC in 2006 while the deposits by other NBFIs only began to grow at a slower pace during the crisis.

deposits by NBFIs and PPFs in particular have significant impact on the liquidity in the banking system. Figure 2 suggests that the impact will be minimal if such a situation occurs. There is also a concern that the deposit withdrawal by NBFIs would affect the liquidity standards under the Basel III requirement<sup>8</sup>. In particular, deposits by PPFs, which are made up mainly of households' contributions, would be subjected to severe withdrawal assumptions (or "run-off" rates) under the new liquidity standard. The assumptions, however, do not take into consideration the underlying liquidity risk profile of the NBFIs' deposits. To assess the validity of these assumptions, a simple regression of the total deposits against its components was estimated.

A simple regression analysis was conducted to determine whether a mass withdrawal of

**Figure 2: Deposits with Banks**



The following OLS was estimated:

$$\begin{aligned} \log(\text{TotalDep})_t &= c + \beta_1 \log(\text{DepBank\&DFI})_t + \beta_2 \log(\text{DepIns})_t \\ &+ \beta_3 \log(\text{DepPPF})_t + \beta_4 \log(\text{DepTrust})_t + \beta_5 \log(\text{DepCoop})_t \\ &+ \beta_6 \log(\text{DepOtherNBF})_t + \beta_7 \log(\text{DepHH\&Corp})_t + \beta_8 \log(\text{GDP})_t \\ &+ \varepsilon_t, \quad \varepsilon_t \sim N(0,1) \end{aligned}$$

- Where
- $\log(\text{TotalDep})_t$  = log of total deposits in the banking system
  - $c$  = constant
  - $\beta_1 \log(\text{DepBank\&DFI})_t$  = log of deposits by banks and DFIs
  - $\beta_2 \log(\text{DepIns})_t$  = log of deposits by insurance companies
  - $\beta_3 \log(\text{DepPPF})_t$  = log of deposits by PPFs
  - $\beta_4 \log(\text{DepTrust})_t$  = log of deposits by unit trust funds
  - $\beta_5 \log(\text{DepCoop})_t$  = log of deposits by co-operative societies
  - $\beta_6 \log(\text{DepOtherNBF})_t$  = log of deposits by other NBFIs
  - $\beta_7 \log(\text{DepHH\&Corp})_t$  = log of deposits by households and corporations
  - $\beta_8 \log(\text{GDP})_t$  = log of nominal GDP
  - $\varepsilon_t$  = error term

<sup>8</sup> See "Basel III: International framework for liquidity risk measurement, standards and monitoring" (BIS, 2010).

The result of the OLS in Table 2 provides suggestive evidence that deposits by NBFIs do not explain the movement of total deposits in the banking system over time as compared to deposits by the households,

corporate sectors, banks and DFIs. This suggests that an extremely large withdrawal by the PPFs may not pose a significant concern to the banks when the new liquidity requirements under Basel III take effect.

**Table 2: OLS for Deposits by Banks and NBFIs in the Banking System**

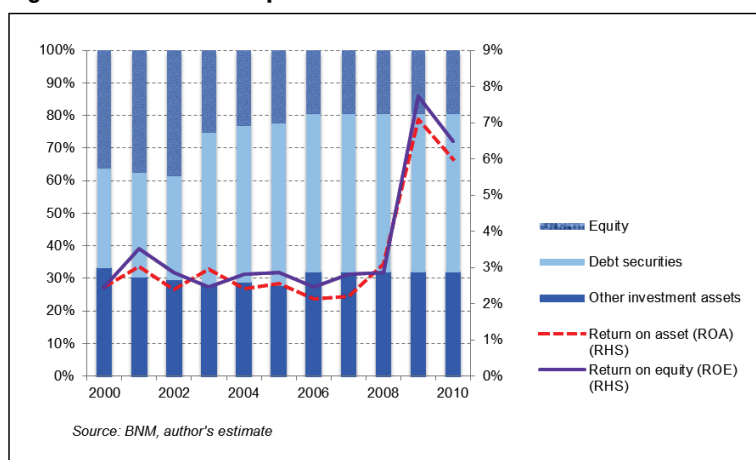
Explanatory Variables	t-Statistic
Log of deposits by banks and DFIs	3.2258* (0.2424)
Log of deposits by insurance companies	0.5867 (0.3004)
Log of deposits by PPFs	1.5395 (0.0481)
Log of deposits by unit trust funds	1.4988 (0.0305)
Log of deposits by co-operative societies	0.6207 (0.0041)
Log of deposits by other NBFIs	0.4083 (0.0026)
Log of deposits by households and corporations	5.0512* (0.5271)
Log of nominal GDP	0.0629 (0.0042)
Adjusted R-squared	0.8966
Durbin-Watson statistic	1.3349
Number of observations	12

Note:  
<sup>1</sup> Figures inside parenthesis are the coefficient of the corresponding statistic  
 \* Significant at 5% level of significance

PPFs also play a significant role in providing liquidity in the domestic capital and bond markets with the Employee Provident Fund (EPF) and Retirement Fund Incorporation (KWAP) being the most significant players. The asset composition of PPFs has been stable over time since 2003, with

investments in debt securities accounted for more than 40% of total assets on average, followed by equity holdings at 16% on average (Figure 3). This is in line with one of the main objective of PPFs, which is to generate sustainable income in the long run.

**Figure 3: PPF Asset Composition**

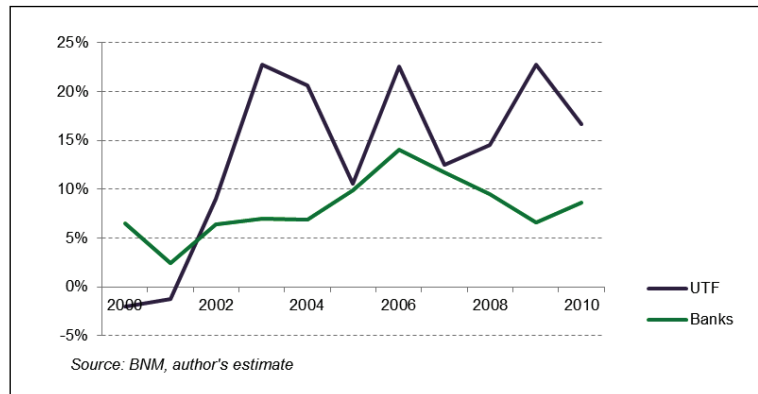


### Unit Trust Funds

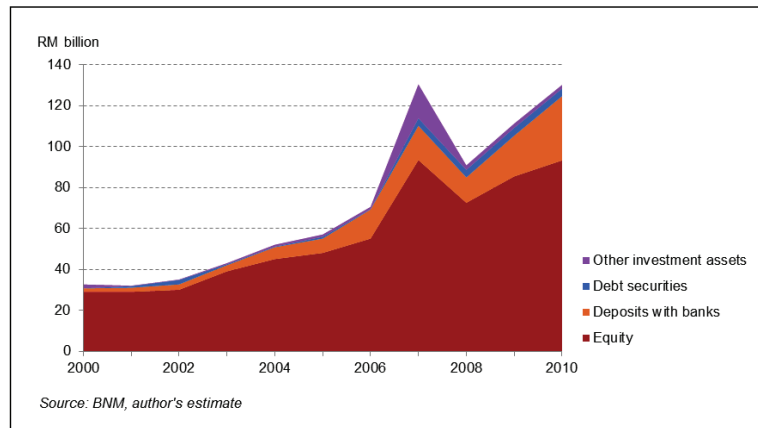
The unit trust funds (UTFs) industry in Malaysia has grown significantly over the years (Figure 4). This growth can be attributed to several factors including the role of the UTFs as an avenue for household to accumulate wealth, the generally high savings level in Malaysia and the introduction of a scheme by the EPF, which allows members to withdraw their funds to invest in UTFs. It is also worth noting that UTFs in Malaysia are not akin to Money Market Funds (MMFs) in the US although both funds are subsets of mutual funds. MMFs are usually funds that invest in high quality and low duration fixed income instruments such as commercial paper and the US Treasury Bill, which are not prevalent in Malaysia. Therefore, UTFs do not transmit the same kind of shocks to the financial system as the MMFs in the US.

UTFs in Malaysia are heterogeneous, comprising variable and fixed net asset value (NAV) funds. Unlike UTFs, MMFs in the US are homogenous where these funds are required to maintain a fixed NAV at USD1 akin to bank deposits. UTFs in Malaysia are also major providers of liquidity to the financial system through their deposit placements in the banking system and significant holdings of securities in the capital market. Figure 5 shows that the investment assets of UTFs in Malaysia peaked at the beginning of the GFC and fell sharply in the following year at the height of the crisis. The decline in asset value was due to the decline in asset prices amidst global market volatility. Nevertheless, the impact of the crisis on Malaysian UTFs was short-lived as investments regained momentum in 2009.

**Figure 4: Asset Growth of UTFs vs. Banks**



**Figure 5: Asset Composition of UTFs**



### Securitisation Activities

The progressiveness of the Malaysian financial markets over time has spurred innovations for sophisticated instruments such as asset securitisation to meet growing financing needs. While Malaysia is among the few countries in Asia that has some presence of securitisation activities, mainly due to the government's concerted efforts in transforming Malaysia into the largest bond market in South East Asia over the past two decades, asset securitisation only accounts for a small share of credit intermediation by NBFIs. The low reliance on securitisation in Malaysia, given the ample liquidity environment and well-capitalised banking system, resulted in securitisation activities to continue to remain small. Cagamas MBS Berhad, a subsidiary of the national mortgage corporation Cagamas Berhad<sup>9</sup>, is the major issuer of asset-backed securities (ABS) in Malaysia. The ABS issued by Cagamas MBS Berhad is currently backed by the Treasury housing loans, which makes it safer than privately issued ABS. The Treasury housing loans are provided only to Government employees and are based on repayment at source (i.e. monthly salary deduction).

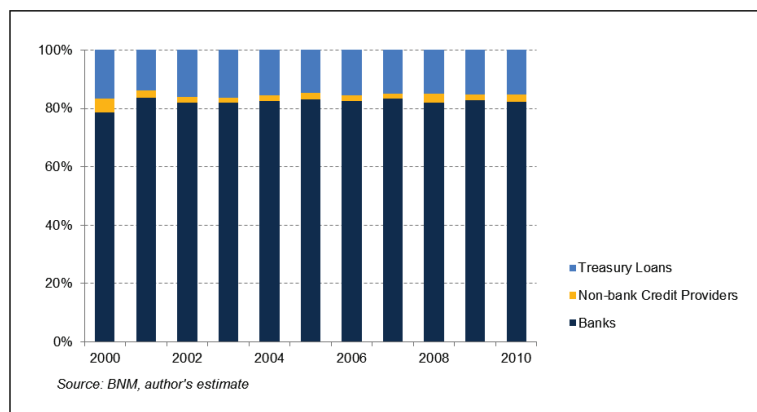
### Other Non-bank Credit Providers

Within the Malaysian shadow banking system, other non-bank credit providers account for a sizeable share of credit extension to households. These credit providers include credit co-operative societies, building societies, money lenders, pawnbrokers, factoring and leasing companies. These "shadow" credit providers exist mainly to serve certain sections of the population. Generally, this segment of population comprises borrowers in

the middle- and lower-income groups who usually reach for non-bank credit providers for personal financing or to finance their small businesses. These institutions continue to be the major providers of personal financing to households, which collectively account for approximately 60% of outstanding personal financing to household in 2011 (BNM, 2011). However, in terms of financing to the household sector, which include personal financing, property financing and credit cards, the market share of non-bank credit providers remains small as compared to the market share of financing extended by banks, accounting for approximately 2% of total financing extended to households (Figure 6).

Another salient feature of shadow banking in Malaysia is that most activities and entities are subject to certain oversight by various authorities. This shows the stark contrast between the shadow banking system and shadow economy whereby the latter operates as a channel for "underground" transactions beyond the parameter of the formal markets established by jurisdictions, which is not necessarily the case for shadow banking especially in Malaysia. UTFs, securitisation entities, as well as credit rating agencies are subject to oversight by the Securities Commission Malaysia (SC). PPFs such as EPF and KWAP, meanwhile, are governed by their specific legislations and monitored by the Ministry of Finance while private pension funds, which are relatively new in Malaysia, are under the oversight of the SC. The Malaysia Co-operative Societies Commission is the authority responsible for the progress of the co-operative societies' movements in Malaysia.

**Figure 6: Sources of Funding to Households**



<sup>9</sup> Cagamas is majority-owned by banks while BNM has a representative sitting on its Board. More information on Cagamas can be found at <http://www.cagamas.com.my>.



## Empirical Analysis on Financing by Non-bank Credit Providers

Shadow banking entities in Malaysia complement the banking system through provision of financial services to specific segments in the economy. In some Asian countries including Malaysia, the emergence of these non-bank credit providers and shadow banking entities in general is the outcome of deliberate policies by the government of the respective country to serve the financial and other supportive needs of specific sectors of the economy (Shrestha, 2007). Non-bank credit providers in Malaysia, which include co-operative societies, building societies and other institutions, are the key providers of personal financing (BNM, 2011). However, in terms total financing to households, banks remain the major providers of credit followed by the Treasury particular for financing the purchase of properties and cars.

Recognising the increasing role of non-bank credit providers in providing credit to households over time, this section of the paper attempts to study further the factors that contribute towards the financing behaviour of these institutions.

### Literature Review – Empirical Background on Financing by Non-bank Financial Institutions

Carmichael & Pomerleano (2002) examine the factors that drive the growth of NBFIs in both developed and emerging markets. In developed markets, the growth of NBFIs is mainly driven by the benefits that accrue to specialisation while in the emerging markets, they often play a broader role in deepening financial markets and overcoming legal and regulatory shortcomings. However, the recent financial crisis has shown that regulatory arbitrage has been the main factor driving the growth of NBFIs in developed markets (Pozsar et al., 2010). Lax, ineffective or non-existent financial regulation may lead to excessive risk taking by both financial institutions and investors (Liang & Reichert, 2012). Acharya et al. (2011) and Plantin (2012) argue that many shadow-banking arrangements preceding the recent financial crisis aimed at bypassing bank capital requirements, thereby achieving a higher leverage than that permitted by prudential regulation.

The main competitors for banks and insurance companies in the real estate markets have been specialised NBFIs, such as savings and loans associations, mortgage banks and credit societies. In their study, Carmichael & Pomerleano (2002) find that the dominant factor behind the overall growth of the real estate finance market has been demographic patterns. The demand for new residential housing follows the growth of population and wealth of which are accompanied by an increase in urbanisation and housing investment.

Regulatory arbitrage also contributes significantly to the level of competition in the real estate markets. Carmichael & Pomerleano (2002) cite heavily the experience in Australia, which shows that finance companies and building societies are competing against banks and insurance companies in providing mortgage lending. The effect of differing regulatory framework on the behaviour of these financial entities was more pronounced in the 1970s where bank lending rates were capped and inflation was rising sharply. In this environment, Carmichael & Pomerleano (2002) note that NBFIs specialising in real estate financing found it attractive to bid away depositors from banks and offer mortgages at unregulated interest rates, which had won them the largest market share in residential housing lending. The evidence led Carmichael & Pomerleano (2002) to conclude that the growth of NBFIs that is driven by regulatory arbitrage is potentially dangerous for systemic stability and costly in terms of financial failure.

Endut & Toh (2009) drew attention to the role of non-bank credit lenders in Malaysia in the provision of credit to the household sector. Non-bank credit providers such as DFIs have grown in prominence in the provision of credit to this segment of the economy. Nonetheless, the banking system, with its extensive branch network and increasingly flexible financing packages, remains the largest provider of household credit in Malaysia. The banking system acts as the main mobiliser of funds in the Malaysian economy and has been able to meet the increasing demand for credit arising from the growth in household asset accumulation. In

the provision of credit to household, Endut & Toh (2009) identified macroeconomic stability, financial sector development and government policies as important in influencing the supply and demand of mortgages and other household credit. Sustained economic growth in Malaysia for the period between 2000 and 2007 has raised household incomes and boosted consumer confidence, which in turn, has induced optimistic expectations of future income. The low inflation and low interest rate environment have helped to reduce the cost of borrowing, which have increased the incentive for households to borrow. The emergence of a more diversified and competitive banking system has resulted in downward pressure on interest rates, expanded credit coverage and increased loan amounts. Meanwhile, the existence of Cagamas, which purchases mortgage loans from originators such as banks and other financial institutions, have helped the Government to promote home ownership among households.

Recent developments have shown that non-bank lenders continue to grow despite the persistent economic turbulence, as well as the role these entities have played in the propagation of risks in the recent GFC. In Australia, non-bank lenders remain a major provider of housing loans with their share in the refinancing market increasing from 21% to 28% by the end of 2011 (Australian Associated Press, January 2012). Low interest rate environment, a ban on loan exit fees and demographic factor were cited to be the drivers of the growth of nonbank lenders (Australian Associated Press, January 2012; The Sydney Morning Herald, June 2012). Meanwhile, non-bank lenders in the US are trying to solidify their presence in the mortgage market, which was adversely affected by the recent financial crisis, through lobbying to policymakers and offering loans with attractive rates to middle income earners (New York Times, March 2012). In the United Kingdom (UK), stricter credit underwriting by banks and government supportive policy have created a new push for alternative financing such as

peer-to-peer financing and asset leasing for small and medium enterprises (SMEs), as well as financing from community finance institutions (Financial Times, April 2012).

#### Methodology

To explain the lending behaviour of NBFIs to the household sector, this paper uses a simple regression analysis on the determinants that have been identified in the literature as follows:

- The growth rate of financing to households by non-bank credit lenders<sup>10</sup>;
- The inverse of the growth rate of total financing approved by banks; and
- The growth rate of nominal GDP.

Data availability remains the biggest challenge in conducting empirical research on non-bank credit providers in Malaysia. Data collection is done on an annual basis hence only annual data are available. This has restricted the period coverage of this study to 2001-2010.

Variables that can be used to explain the financing disbursement include the average return on assets (ROA), average cost-income ratio and average capital ratio over estimation period to measure the growth in assets as applied in other studies (Barron et al., 1994). However, data limitation impedes the use of such variables. Consequently, in this study, the growth rate of financing to households indicates the trend of financing disbursement by non-bank credit providers in Malaysia over the years. As reflected in Figure 6 in the previous section, the disbursements of financing to households by non-bank credit lenders have seen moderate growth for the past decade and account for approximately 2% of total household indebtedness.

The growth rate of nominal GDP is the only macroeconomic variable used, which hypothetically may explain broadly the financing behaviour of both banks and non-bank credit providers. The growth rate of financing approved by banks is expected to have an inverse relationship with the non-bank credit providers' financing behaviour.

<sup>10</sup> A sample was taken from major non-bank credit providers that include credit co-operative societies, building societies, finance companies and hire purchase credit providers.

An OLS was estimated:

$$\widehat{NonbankL}_t = c + \beta_1 \widehat{InvApprv}_t + \beta_2 \widehat{GDP}_t + \varepsilon_t, \quad \varepsilon_t \sim N(0,1)$$

Where  $\widehat{NonbankL}_t$  = the growth rate of financing to households by non-bank credit lenders  
 $c$  = constant  
 $\beta_1 \widehat{InvApprv}_t$  = the inverse of the growth rate of total financing approved by banks  
 $\beta_2 \widehat{GDP}_t$  = the growth rate of nominal GDP  
 $\varepsilon_t$  = error term

### Results

The result of the OLS in Table 3 suggests that the growth of nominal GDP explains the financing disbursement to the household sector by non-bank credit providers. An increase in GDP growth may translate into higher financing to the household sector by the credit providers. Meanwhile, the coefficient on the growth rate of financing approved by banks carries the expected sign but not statistically significant, suggesting that there is a possibility for non-bank credit providers to take up banks' market share in financing to households although it is unlikely to materialise at present.

While the result may not be statistically robust given the data limitation, it provides an indicative picture of lending behaviour of non-bank credit providers over time. Short time series data availability has also limited the possibility of identifying determinants of the lending behaviour of non-bank credit providers. This study lends support to the need for better data capture on the shadow banking system and gives credence to the current initiatives undertaken by BNM in enhancing further its surveillance framework including improving the data capture on the activities and entities of the shadow banking system in Malaysia that may give rise to systemic risk to financial system stability. The initiatives are discussed in the next section.

**Table 3: OLS for Financing to Household Sector by Non-bank Credit Providers**

Explanatory Variables	t-Statistic
Inverse of growth rate of total financing approved by banks	0.4449 (0.0109)
Growth rate of nominal GDP	2.4092* (4.5378)
Adjusted R-squared	0.3048
Durbin-Watson statistic	1.7550
Number of observations	10

Note:  
<sup>1</sup> Figures inside parenthesis are the coefficient of the corresponding statistic  
\* Significant at 5% level of significance

## Surveillance Framework of the Shadow Banking System in Malaysia

### Surveillance Framework

The regulation of shadow banking should not be skewed towards limiting the size of the shadow banking per se<sup>11</sup> because shadow banking, as discussed earlier, is the other component that completes the overall financial system. Regulation also should not be static or uniformed across all jurisdictions as there is no unique way to monitor the ever-evolving shadow banking system. Realising this challenge, the FSB has proposed seven high-level principles in developing an effective monitoring framework and stylised steps on monitoring the shadow banking system (Table 4).

The surveillance framework for shadow banking in Malaysia was developed based on the FSB's approach with necessary adjustments according to the local shadow banking system. Figure 7

illustrates the current surveillance framework undertaken by BNM.

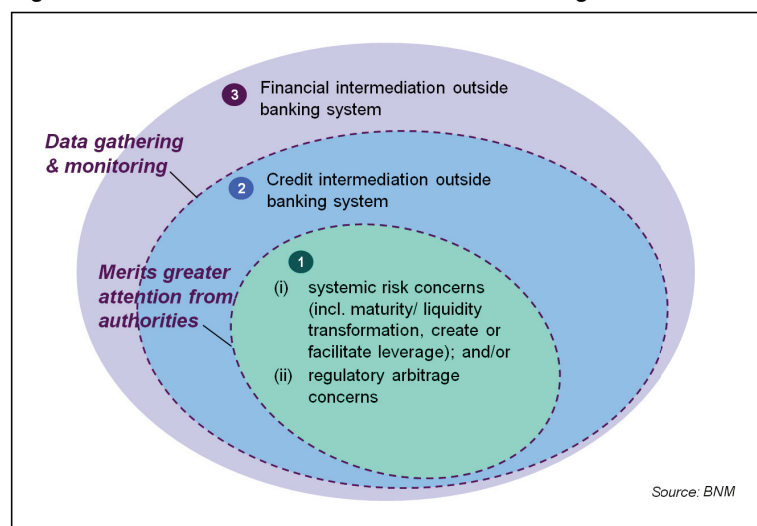
Entities that meet the definition of shadow banking are grouped based on their activities. Circle 1 contains entities that raise potential systemic risk concerns through their high level of interconnectedness with the banking system, which includes, inter alia, banks' funding exposures to the shadow banking entities, deposit placement with banks and ownership of financial institutions, apart from maturity and liquidity transformation activities. These entities also possess sizeable balance sheet in general that raises substitutability concerns. Moreover, several of them have the financial muscle to move the markets via their substantial participation in capital and money markets. Lack of substitution and high inter-linkages with banks are among the factors that make these entities systemically important that warrant greater surveillance from authorities.

**Table 4: Proposed Monitoring Framework of the Shadow Banking System**

High Level Principles	Stylised Steps to Strengthen Monitoring
<ol style="list-style-type: none"> <li>1. Authorities should cast their surveillance net wide and have an appropriate system-wide oversight in place.</li> <li>2. Identification and assessment of risk emanating from shadow banking should be conducted on a regular basis.</li> <li>3. Authorities should have the power to collect all necessary data and information.</li> <li>4. Monitoring framework should be flexible, adaptable and forward-looking.</li> <li>5. Authorities need to be mindful of possible avenues for regulatory arbitrage.</li> </ol>	<ol style="list-style-type: none"> <li>1. Scanning and mapping the overall shadow banking system.</li> <li>2. Narrowing focus to aspects that pose systemic risk or arbitrage concerns.</li> <li>3. Conduct detail assessment on those identified aspects.</li> </ol>

Source: FSB (2011)

**Figure 7: Surveillance Framework for Shadow Banking**



<sup>11</sup> See for example Schwarcz (2012).

Circle 2 encompasses entities that are involved in the extension of credit, either directly or as part of the credit intermediation chain. Most NBFIs are grouped in this circle, making it an integral part of the monitoring framework. Meanwhile, Circle 3 encompasses entities that do not fall under the shadow banking definition yet facilitate the flow of capital between end-supplier and end-user of funds, which is part of the financial intermediation chain at large. Examples of entities that fall under this category are institutional investors that provide equity funding and investment venture capital that may facilitate the conduct of credit intermediation process.

In operationalising this framework, BNM is empowered by the Central Bank of Malaysia Act 2009 to collect appropriate data from shadow banking entities outside BNM's regulatory perimeter. The current monitoring framework is tailored to each circle based on the entities' potential systemic risk to the financial system. Table 5 summarises the enhanced types of information requested according to the entities' risk profile.

The submission frequency differs for each circle. The current monitoring framework undertaken by BNM is summarised as follows:

1. Non-bank systemically important financial institutions in Circle 1 require more intensive monitoring. This is done via quarterly submission of information

and data. These entities also have the possibility of future regulation by BNM should their activities pose greater systemic risks to the financial system and the wider economy.

2. The monitoring approach for entities in Circle 2 is conducted through annual submission of required data and information. Nonetheless, the frequency of data submission of an entity will be increased to quarterly should there is a necessity to do so based on the risk assessment of that particular entity.
3. For entities in the third circle that do not meet the shadow banking criteria, surveillance is done via annual submission of data and information.

The seventh broad principle for developing an effective monitoring framework requires authorities to exchange appropriate data and information within and across jurisdictions. While cooperation among regulators in Malaysia has always been present, BNM has embarked on several initiatives to enhance its monitoring framework through strengthened inter-agency cooperation and information exchange arrangements. These include the ongoing enhancements to the Memorandum of Understanding (MoU) with the SC and the establishment of a MoU with the Malaysia Co-operative Societies Commission, which is currently in progress.

**Table 5: Types of Information based on Risk Profile<sup>12</sup>**

Information Required/Risk Profile	Types of Information
Information to facilitate assessment on financial inter-linkages and market risk position	<ul style="list-style-type: none"> <li>• Asset allocation at cost and market value, and in local and foreign currencies</li> <li>• Asset concentration in particular industry</li> <li>• Derivatives position and other off-balance sheet data</li> <li>• Exposure to repurchase agreement (repo) market</li> <li>• Borrowings from banks or other financial institutions</li> <li>• Credit exposure via financing granted and investment in private debt securities (PDS)</li> <li>• Analysis on the profile and concentration of contributors of fund</li> </ul>
Information on liquidity risk position	<ul style="list-style-type: none"> <li>• Maturity profile of assets and liabilities</li> <li>• Asset-liability mismatch analysis</li> <li>• Value of proportion of liquid assets held</li> <li>• Cash reserves</li> <li>• Cash flow position</li> <li>• Key components of income and expenditure</li> </ul>

Source: BNM

<sup>12</sup> The list of information requested is non-exhaustive and will be reviewed periodically.

### Monitoring Challenges

One of the key challenges faced is the lack of granular and quality information for risk assessment. As discussed earlier, most shadow banking entities in Malaysia are subjected to some form of oversight by various authorities. Nevertheless, there are also entities that remain outside any regulatory perimeter and hence, are not subjected to any form of statistical reporting; implying a lack of transparency. Furthermore, the lack of transparency in disclosing data and limited publicly available information about balance sheet activities hamper the understanding of shadow banking entities, which eventually complicates the assessment of risk and inter-linkages of shadow banking entities with the financial system.

The integrity of information collected from the shadow banking entities also remains an integral issue that warrants attention and immediate action. The concept of information integrity focuses primarily on the reliability of the information, which also plays a central role in information relevance and usability (Boritz, 2004). One of the attributes of information integrity is the granularity of the data. These complications arise from two ends, namely the end-provider of information (i.e. shadow banking entities) and the end-user of information (i.e. authorities). Authorities are currently plagued by the problem of

having an unclear picture of the shadow banking inter-institutional exposures with the financial system and the probability of cascading collapse from the former to the latter, which in turn compromise the quality and integrity of information collected. This is probably due to either authorities' lack of appreciation of the mechanisms of the shadow banking system or the limited dimensions in data collection. Lack of information transparency and reluctance in disclosing data by NBFIs remain the major contributing factors to the small dimensions in data collection.

Another interesting yet challenging area that this paper intends to highlight is the difficulty in finding the common financial soundness indicators for shadow banking entities and activities. The difficulty arises from the varied nature of the shadow banking system. As discussed in the previous section of this paper, shadow banking entities in Malaysia are clustered in three different circles. Although the circles indicate clearly the traits of entities that are grouped into them, there is still room for improvement in the current framework relating to statistical gauges that are specific to each circle. Currently, there are no specific systemic risk determinants that may explain the inter-circle movement among the shadow banking entities.

## Conclusion

The shadow banking system can be defined as a system comprising NBFIs that undertake or facilitate the credit intermediation process. In Malaysia, the current approach in defining the shadow banking defines the system as a “system of credit intermediation that involves entities and activities beyond the regulatory parameter of BNM”. Similar to their counterparts in Asia, NBFIs in Malaysia play a complementary role in providing access to financing to niche segments in the economy that are usually unable to get the same access from banking institutions. These entities are interconnected with the banking system through several channels such as deposit placements and borrowings, which make them a potential source of systemic risk to the financial system stability.

The recent GFC has drawn tentative lessons for authorities worldwide on the need to put greater emphasis on the surveillance of the shadow banking system. A number of initiatives to improve the surveillance on the system undertaken by international standard setting bodies are already under way. Malaysia

through its central bank has embarked on several measures on improving its surveillance of the domestic shadow banking system. The current surveillance framework differs according to an NBFIs potential systemic risk to the financial system. NBFIs that are systemically important in the financial system are required to submit granular data on a quarterly basis to BNM for risk assessment purposes. Entities that are less systemic to the financial system are required to submit relevant information on an annual basis.

Data limitation remains the biggest challenge faced by financial stability authorities in their surveillance of the shadow banking system. Experience in Malaysia has shown that the lack of granular data impedes the central bank’s initiative in developing a more robust surveillance framework. While there are challenges, the accordance of power to collect relevant information from non-BNM regulated NBFIs to BNM by the Central Bank of Malaysia Act 2009 has enabled BNM to undertake rigorous assessments on the systemic implications of the Malaysian shadow banking system to the financial system and the overall economy.

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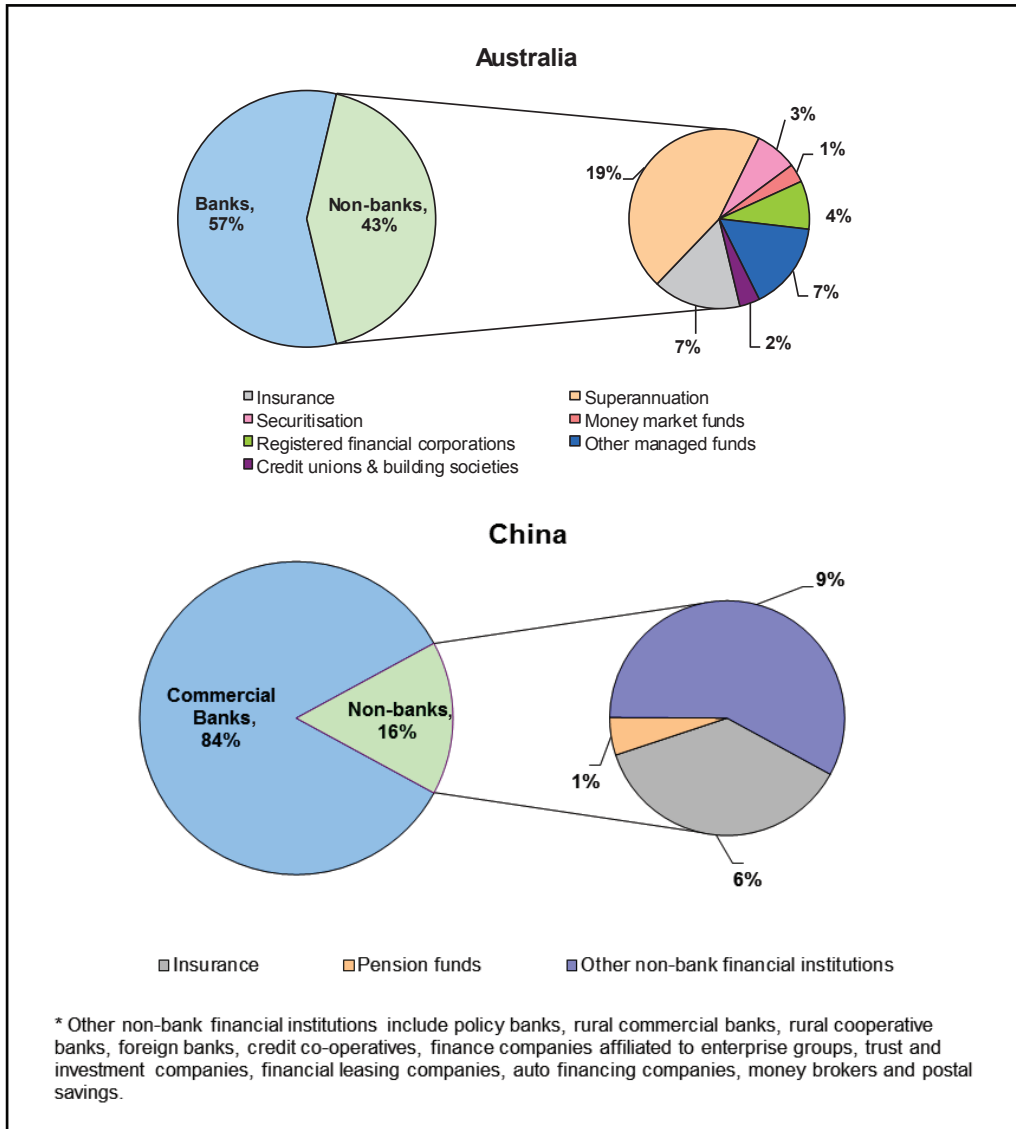
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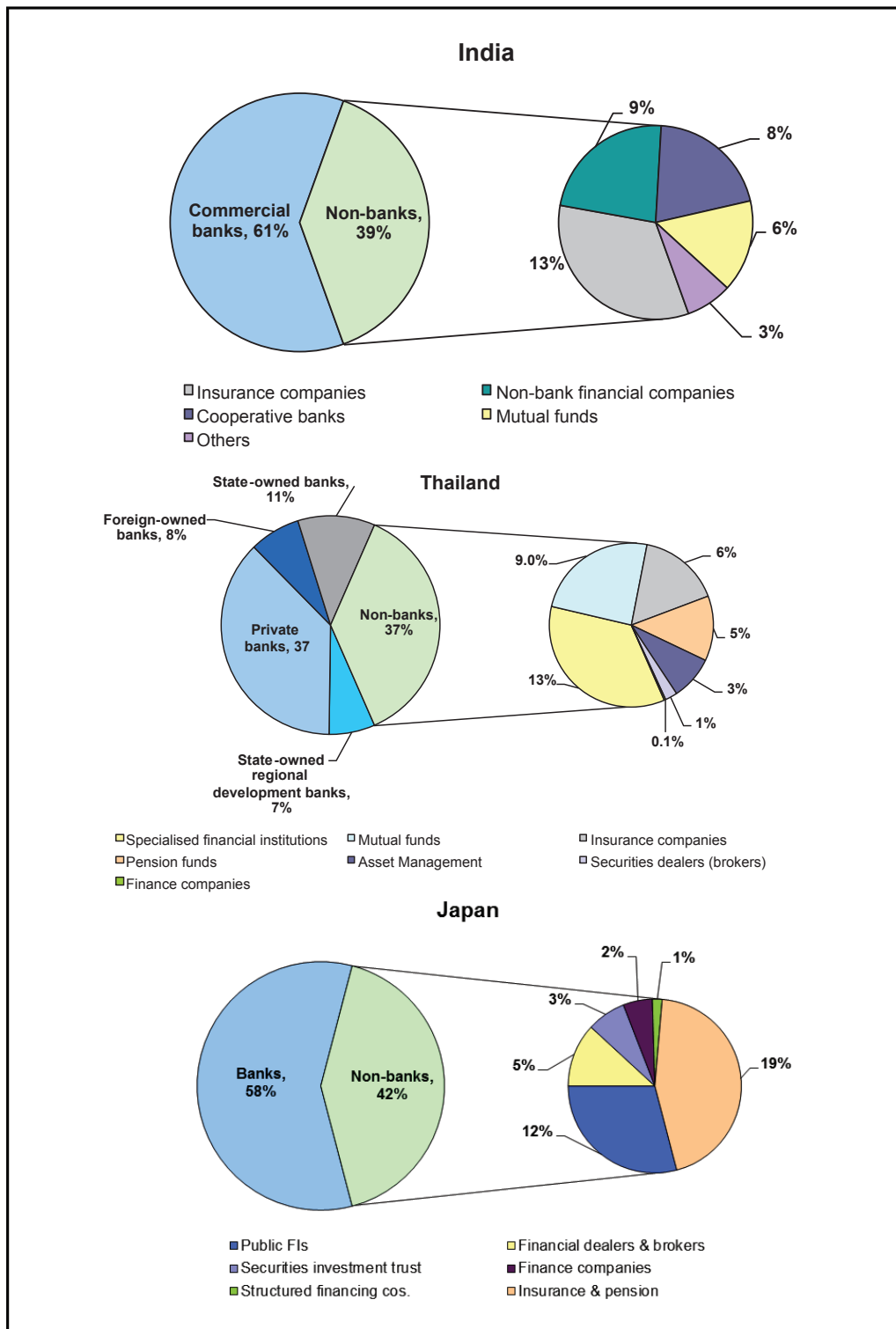
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**Composition of Financial System Assets for Selected Asian Economies**



## Composition of Financial System Assets for Selected Asian Economies



Source: National authorities, IMF Global Financial Stability Reports, various years and FSB (2011).





# LEVERAGING ON BUSINESS INTELLIGENCE TOOLS FOR MICRO AND MACRO DATA ANALYSIS AND RESEARCH: BANK NEGARA MALAYSIA'S EXPERIENCE

Tai Yoon Foong and Muhamad Kamal Firdaus bin Muhmad Foudzi<sup>1</sup>

## Abstract

Business Intelligence (BI) plays an important role in creating meaningful and complex data for analysis and decision making. Briefly, it is an application of technology to collect, integrate, access and analyse data. Given the increasing complexity of the economic environment in many countries and the emergence of Big Data, this has spurred the collection and availability of large volume of data and the creation of new statistics and indicators for analysis and surveillance. Hence, the field of BI is becoming more relevant today than it ever was previously.

Bank Negara Malaysia (BNM) has long undertaken the role as a primary producer as well as a secondary compiler for many key statistics used internally and disseminated externally, particularly key indicators on the financial system in Malaysia. This paper discusses the role of data management and BI in supporting the diverse needs of BNM users to facilitate surveillance and timely policy decisions to mitigate any potential risks or threats to the financial system in Malaysia. It is hoped that by sharing BNM's experience and procedures on data management, relevant parties who are involved in the production and/or collection of quality statistics can gain insights and guidance from our experience.

## Introduction

Business Intelligence (BI) plays an important role in analysing complex data to facilitate meaningful analysis and decision making. Briefly, it is an application of information technology to collect, integrate and analyse data.

Given the increasing complexity of the economic environment in many countries and the emergence of Big Data, this has spurred the collection and availability of large volume of data and the creation of new statistics and indicators for analysis and surveillance. Hence, the field of BI is becoming increasingly important and more relevant today than it ever was previously.

Similarly, within BNM, as financial markets and economic activities become more developed and interconnected, the need for a systematic collection of micro and macro data for analysis, research, policy making and surveillance has become increasingly critical. As one of the key policy makers in the country, BNM has been a primary producer and secondary compiler for many key statistics to meet the internal needs of BNM and external demand of the public, particularly indicators on the financial sector in Malaysia. To better serve the data needs of key users, BNM is currently revamping and transforming its various existing statistical systems into an integrated system, while leveraging on the BI tools that meet its purpose. This initiative was initially spearheaded by BNM's Statistical Services Department (SSD), and the project is currently being managed by the Strategic Risk and Management Department, in collaboration with the SSD and IT Services Department.

The next section of this paper provides an overview on the data management framework in BNM. The following section describes the application of BI in BNM and this paper concludes with a discussion on the future direction of statistical collection and data management within BNM.

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## Data Management Framework in BNM

Data management refers to a process which begins from the sourcing of data, followed by processing and quality assurance, and ends at the reporting stage for users. In the context of BNM, data management consists of three main components, i.e. data collection including processing, data warehousing and BI tools for data access.

### Data Source

As a central bank, BNM's mandate involves promoting monetary and financial stability and fostering a sound and progressive financial sector to achieve sustained economic growth for the benefit of the nation. In carrying out its mandate, it is crucial for BNM to gather comprehensive, relevant and timely data to serve the business needs of the Bank's policy makers, analysts, researchers, regulators and supervisors.

BNM is empowered by the following laws to collect statistics:

- i. Central Bank of Malaysia Act 2009
- ii. Financial Services Act 2013
- iii. Islamic Financial Services Act 2013
- iv. Development Financial Institutions Act 2002

In collecting data, it is important not only to meet the current data needs, but also to foresee new developments and future data requirements. Micro or macro data, and the level of data granularity are among the important considerations. The current trend indicates a preference for more granular data to facilitate various cross dimensional analysis and to analyse the inter-linkages between global institutions and cross-border flows. Nevertheless, collecting large volumes of data poses significant financial and technical burden to BNM. It is also a cost to the reporting entities which are required to source and prepare the data in accordance to BNM's requirements. Thus, it is necessary to balance between the statistical needs of the organisation and the cost to the reporting entities.

The SSD in BNM plays a pivotal role in coordinating and providing centralised data collection and statistical support services to the regulatory, supervisory and research departments in the Bank to facilitate their analysis and surveillance. The SSD collects a wide range of financial and credit data directly from the banking, insurance, development finance and payment systems industries, as well as the real and external sector data from various government agencies and non-financial private sector corporations. Sixty percent of these data are collected at the macro level, while the remaining forty percent are collected at a micro level. Such micro level information includes borrowers' loan information and cash balance of payments data, both of which are collected at the customer level. These two sets of micro data offer users the flexibility to perform multidimensional analysis such as by sector, country, currency, borrower profile type, loan type and purpose of transaction.

### Data Warehouse

The data collected by SSD are compiled and processed, verified and transformed into various forms or formats, such as standard reports, tables for publications and databases for direct access by users.

Due to the heterogeneity and differences in the granularity of data sources, data collected by BNM will go through an "Extract, Transform and Load" (ETL) processes before the data is stored in the data warehouse. Data in the data warehouse conforms to specific and consistent rules, standards and definitions, thus, offering a single point of reference for all users across the organisation. The standards and definitions used by BNM in its statistical compilation are aligned with international standards, best practices and compilation methodologies to facilitate cross country comparisons for similar subject areas, such as International Financial Reporting Standards (IFRS) and IMF Balance of Payments 6th Edition. Data that has been processed is organised and structured within the data warehouse and made available to users for micro or macro analysis using BI tools.

### BI Tools

BI is an important tool to enable users to extract and analyse large volumes of data for the purpose of making effective and timely decisions. There are many analytical tools in the market to serve different business analytics. Thus, it is important to select the right tool for the right purpose. There is no single tool that can meet the varied needs of different groups of users with different data skills. As such, organisations usually select a combination of BI tools, and where necessary, some of the tools are further customised to meet business requirements for greater efficiency and effectiveness. A good and user-friendly tool will encourage more users to maximise data usage.

In BNM, there is a wide range of tools offered to users for data extraction and analysis such as Cognos Impromptu, Cognos Power Play, TM1, SAS Enterprise Guide and SAP Business Object (BO).

### Application of BI in BNM - Current Status

#### Types of Users and BI in Supporting User Needs

There are different groups of data users playing different roles to achieve the objectives and deliver mandates of BNM. Generally, they are divided into three categories as follows:

- i. Data Compilers
- ii. Regulators and Supervisors
- iii. Analysts and Researchers

Different group of users have different BI tool preferences.

### Compilers

The role, played by SSD as a one stop statistical services centre, is to collect, compile and disseminate data for final consumption by users. There is a wide range of statistics collected by BNM. The main focus is on monetary and financial statistics, which cover various sectors including banking, insurance/Takaful, payments, development financial institutions, as well as credit information. To ensure the completeness of data for analysis, external sector and macroeconomic statistics are also being collected by BNM.

Listed below are the steps performed by SSD in relation to data management:

1. Collection  
Online data submission by reporting entities (REs) within the stipulated timeline and manual data retrieval from other published sources e.g. newspapers, subscribed bulletins, commercial databases, and websites.
2. Data Storage  
Data collected is stored in decentralised or standalone databases and systems according to data sets.
3. Processing  
Data quality checking is performed by applying rules such as setting thresholds to detect out of trend submissions and performing validation of business-defined rules to ensure accuracy of data. Cross data comparison after the data rationalisation process is also performed to ensure data consistency across the systems.



## Dissemination

Upon completion of step 3 above, data is released for extraction by internal users, according to the agreed service level agreement. Standard reports are also prepared for dissemination to BNM users and external organisations.

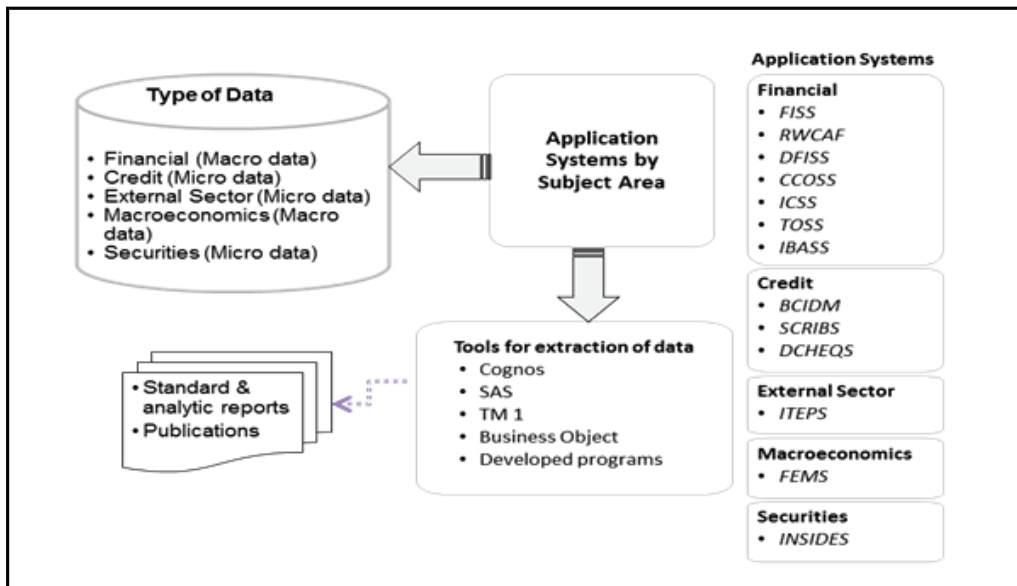
The types of data managed and various tools used by SSD are shown in Figure 1 below:

Centralised and independent data collection in SSD has allowed for specialisation of data management and adoption of tools across the Bank. Each data set is managed using different tools according to its nature. To ensure quality data is disseminated to users, SSD performs intensive data quality checking. While some automated and system-built validation rules have been incorporated in most of the statistical systems, there are also data qualities checking which is dependent on human and is labour-intensive. After the ETL processes, the data will be checked by SSD officers prior to dissemination to users. Different data sets are extracted using different tools, and produced in the form of reports for checking manually by SSD.

As part of the process improvement to ensure quality data is disseminated, many exceptional checks have been incorporated into the reports, such as threshold setting to flag out anomalies, for example large changes in absolute values or percentage growth. Reporting entities are required to provide justifications on those anomalies. Periodic data quality analysis according to submission frequency is also conducted prior to data release.

For micro data, outlier transactions are individually identified and officers in charge are required to follow up with the respective reporting entities. In addition to checking at a transactional level, data quality assurance is also carried out at the aggregated level. Comparable statistics to these aggregated micro data are obtained from sources within and outside BNM and used as important benchmarks, particularly in recognising consistency of trends between the data sets. For instance, transactional credit data by accounts of borrower is aggregated and benchmarked against aggregated credit data which is collected using another system, categorised by dimensions such as industry sector and purpose of loan.

**Figure 1: Types of Data and BI Tools Available in SSD**



Note: FISS – Banking data, RWCAF – Risk-Weighted Capital Adequacy data, DFISS – Development Financial Institutions data, CCOSS – Credit Card data, ICSS – Insurance data, TOSS – Takaful data, IBASS – Insurance and Brokers Adjusters data, BCIDM – Credit data, SCRIBS – Workflow system for credit data, DCHEQS - Dishonoured cheque information, ITEPS – International Investment Position Data, FEMS – Macroeconomic and financial data, INSIDES - Debt Securities information

A large portion of the resources are also required to manually update the templates used for myriad of standard reports, Monthly Statistical Bulletins and ad-hoc requests.

#### Regulators and Supervisors

This group of users, mostly from the financial stability sector, accounts for about 50% of the total data users in BNM. They are the main users of both financial and macroeconomic data to facilitate a more effective surveillance of the financial system. The regulators and supervisors use BI tool to extract data for trend analysis and to produce key indicators for the banking system and individual financial institutions to update BNM's senior management. In addition, the regulators and supervisors also use the data to monitor banking institutions' compliance with liquidity, capital and statutory requirements, and carry out risk assessments on the banking system in Malaysia.

Other than the direct extraction of data, regulators and supervisors also utilise customised standard reports for periodical analysis and surveillance of the industry. The standard reports are prepared by SSD in the format as required by the regulators and supervisors. Standard reports frequently used by the regulators and supervisors can be automatically updated according to the frequency of the report templates with a direct link to the source data from the database. The report templates, prepared in collaboration and consultation with users, are comprehensive with wide range of data coverage and classification by subject areas.

#### Analysts and Researchers

Analysts and researchers in BNM require a broad spectrum of data for analysis to facilitate the formulation of policy or development of Malaysia's financial and economic sectors. The task of preserving financial stability has become increasingly challenging given the rapidly evolving financial landscape and greater volatility in financial markets. The challenge is even greater for an open economy like Malaysia with an increasing economic and financial integration and inter-linkages with the external environment.

With the adoption of a more holistic approach to address the potential risk to financial stability, data become an important source of information to facilitate the understanding of the actual situation of the financial system. This will facilitate timely policy intervention to mitigate any potential risks or threats to the financial system in Malaysia.

This group of users may also draw data from the macro level right down to the micro level, both financial and macroeconomic data, to perform historical trend analysis and derive forward looking assessments of potential stress within the system. They produce quantitative analysis to support policy development and carry out market assessments to facilitate policy implementation. These analysts and researchers also monitor key data to assess the effectiveness of policies implemented; analyse key trends and developments in the financial industry to identify issues and propose new policies to the management; as well as assess potential impact and readiness of financial institutions in complying with the proposed new policies.

Currently, different statistical systems and repositories are used to store key data accessible by different BI tools. This has an impact on the search time of users who require to search for relevant statistics across multiple platforms. There is no universal data extraction tool available for users in BNM since different tools are being used for different subject matters. Consequently, the access to the data is, at times, constrained by the data extraction tool that the users are trained for and familiar with. For instance, users who frequently use PowerPlay to extract banking data may not be competent in extracting data on debt securities, which utilises Web Intelligence by BO.

In meeting the analyst and researchers' needs of a big database to facilitate the selection of cross subject area data items and dimensions for extensive analysis, SSD has also developed a secondary data source repository that collates selective financial and macroeconomic data, sourced either from data integration with the primary system

(e.g. Banking data from FISS) or collection from official compilers such as Department of Statistics, Malaysia (data on balance of payments and gross domestic product).

Various multi-dimensional cubes have been developed to store these data based on subject areas and the cubes were designed to include identified data items, dimensions and measures to suit diverse users' needs. The tool is user friendly and can also facilitate the exports of data to Microsoft Excel for further analysis.

#### Current State of Statistical Collection and Data Analysis

As the existing statistical systems maintained by SSD were developed over the last 10 to 15 years period based on the subject areas such as banking, insurance/ Takaful, payments, external sector, etc., it has introduced several challenges to SSD, particularly in terms of system maintenance, data consistency and ease of access. Despite the centralised operations established in SSD, a significant amount of resources are allocated for system maintenance of the various BI systems.

With each system working in isolation, significant amount of effort is required to synchronise the data and to ensure their consistency for analysis. In the event of any changes on data items that are common among the systems, concurrent amendments have to be carried out on multiple data repositories to reflect the changes on all systems. In addition, due to the current decentralised data storage arrangement as described earlier, users are required to use different tools to retrieve and consolidate data required for their analysis. This poses challenges to them as they are required to learn and familiarise themselves with multiple tools, and reconcile different data definitions or methodologies adopted by different systems.

Over the years, emergence of data needs arising from the change to new regulatory and supervisory approach requires a more holistic approach to be undertaken to address potential risk to the financial stability.

The surveillance approach in BNM has evolved from a micro approach that focuses on individual bank's performance to macro approach which aims at the early detection of systemic banking risk. This has also led to a change in users' expectation on data. Other than extracting the data of individual bank or focusing only on financial data, users are now extracting macroeconomic data in their analysis to establish the link between the real economy and the financial system.

#### Application of BI in BNM - Moving Forward

To meet the increasing demand of data by users in BNM, especially in view of the recent financial crises and new global developments, the SSD has embarked on a two-pronged data management transformation approaches aim at providing more efficient and effective statistical support services to the users. Firstly, an IT project was initiated in 2011 to develop an integrated statistical warehouse system which will improve data delivery services to users. Secondly, the Enterprise Data Governance Policies, Procedures and Processes and Standards, was established and implemented Bank-wide in 2011 to instil discipline and systematic approach to data management within the Bank.

Implementation of the integrated statistical system has provided a favourable environment that allowed for specialisation of data management in four key areas i.e. data collection, data processing and storage, data dissemination and data retention.

#### Integrated Statistical System (ISS)

The ISS will integrate all financial and economic statistical data residing in various databases within BNM in a single system. The system targets to achieve consistency and credibility of data across BNM for regulatory compliance, monetary and financial analysis, research and decision making, as well as to enhance operational efficiency. Figure 2 shows the entire architecture of ISS.

The ISS will transform data from various sources into consolidated information for stakeholders. Data is transformed using business rules and technical conversions,

staged in the databases, structured in harmonised metadata across the various types of financial institutions and made available to the stakeholders in the form of cubes, data queries, data mining and dashboards for comparative analysis within and across industries.

BNM has adopted BO as the BI tool for the ISS. By leveraging on BO, users would be able to extract multiple types of data from a single database and this will reduce the challenges of applying multiple tools to extract cross subject areas data. Other than analytic and reports, the dashboards which is equipped with a trigger and alert mechanism, have been developed to allow the regulators for timely identification of emerging risks and vulnerabilities for pre-emptive actions.

#### Current Progress of ISS

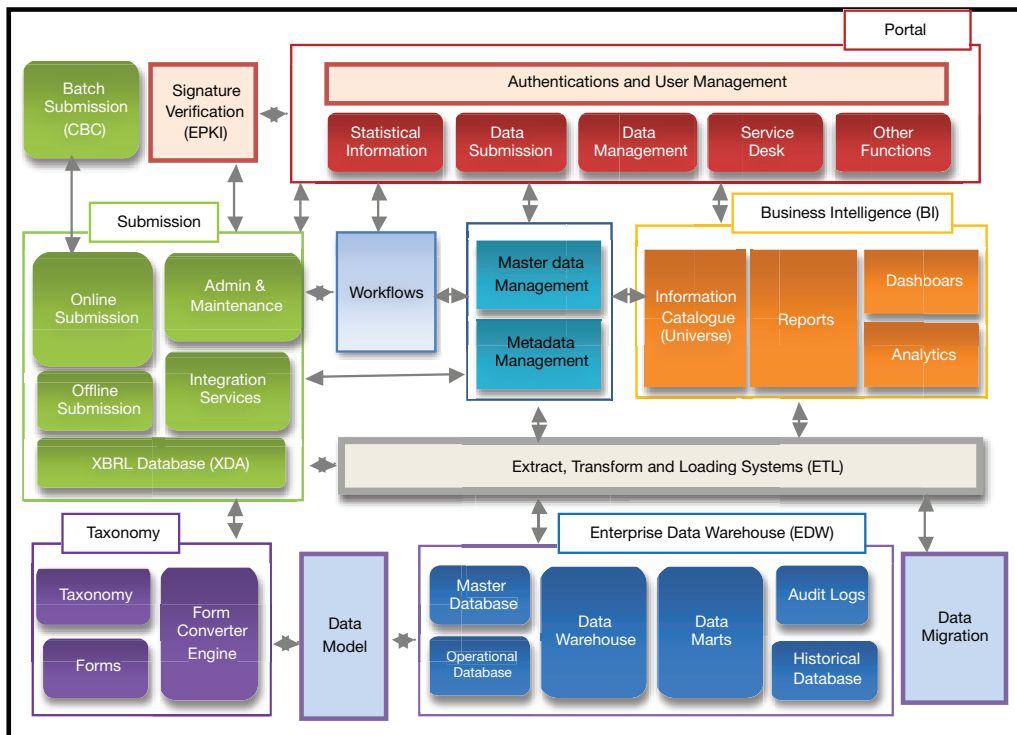
The ISS is being implemented in phases and target for full completion by 2016. Phase 1, which focuses on developing the overall ISS architecture design and infrastructure, has delivered the following key components:

1. Portal and workflow
2. Submission module
3. Master data and metadata management
4. BI reports

In terms of reporting and data subject areas, Phase 1 focused on reporting of the banking institutions, development financial institutions and payment system operators data, and is targeted to be completed by June 2014. Currently, all historical banking data has been successfully migrated to the data warehouse, and transformed into two cubes and a universe to facilitate data extraction using BO. Output in the form of standard reports, dashboards and publications are now made available for access by users. The transformation of data on development financial institutions and payment system operators will be completed by June 2014.

Upon full completion of Phase 1, Phase 2 and 3, which cover the macroeconomic, external sector, insurance/Takaful and credit data, will commence in the second half of 2014 and is targeted to complete by end of 2016.

**Figure 2: ISS Architecture**



## Conclusion

BI tools play an important role in data management within SSD as well as in enhancing the ease of access and usage of statistics by the users, particularly the regulators and supervisors as well as analysts and researchers within BNM. The implementation and adoption of the Enterprise Data Governance Policies, Procedures and Processes, and Standards has improved the data management discipline and efficiency

within the Bank. It is envisaged that the full implementation of ISS by 2016 will further enhance data management processes and improve the usage of statistics by users for surveillance, research and policymaking. The adoption of standard BI tool across the ISS which covers all the statistics compiled by BNM will reduce the training needs to users and maintenance cost by BNM, compared with the current multiple BI tools adopted across various non-integrated statistical systems.

# ADDRESSING STATISTICAL GAPS IN A DYNAMIC PAYMENT ENVIRONMENT

Yee Chee May<sup>1</sup> and Ravinder Kaur<sup>2</sup>

## Abstract

The payment system is a critical component of the economic and financial infrastructure of a country. It facilitates the circulation of money in the economy thus enabling the conduct of trade, commerce and other economic activities. Bank Negara Malaysia (BNM) plays its role as an overseer in ensuring the safety, reliability, and efficiency of the payment systems infrastructure and to safeguard public interest. In addition, BNM is the driver for the adoption of electronic payments in the country. The task involves taking advantage of the technology and innovation wave, to move towards more efficient payment modes.

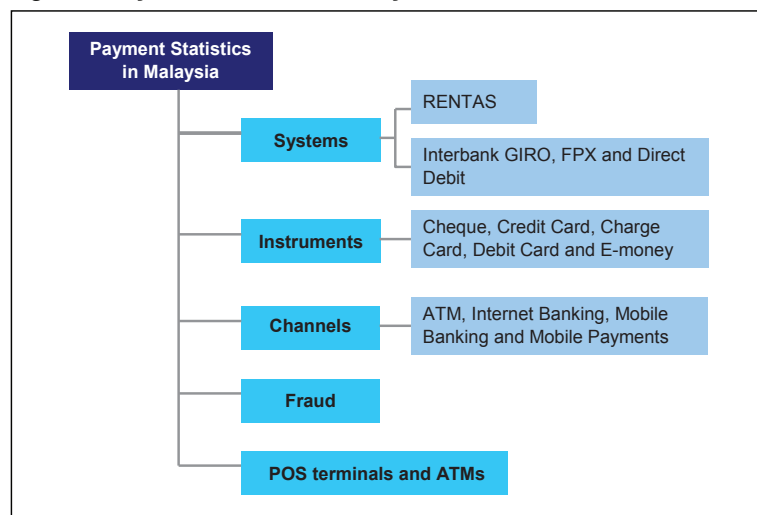
In performing its role, BNM undertakes policy formulation, conducts surveillance and analysis on payment systems utilising various payment statistics. The importance of these statistics has grown over time following the enhanced scope of oversight, the internationalisation of payment services, as well as the migration towards e-payment following the release of the

Financial Sector Blueprint in 2011. All these new developments together with the innovation and technological advancement in payment products and services have led to the transformation of the payment landscape. In this regard, a holistic review of data requirements in meeting the rising need for payment statistics is necessary. The paper will discuss four main aspects covering the current landscape of payment statistics, importance of these statistics, evolution and the future of payment statistics.

## Current Landscape of Payment Statistics in Malaysia

Payment statistics in Malaysia is jointly compiled by the Payment Systems Policy Department (PSPD) and the Statistical Services Department of BNM. These statistics are used by the PSPD mainly to conduct analysis, to support policy development and to perform oversight functions. These statistics are also disseminated via BNM website and publications, such as the annual Financial Stability and Payment Systems Report.

Figure 1: Payment Statistics in Malaysia



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Currently, the compilation of payment statistics by BNM can be categorised into five main segments:

- i. Payment Systems;
- ii. Payment Instruments;
- iii. Payment Channels;
- iv. Fraud; and
- v. POS terminals and ATMs.

Most data are captured on a monthly basis and submitted by the reporting institutions on an aggregate basis. To ensure transparency and clarity, the requirement for statistical submission is stipulated in relevant policy documents or letters issued to the issuers of designated payment instruments and operators of payment systems. This requirement is supported by Section 143 of the Financial Services Act 2013 and Section 155 of the Islamic Financial Services Act 2013 (Section 65 of the Payment Systems Act 2003 prior to 30 June 2013). Reporting entities comprise both banks and non-banks that are under the ambit of payment regulations in Malaysia.

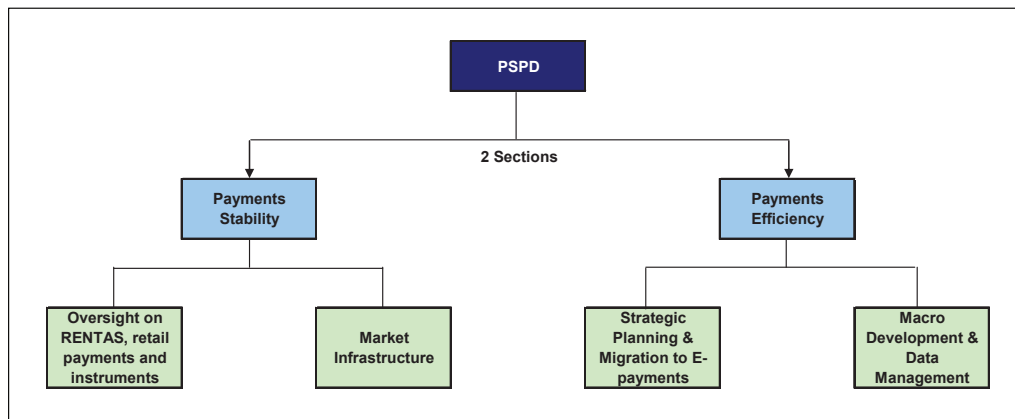
#### Importance of Payment Statistics

Historically, the role of payment systems has been to facilitate large value transactions and cheque clearing. With the evolution of technology, technologically-savvy consumers and businesses began to demand for increased

efficiency in making transactions. This supported the development of card payments and electronic payments in Malaysia, both of which require integrated retail clearing and settlement systems. Through time, the importance of electronic forms of payment to reduce costs, to increase efficiency and to support economic growth has gained global prominence. This gave rise to various initiatives to promote the adoption of electronic payments (e-payments) vis-à-vis paper-based payments. With this, there is a greater need for a balanced policy i.e. a policy that supports innovation and growth without compromising the safety and security standards of the infrastructure. One of the key ingredients fundamental to formulating sound and strategic policies is having a complete and concise database of payment statistics that would facilitate the conduct of accurate assessments to steer policy makers to focus on the correct area, whether it is an area of concern, gaps or potential growth.

The PSPD is segregated into two sections, i.e. Payment Stability, which is responsible to conduct oversight and formulate relevant policies; and Payment Efficiency, which is responsible to promote the migration to electronic payments and formulate developmental policies. Both sections use payment statistics extensively to perform their tasks although the data requirements sometimes differ.

**Figure 2: Organisation Structure of Payment Systems Policy Department (PSPD)**



**Table 1: Basic Data Requirement**

Data	Section	
	Payments Stability	Payments Efficiency
<b>Payment System</b>		
Real Time Electronics Transfer of Funds and Securities (RENTAS)		
• Transaction volume and value	x	x
• Type of payments	x	x
• Utilisation of Intraday credit facility	x	
• Holdings of debt securities		
• Critical payments and settlement by time band	x	
• Financial statement	x	
Retail payment systems		
• Transaction volume and value	x	x
• Type of payments		x
• Transactions by channels and subscribers		x
• System availability and unsuccessful transactions	x	
• Financial statement	x	
<b>Payment Instruments</b>		
Cheques		
• Transaction volume and value	x	x
• Type of issuer	x	x
Payment cards		
• Transaction volume and value	x	x
• Transactions by sectors, by card brands and card types	x	x
• Number of cards	x	x
• Outstanding liabilities/balance and impaired loans	x	
• Repayment behaviour of credit cardholders	x	
• Tiered pricing structure of credit cardholders	x	
• Bankruptcy cases due to card business	x	
• Income and expenditure due to card business	x	
<b>Payment Channels</b>		
• Transaction volume and value	x	x
• Type of payments	x	x
• Number of subscribers/users		x
• Unsuccessful transactions	x	
<b>Fraud</b>	x	
<b>POS terminals and ATMs</b>	x	x



### Payment Statistics for Oversight and Policy Formulation

To ensure effective oversight by BNM, detailed statistics are closely monitored and analysed. This would enable policy makers to identify emerging trends and to anticipate warning signals in the market in the near term. Ideally, an effective early warning system that would trigger regulatory intervention could be developed with good quality payment statistics. In this regard, statistical analysis could assist in identifying threshold and tolerance levels before intervention or regulatory action is required. Of significance, statistics on payment fraud, for example, is being closely monitored and analysed to identify signs of emerging fraud trends in the market, so that appropriate policy or strategy can be formulated to mitigate potential risks.

For the purpose of formulating a holistic, relevant and effective policy, in-depth analysis of the industry and issues affecting the industry must be performed. In this regard, statistics should be robust both in terms of breadth and depth. For example, assuming BNM is formulating a policy to introduce new security standards to combat payment card fraud, should the policy recommendation be guided by statistics of fraud losses only, BNM may implement biometric verification with the assumption that chip standard for credit cards is insufficient as it did not lead to zero fraud losses. This would be a wrong policy decision caused by insufficient statistics.

A more accurate deduction is derived when the fraud losses data is scrutinised further to understand the types of fraud, the frequency of occurrence, the parties that bear the loss, the types of transactions, etc.; comprehend with an understanding of the payment system rules, existing consumer protection guidelines etc. Thus, the biggest losses due to fraudulent transactions are from online transactions, which biometric verification would be unable to address.

### Developments in Oversight of Payment Industry in Malaysia

Through time, the demand for payment statistics to support payment oversight activities have expanded exponentially driven by two main factors; (i) the enhanced scope of oversight with the enactment of the Financial Services Act 2013 (FSA) and the Islamic Financial Services Act 2013 (IFSA); and (ii) the internationalisation of payment services.

(i) The enhanced scope of oversight  
With the entrance of new types of regulated entities, such as card network operators, new demands for payment statistics have emerged. As new statistics are collected, while it may support forward looking oversight activities, such as monitoring of system performance and compliance levels, historical statistics are not readily available hence in-depth analysis, such as comparative studies or statistical regressions cannot be performed.

**Table 2: New Regulated Entities Under the FSA and IFSA**

PSA 2003		FSA and IFSA 2013	
Approval regime	Notification regime	Approval regime	Registration regime
Credit card issuer	Payment system operator	Credit card issuer	Merchant acquiring services
Charge card issuer		Charge card issuer	
e-Money issuer		e-Money issuer	
		Debit card issuer*	
		Payment system operator*	

Note:  
\* New entities  
\* Subject to certain conditions

(ii) The internationalisation of payment services Globalisation had brought about greater interconnectedness of payment services. Cross-border transactions are becoming seamless and occurring with greater speed. Sending funds to neighboring countries, such as Indonesia, used to be expensive and took 10 days; but now, it can happen in near real-time for a fee of as low as RM5.

A series of key initiatives to enhance RENTAS to support regional financial integration had also been undertaken, such as the establishment of Payment versus Payment link between the RENTAS and the USD Clearing House Automated Transfer System (CHATS) system in Hong Kong to mitigate settlement risk arising from Malaysian ringgit and US dollar foreign exchange trades. An outbound link to Euroclear, an International Central Securities Depository, was also established to enhance the efficiency of cross-border debt securities settlement and improve the visibility of Malaysian bond market to global investors. Recently, RENTAS was also enhanced to offer multi-currency funds and securities settlement facility, starting with Renminbi, to enhance the efficiency of trade settlement for Malaysian corporates.

These have translated into new demands for payment statistics that continue to expand over time. The tasks of the officers responsible to compile the statistics have also become more complex. In the past, it was sufficient to have people with good number crunching skills; now the PSPD requires people with deep understanding of the payment business in order for them to effectively crunch numbers. For example, statistics are required for policy makers to understand the advantages of cross-border settlement and to identify countries/parties that would benefit from the new policy implemented. At the same time, reporting institutions have to upgrade their data collection systems to be able

to drill down to the level of details required. This will be further discussed in the next section.

#### Payment Statistics for Strategic Planning and Developmental Policy Formulation

The use of payment statistics has become more extensive following the release of the Financial Sector Blueprint 2011-2020 in 2011 – a document which charts the future direction of the financial system over the next 10 years. One of the focus areas is the positioning of e-payments as the preferred mode of payment for economic transactions in Malaysia. BNM's success in accelerating the migration to e-payments is measured by four key performance indicators (KPIs) which are monitored on a monthly basis (Table 3). Statistics on cheque usage and e-payment transactions of advanced countries<sup>3</sup> have been used by BNM to set the level of e-payment adoption to be achieved by 2020.

BNM actively strategises and undertakes various initiatives to elevate the country's migration of e-payments to the next level. Currently, research and analysis based on payment data is used as a basis to justify any policies being formulated. Detailed statistics is thus crucial for policy makers to understand the trends of e-payments and cheque usage in the country, the strengths and weaknesses of the current payment services and instruments, market demand and sentiments, as well as the current level of efficiency and safety of payment systems. For instance, when comparing the trends of credit card against debit card transactions, statistics are analysed to come up with deeper insights. Transactions for both payment cards have been growing in level terms, however, the growth in percentage show that debit card transactions have been growing at a faster pace compared to credit card. Further analysis would be able to indicate segments that have led to the growth in debit card, type of debit cards that is growing and the underlying reasons on why certain type of debit card is declining.

**Table 3: Key Performance Indicators**

KPIs	Target by 2020	2012
E-payment transactions per capita	200	56
Debit card transactions per capita	30	1.2
Point-of-sale terminals per 1,000 inhabitants	25	9.3
Number of cheques cleared (million)	100	204

<sup>3</sup> Countries that have achieved high level of e-payment adoption and declining cheque usage

On e-payment initiatives in priority sectors, data on e-payments and cheque usage for payments of purchase and sales of shares, insurance payments and payment to selected Government services such as tax, Employees Provident Fund (EPF) and Social Security Organisation (SOCSO) have also been collected for BNM to compare the trend of payments made electronically versus cheques; as well as to monitor the progress of initiatives undertaken.

#### Developments in Strategic Direction of Payment Industry in Malaysia

In promoting the adoption of more efficient e-payment modes, BNM has implemented a new pricing framework, of which the first phase took effect in May 2013.<sup>4</sup> The objective of the framework is to address price distortion and induce the payment behavioural change. Under the pricing framework, financial institutions will be implementing a tiered pricing structure for funds transfer services to incentivise the use of a more cost-effective channel. Additionally, in the payment card industry, a framework will be implemented to establish transparent and cost-based ceilings to interchange fee, to address restrictive international payment card rules and to enhance the card acceptance infrastructure in the country.

Following these new developments, data requirement has to be expanded to capture new items such as the cost structure for different type of payments, developments in costs over time as well as the relationship between prices/income and costs for payment services. These costs will be distributed between the different payment services on the basis of an activity-based costing (ABC) analysis. In other words, a holistic payment cost study covering all types of payment systems, channels and instruments, which will serve as a fundamental element for the reform process, is necessary to support policy formulation.

Over the years, a number of innovative developments in payment systems have emerged and this has led to the transformation of the payment landscape towards greater offerings and the adoption of e-payment products and services. Driven by innovation and technology advancement, financial institutions and payment operators/issuers today offer a wide range of payment products and services to meet market demand and to remain competitive. Therefore, it is a challenge to keep abreast with the latest development in the payment market to ensure data collected are comprehensive enough in providing a complete picture to analysts and policymakers. Further development of payment statistics will be discussed under the next section in this paper on Evolution of Payment Statistics in Malaysia.

#### Payment Statistics to Support Other Objectives

In recent years, the importance of payment statistics to other segments of the economy is well known. Statistics on payment card transactions, such as credit card, debit card and electronic money has been used to gauge private consumption and to measure household's usage of these instruments on essential or necessity goods. There is also a demand for card transactions by economic sectors to study individual's retail spending behaviour and trends. In addition, credit card statistics such as total spending, repayment behaviour of cardholders, outstanding balance, non-performing loans and bankruptcy cases have been used to assess credit exposure to the household sector.

E-payment indicators such as Internet banking and mobile banking transactions and penetration rate of subscribers, number of ATMs, point-of-sales terminals and merchants accepting payment cards have become important indicators to measure the level of financial inclusion of the country, i.e. the accessibility of households and small business to financial services.

<sup>4</sup> Phase 1 (May 2013 – 2015) – Selected e-payment methods that are more cost-effective were priced below cost while additional fees were introduced for cheques to effectively drive payment behavioural change

The statistics on Internet and mobile banking services and online card payments to some extent have also been used by the Government as indicators to assess the trend of e-commerce in Malaysia. Furthermore, there is also a need for the payment data to be disseminated to the industry and major players for them to assess their market share and to monitor their performance in the payment market.

#### Evolution of Payment Statistics in Malaysia

In view of the considerable number of new developments in payment systems, which has reinforced the importance of payment statistics, it is notable that currently available statistics are insufficient for BNM to perform its objectives in overseeing payment systems and accelerating the migration to e-payments. Thus, in ensuring that the current data collected remain relevant and comprehensive, there is a need to ensure that existing data requirements are continuously reviewed and enhanced, while data definitions and classifications are frequently updated. To have a clear and complete picture on the changing payment landscape, which is fast-moving and dynamic, additional statistics and indicators are vital for policy makers and analysts. In this context, it is necessary for BNM to undertake a holistic review of its data requirements in meeting the rising demand for payment statistics. The findings of the review will be deliberated in the next section on The Future of Payment Statistics in Malaysia and the Prerequisites.

Since 2011, data requirement on payments has been expanded significantly to gather different types of e-payments data such as payment made using single purpose payment cards<sup>5</sup>, standing instructions and intrabank direct debit transactions via current and saving accounts, and self-service point-of-sales terminals at the petrol stations. The statistics on point-of-sales terminals and merchant accepting payment cards have been used as important information to gauge the level of e-payment acceptance.

A number of indicators have been introduced for the purpose of conducting surveillance and analysis on payment systems. This include among others, transaction per capita, daily average turnover, penetration rate, fraud ratio, turnover over GDP and private consumption, average value per transaction and average transaction per card. There have been continuous efforts undertaken by BNM in creating new indicators and developing linkages between the payment system data with other economic indicators for more impactful analysis.

Another important development to be highlighted is the enhancement of the submission platform for payment statistics, which will take place by end-2013. In this regard, the PSPD has leveraged on the bank wide project to establish an integrated statistical system (ISS) that would facilitate online submission for statistics by all regulatees to BNM. The system would reduce manual data capturing mainly from non-banks, as well as to support in-depth analysis by regulator. To further benefit from the migration, data requirements along with more detailed and standardised definitions have been developed to improve data accuracy and to reduce data gaps.

Additionally, in view of the importance of RENTAS statistics, BNM has established a new data extraction tool in 2008, known as Information and Surveillance System for Debt Securities (INSIDES). INSIDES is a secondary source of RENTAS data that allows extraction by various dimensions and frequencies and provides in-depth information of RENTAS activity.

On payment fraud, BNM is undertaking an initiative to enhance its data requirements by developing a new operational risk system to replace the existing Fraud Management Database System. The new Integrated Operational Risk Reporting System (i-ORRS), targeted to be completed in 2014, is envisaged to serve as a single, integrated repository for operational risk related structured and unstructured data such as

<sup>5</sup> Widely used payment instruments that facilitate specific payments and not regulated by Bank Negara Malaysia (Example: MyRapid card)

loss events, payment fraud, key risk indicators and scenario analysis. With the new system, policy makers and analysts would be able to analyse and manage operational risk data in a more efficient way, and that more robust surveillance activities can be carried out up to a micro level.

In overseeing widely used payment instruments such as credit cards, debit cards and electronic money, statistics have been collected for the purpose of formulating guidelines and standards as well as monitoring. Of significance, the data requirement for credit card business has been expanded to capture detailed information of specific group of cardholders following the implementation of new requirements in 2011. Among the new data gathered are number of cardholders with income below RM36,000 per annum, cardholders with outstanding balance of more than 2 times their monthly income, number of cardholders according to their credit limit, and number of principal cardholders and outstanding balance by income and age group.

**The Future of Payment Statistics in Malaysia and the Prerequisites**

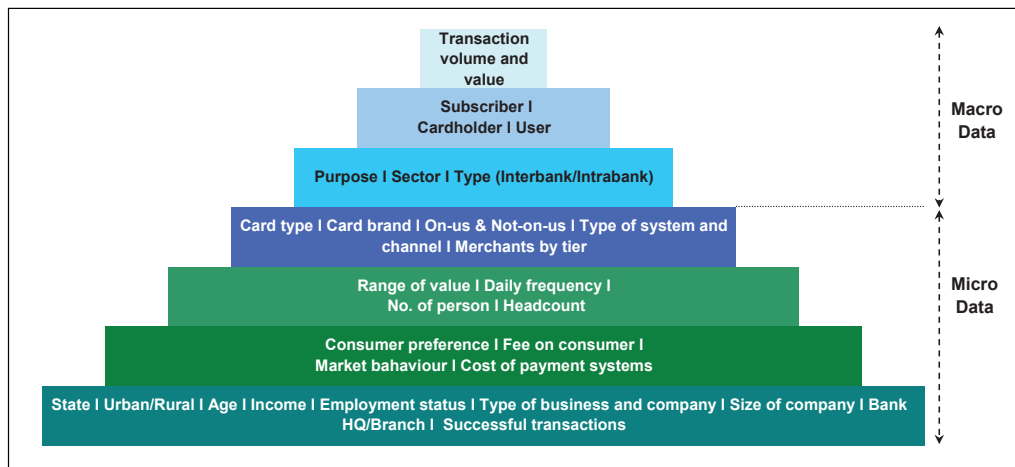
The future of payment statistics should take into consideration 3 aspects: (i) micro level statistics; (ii) demand side statistics; and (iii) new requirement for benchmarking against other countries.

(i) Micro level statistics  
Currently, payment statistics collected by central banks are mainly macro data. This presents a challenge to policy makers and analysts in

performing in-depth analysis and assessing the plausibility of payment data. On the other hand, payment regulatees, mainly the financial institutions, are required to periodically enhance their internal systems to produce the data required by the regulator. This is caused by the lack of micro data in payment systems. To overcome such challenges, payment statistical requirements have to be expanded to allow for a more inclusive coverage detailing all segments of the payment market such as types of payments, categories of parties who make and receive payments, categories of cardholders, types of payment modes and channels and types of technologies. In line with this, financial institutions and payment system operators should ensure their system is capable and robust enough to capture micro data to meet the rising data needs.

On an individual customer level, micro data would contain detailed information of individuals such as age, gender, education level, employment status and income level. Meanwhile, for businesses, micro data would contain information on company type (SMEs, Government, professional etc.), business type (retail, food and beverages etc.), and the size of a company. On payment systems such as RENTAS and IBG, details of payer and payee, type of transactions (intrabank or interbank), purpose of transactions (funds transfer, loan repayment etc.), channels used (via Internet banking, mobile banking or ATM), and whether a transaction is successful should be collected. For payment cards, micro data would refer to information on details of cardholders, card brands, card types and purpose of payments.

**Figure 3: Macro and Micro Data of Payment Systems**



The availability of micro data would facilitate users, particularly regulators and policy makers to have the most detailed information that would allow more flexibility in using the data in various dimensions to produce a robust analysis. More indicators can be created as more variables can be combined or linked to explore relationship or impact. An illustration of multi-dimensional payment statistics using micro data is shown in Table 4. On the other hand, the burden of the reporting entity would be reduced in terms of resources needed in enhancing their system to meet data requirement.

(ii) Demand side statistics

The current data requirement focuses only on the supply side, in other words, statistics

collected focuses mainly on the offering of payment systems and channels and the issuing/acquiring of payment instruments. The demand side data, which covers market behaviour and sentiments, are crucial in supporting BNM's decision making process as well as for analysts to assess the plausibility of the macro data. In this regard, statistical information provided by the financial institutions and payment operators should also be supported by the demand side information, which is mostly unstructured, for example, the preference of consumers and businesses in making payments, factors contributing to the recent trends and development, reasons why certain age of population do not prefer payment cards and who are the high cheque issuers.

**Table 4: An Illustration of Multi-dimensional Payment Statistics**

Payment Statistics	Payment Channels			
	OTC	ATM	Internet Banking	Mobile Banking
<b>Payment Systems</b>				
Interbank GIRO (IBG)	x	x	x	x
Interbank Fund Transfer (IBFT)	x	x	x	x
Direct Debit	x	Data item: Time period Users/Subscribers/Cardholders Type of payments Purpose of payments		x
RENTAS	x			x
<b>Payment Instruments</b>				
Cheque	x			x
Credit Card	x	x	x	x
Debit Card	x	x	x	x
e-Money	x	x	x	x

**Table 5: Malaysia's Data Requirement for Benchmarking with Other Countries**

Data items	BIS: Statistics in CPSS Countries	EU Countries	Norway	Finland	Australia	US	Canada	Korea	Singapore
ATMs with a credit function	X								
Paper-based credit transfers				X					
Point-of-sales card transaction		X	X						
Card transactions by range of value			X						
Terminals with credit transfer functions	X	X							
No. of merchants surcharging credit cards and merchants with no surcharging plan					X				
On-us and not-on-us transactions					X				
Interchange fees for different purchase values by merchant type and card programme					X	X			
Foreign currency cheque clearing									X
Payment cost study		X	X		X	X	X		
Cash payments		X	X	X	X	X		X	

(iii) New data requirement for benchmarking against other countries

The new payment statistics should also take into consideration data compiled by other countries, which is crucial for the regulator in making assessment on Malaysia's achievement compared to others. In reviewing the data requirement, a benchmarking exercise has been undertaken to understand data compiled by other countries that BNM should also gather so that Malaysian payment statistics are comparable with that of other countries. This exercise is also vital for BNM to understand its current data gap. The benchmarking exercise focused particularly on the advanced countries with high adoption of e-payments and have sound oversight standard such as Nordic and EU countries, Australia and some regional countries, namely, Singapore, Japan and Korea. Table 5 detailed the list of data compiled by other countries that form part of the data requirement in Malaysia.

**Conclusion**

Payment statistics play an important role for regulators and policy makers to

effectively perform its oversight role over payment system operators and payment instrument issuers as well as in driving the national agenda of migration to e-payments. Financial institutions and payment system operators should play their parts in meeting the rising data requirement. Commitment from all parties is necessary to understand the current data structure and definitions as set by the regulators, which is crucial in ensuring data accuracy, comprehensiveness and timeliness.

Financial institutions should keep abreast with various initiatives undertaken by BNM through active engagement for them to appreciate the importance of statistics and to understand the data requirement. Payment systems driven by innovations and technology advances must be robust enough to capture micro data and allow easy data extraction. Structured data should also be supported by demand side information such as market behaviour to paint a more accurate picture on the payment system developments in Malaysia.

## Conclusion

Payment statistics play an important role for regulators and policy makers to effectively perform its oversight role over payment system operators and payment instrument issuers as well as in driving the national agenda of migration to e-payments. Financial institutions and payment system operators should play their parts in meeting the rising data requirement. Commitment from all parties is necessary to understand the current data structure and definitions as set by the regulators, which is crucial in ensuring data accuracy, comprehensiveness and timeliness.

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# LOCATION BASED STATISTICS: KNOWING YOUR PLACE

Wan Razali Matsah<sup>1</sup>

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## Abstract

Telekom Malaysia (TM) has had its own digital map to facilitate its internal network planning since 1992. In 2012, TM began using its digital map to ensure that its marketing campaigns are effective and targeted. TM overlays other useful data in addition to the digital map such as TM's existing customers' data and its network infrastructure data.

Data sourcing for digital maps and other useful data remains a huge challenge for TM in the updating of its map contents. To address this, TM has invested in the appropriate hardware, software and its people to ensure that TM's data content are updated to the latest. TM also purchased content from other content providers and have smart partnerships with other content providers to ensure TM's map is updated to the latest.

In addition to TM's uncompromised effort to provide updated and comprehensive map data, TM uses multiple quality controls and quality assurance methodologies to ensure the accuracy of its content.

Seeing the value of TM's comprehensive and updated contents, TM has offered its services to businesses and government sectors, to be used in their planning and operations so that they can produce informed and better decisions for their businesses.

## Introduction

Activities such as the opening a new branch, effective and targeted marketing campaign, easier assets maintenance, delivery planning and surveys require significant data gathering. Usually, the data collected are location based data.

Location based data are data that comprise of an individual's name, address and geographic coordinate (latitude and longitude). This information is presented in a graphical manner for easy reference and better understanding. For instance, an effective marketing campaign targeted at end-consumers will require information on the number of potential customers in an area. We need to know their location and their profile. From there, a planner can identify who to target, estimate the number of resources to be deployed to reach the target customers and measure the effectiveness of each campaign.

To ensure the accuracy and reliability of the analysis, it is important that the data collected are continuously updated. This is to enhance its usefulness for planners because having outdated data is as good as not having any data. Quality assurance and quality control (QAQC) must be applied to the collected data to reduce errors, and hence, increased data reliability. Accuracy of data is crucial to ensure planners make the right decision and avoid costly mistakes.

Designing and developing an IT system to store location based data for fast retrieval and easy maintenance is another major component in having a location based data facility. Location based data facility is an end-to-end process, starting from data gathering to data delivery to end users for analytical purposes. It requires appropriate methods of data sourcing, well-defined procedures, skilled human capital and a well-functioning IT system to support the procedures. It also requires that a QAQC mechanism be put in place to ensure data reliability.

Collecting and maintaining location based data can involve high costs for companies intending to embark on such projects.

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## TM's Contents Journey

TM embarked on its location based data facility in 1996. Initially, the production of digital maps was solely for TM's network planning purposes. As it evolved, TM started offering location based analytical tools in 2011 for internal marketing campaigns, the setting up of new TM Point branches and for service coverage planning purposes in a project known as the Local Network Management System (LNMS). LNMS is a system to manage network infrastructure planning and provisioning. TM later decided to produce its own digital maps because they were unable to obtain comprehensive nationwide digital maps at that time.

In 1998, TM installed two GPS base stations in Brickfields, Kuala Lumpur and in Miri, Sarawak to further enhance TM's digital maps to sub-meter accuracy. This initiative was successfully completed in 2001. Later in 2007, TM through its partners launched its navigational map which is currently being used by national car makers. Arising from this navigational map, TM Map began having more locational attributes. The navigational map requires the collection of street

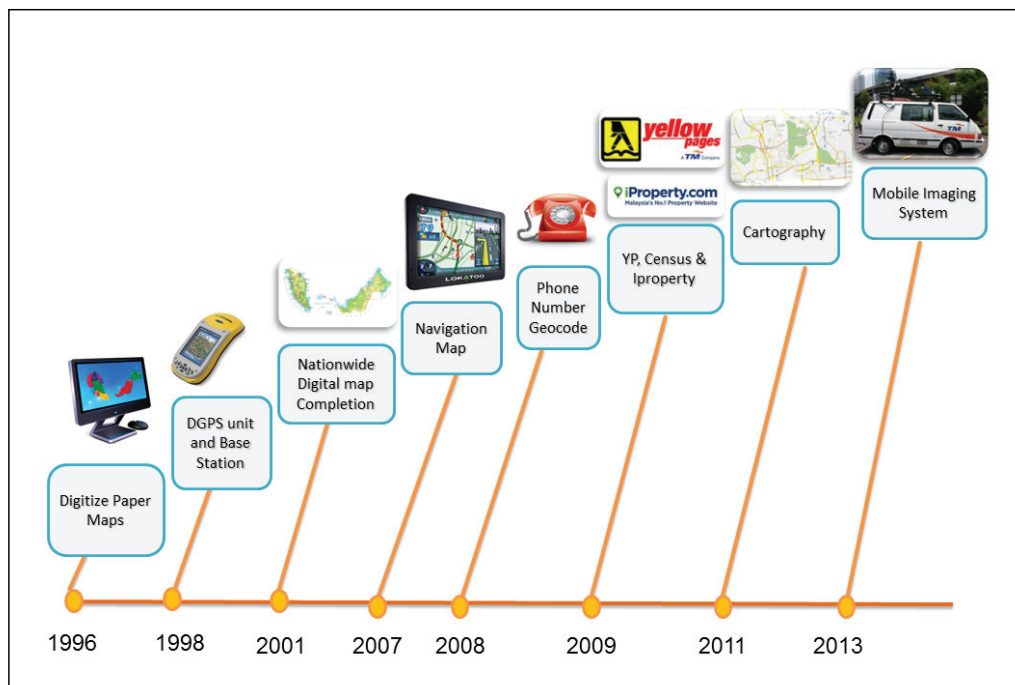
information such as road signs, one way streets and information on street junctions.

Kementerian Komunikasi dan Multimedia Malaysia (KKMM) awarded the project Malaysia Emergency Response System (MERS999) to TM. The project MERS999 played an important role in the evolution of TM Map as it required TM to geocode its fixed line numbers to the digital map to allow callers to be located from fixed lines. Since then, TM began receiving more requests by enterprises for the use of TM map for their planning purposes.

This is when TM began enriching its digital map sourcing data through the sourcing of information from censuses, Yellow Pages directory and iProperty listings. In 2011, TM launched its location based analytical tool known as the SmartMap™. During this time, TM further improved its digital map cartography for analytical purposes by adopting a simple map presentation for ease of analysis by users and to smoothen the loading experience on the Internet.

To further improve the quality and timeliness of its content, TM will deploy its "TM Map Car" to scan and gather nationwide data in 2014.

**Figure 1: TM's Contents Journey**



## Contents Sourcing

TM receives new content from multiple of sources. One important source is property developers. Property developers send proposed development plans to TM so we can plan and provide TM services to proposed development areas. On average, TM receives 300 new proposed areas monthly.

In addition to the proposed development plans, TM's staff, which numbers over 20,000 nationwide, is a good source of updates for the maps. The company has a web based application where staff can submit new map updates. Through this initiative, TM receives approximately 500 to 1,000 feedbacks from staff each month. Besides that, existing customers of TM also provide valuable feedback on areas which requires updating.

TM also uses publicly available information from well-known websites to obtain latest updates. TM utilises an application to download information on companies' branches to ensure its points of interest (POI) is up to date. The term "scrap" is used to refer to the downloading of information. TM scraps 3,000 new POI information from websites monthly. This is done by using web crawlers

to browse the web and obtain valuable location based information to be integrated into TM's contents.

Any changes in customers' profile will be reflected in TM's map via a loose integration with their provisioning system. For instance, whenever TM's customers change addresses, subscribe to or terminate a TM service, their new location will be automatically updated into TM's digital map. This can amount to about 90,000 changes per month.

TM also uses its own subsidiary directory, Yellow Pages, to track changes in the listing and update their content accordingly. They receive approximately 1,000 changes on monthly basis.

Notwithstanding these sources of information, of greater importance is on-the-ground information. Thus, TM also sends its survey team to verify and update its land base and POI. The teams capture videos and GPS positions to ensure the accuracy of data collected. Currently, TM has nine teams surveying the country.

As of August 2013, TM was able to gather the following contents:

**Table 1: TM Map Contents Value by Type Content**

Content	Value
Street - Street sections, highways, road, main road, and alley	800,000+
Point of Interest (POI) - A specific point location that is useful or interesting to public	300,000+
Properties - Physical properties and its information, e.g. address and property types	4,500,000+
Buildings - Physical prominent buildings information	130,000+
Location based Yellow Pages directory - Businesses that registered with Yellow Pages directory with spatial data	100,000+

All contents gathered were subsequently categorised to ensure that the data are properly structured. Currently, TM Map has over 70 categorised layers. Below are among the categorised layers available in TM Map:

With all the effort invested into obtaining sources to facilitate the updating of TM Map's content, on average the monthly map updates are as follows:

**Table 2: TM Map Categorised Layers**

Layers
Agriculture - Estates, farms, FELDA, FELCRA
Education - Pre-schools, primary, secondary, tertiary
Food & Beverage - Fast food, coffee, kopitiam, Malay eateries, confectionaries etc.
Fast Moving Consumer Goods (FMCG) - Hypermart, drug and personal care, groceries etc.
Government - Federal, states, consulates, embassy, judiciary, local authority
Medical - Hospitals and clinics
Financial - ATM, Bank offices and branches and Insurer offices
On-the-road - Authorised car services, Independent automotive services and petrol stations
Public Facilities - Cemeteries, places of worship, playing fields and open area
Public transportations - Airports, bus & taxi, KTM, LRT and Monorail
Travel & Leisure - Hotels, golf and resorts
Boundaries - Bandar, Mukim, Daerah, Negeri
Property - Lots, lot/house numbers

**Table 3: Average Monthly Map Updates Counts**

Content	Values
Street (number of sections)	100
Property	1,000
POI	10,000

In the near future, TM will be using its own “TM Map Car” to scout for and collect 360 videos to update its map. TM plans to start collecting data using this new mechanism by the end of 2014. This method will be helpful in ensuring that the updating process can be done faster and also presents the possibility of adding more content layers to enrich the TM Map.

**Quality Matters**

Good decision making depends significantly on good analytics, and good analytics depends considerably on the reliability of the data used. Thus, it is very crucial to ensure that location based information is as current as possible to reduce on the probability of uncertainty that is caused by the data.

Location based information quality depends on:

- i. Location correctness – location feature on the map must be the actual physical position of the feature on the ground.
- ii. Information correctness – the map data must contains current information about the feature.

Often, despite the map identifying a correct location, the map might reflect incorrect information. This might happen when a shop changes its name but this was not reflected in the features of the map data.

There are also instances where some location based data contain correct information except for information on the entity’s location. Usually this happens when an entity has moved to another location.

It is impossible to check and verify the quality of each data as it is very time and resource consuming. Thus, based on our current quality and assurance practices, the data will be verified on sample data of certain checksum. Besides that, TM will communicate directly with the data owner to verify the accuracy of information provided.

TM plans to introduce more statistical methods in the future such as the use of naive Bayes and other mathematical approaches to improve its sampling efficiency for more diverse quality checking.

**Figure 2: TM’s Contents Sources**



### Delivering Location Based Statistics

TM realises the value of its digital map. To unlock its value, TM has developed SmartMap™ which is a location based analytics or statistics that can provide meaningful location based information.

It provides users with the ability to associate data with geographic information so that they can view their sales, operations, customers and other business data from a locational perspective in hope that it can assist them in making informed decisions.

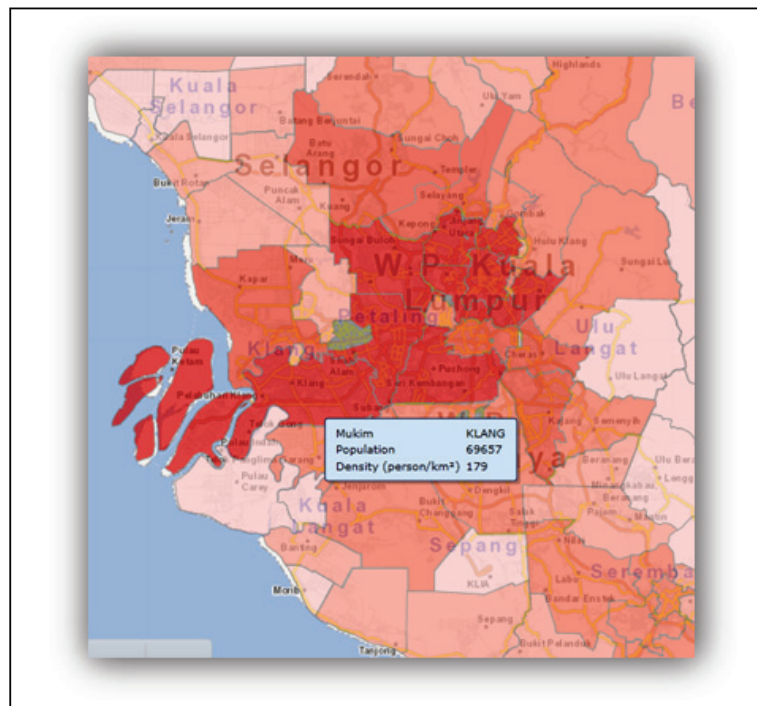
The application does not only answer the basic “where is” question, but the “how many” and “what is” questions as well. For instance, when a planner wants to decide on the location of a new outlet, he would definitely want to know “what is the potential market within walking distance from this store?”; or “How many competitors are already

established within 3km from this store?” and “What is the estimated income level of the market potential 3km from this store?”.

The method of obtaining the results is rather simple, first, set the radius distance from a location. This will generate a ring search. Following this, choose the category to be queried. The results will not only appear in numbers but also in points or heat maps. This way, users will immediately be able to identify the concentrated areas on the map.

In addition to utilising TM's or their partners' databases for such queries, another valuable data which might be of interest is data on demography. For example, if one is searching for a place to start a marketing campaign for a cosmetic product and want information on “where women from ages 20 – 35 mostly reside?” Instead of having to analyse a long list of tables, it would be much easier to view it in thematic map.

**Figure 3: Heat Map of Residential Area**



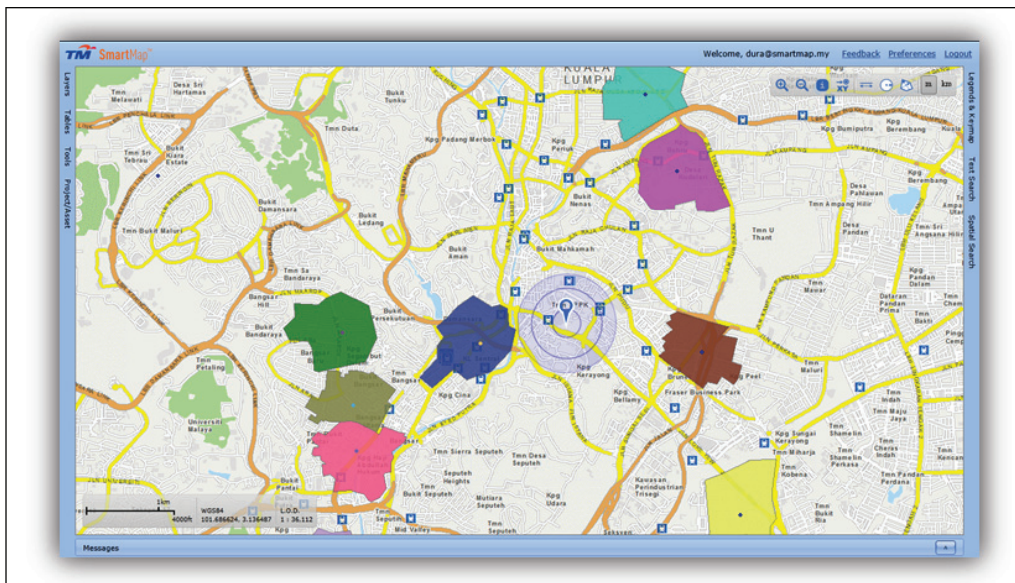
**Figure 4: Thematic Map of Population**



In fact, users can even conduct a simple predictive analysis by uploading their historical data to visualise and assist in predicting trends and patterns of their business. Things such as “what are the local’s favourite ice cream flavours?” or “Identifying the cause of revenue

drop down in one of the states”. Based on user’s uploaded data, the SmartMap™ is not only able to generate simple queries for identifying the changing patterns but it can also represent the data in a graph, chart or other tools that could assist users in their analysis.

**Figure 5: Service Boundary Plotting on Map**





## How TM uses its Digital Map and Location Based Statistics

### TMPoint Outlet Planning

When planning for new TMPoint outlets, TM has to ensure that there is a demand for its services in the particular area and the facility has to have enough capacity to meet demand.

Using SmartMapTM, TM will first identify the area that has high density using the property count. For better visualisation, the area density will be mapped out against data on the number of TM exchanges for the services to be delivered effectively to customers. In the case where an area has high density, it can focus on two things; number of outlets required to cater the needs and the distance from one outlet to another. Benchmarking competitors' outlets is also a good way to determine site selection for new TM Point outlets.

The placement of resellers is also important to ensure that TM expands its market reach properly especially on places where it is not covered within TM Point service area. Thus, planning ahead using SmartMapTM can assist in determining the best location for locating the reseller by using the radius distance and measuring tools.

### Targeted Marketing

One of the most important things for a utility company like TM is the need to know the location of their customers. Thus, TM geocodes its customers on a map to study and conduct predictive analysis on market behaviours based on location.

TM is able to view customers' distributions based on the types of services and packages subscribed. Whenever a service or package, or marketing campaign is introduced in a particular area, a pattern would start to emerge. For example when TM begins promoting its Streamyx high speed 4MB package in an area of interest, the changes in behaviour indicated by statistics and ratio over a period of time would indicate whether the current market is reacting to the marketing campaign.

Once the market has started to react, it is important to study its growth. When the growth is stagnant, it is an indication to switch to a direct marketing approach to up-sell the package to existing customers. Besides up-selling, sales personnel or resellers can promote the package to potential customers who have yet to subscribe via simple comparisons on statistics of existing customers against potential customers in that area.

### Location Based Statistics Used by Other Industries

**Table 4: Use of Location Based Statistics in Other Industries**

Industry	Usage
Retailers	Outlets Planning
Finance	Outlets Planning, targeted marketing
Education	Outlets planning
Telecommunication	Network planning, outlets and sales coverage planning, targeted marketing, churn management, collection
Media	Out of home coverage and planning
Government	Service area coverage and planning, collection

## Conclusion

Location based analytics is gaining popularity and is among the more important solutions enterprises are looking for in order for them to determine the best location for their new outlet, structure of their sales and marketing campaigns and provides an indication on ways to optimise sales productivity.

Previously, having location based data was a big challenge for businesses. For TM, it

was a significant decision to invest in the project but upon its completion, TM benefited considerably from it. TM Map and location based statistics are now widely used in various TM departments, from the planning of TM Point outlets, to the determination of the best location for marketing campaigns, demarcation of TM's sales team, and the operation of installation and restoration services to homes or offices.



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## Papers

### **Session 1: New Statistics for Better Surveillance and Policy Action**

Global Financial and Economic Crises: Lag in Statistics or Slow in Policy Actions?  
Per Nymand-Andersen 27

Statistics after the Financial Crisis: Response to New Data Demands and Data Gaps  
Dr. He Qi 37

Strengthening Statistical Compilation and Usage of Relevant Statistics in Malaysia  
Abd. Latib Talib, Nur Hidaah Mahamad Rappek, Siti Rahmah Seh Omar and Nurul Naqiah Mansor 47

### **Session 2(A): Innovation in Analysis and Statistics**

Compilation and Management of Labour Market Statistics for Macroeconomic Analysis at the  
U.S Bureau of Labor Statistics  
Kenneth W. Robertson and Dr. John L. Eltinge 59

Domestic Demand-Driven Growth: Analysis Perspective and Statistics Needed  
Dr. Yeah Kim Leng 75

Core Inflation: The Malaysian Case  
Mohd Helmi Ramlee and Muhamad Shukri Abdul Rani 101

### **Session 2(B): Leveraging on Statistical Methods and Scientific Approaches for Better Analysis**

An Overview on the Statistical Methods for Economic Research and Risk Assessment  
Dr. Lau Wee Yeap 127

Aggregate Financing to the Real Economy  
Dr. Sheng Songcheng 133

Measurement and Contribution of Total Factor Productivity to Economic Growth  
Dr. Rahmah Ismail and Dr. Noorasiah Sulaiman 139

Estimating Malaysia's Output Gap: Have We Closed the Gap?  
Dr. Chuah Lay Lian and Dr. Nur Ain Shahrier 153

### **Session 3(A): New Horizon for Financial and Economic Statistics**

Transcending the Traditional Approach through Satellite Accounts  
Zubaidah Ismail, Mazreha Ya'akub and K Megala Kumarran 179

Monitoring Shadow Banking and its Challenges: The Malaysian Experience  
Muhamad Amar Mohd Farid 191

### **Session 3(B): Application of Technology in Transforming Malaysia's Statistical Landscape**

Leveraging on Business Intelligence Tools for Micro- and Macro-Data Analysis and Research  
Tai Yoon Foong and Muhamad Kamal Firdaus Muhmad Foudzi 213

Addressing Statistical Gaps in a Dynamic Payment Environment  
Yee Chee May and Ravinder Kaur 221

Location Based Statistics: Knowing Your Place  
Wan Razali Matsah 233