ENHANCEMENT OF THE COMPOSITE LEADING ECONOMIC INDICATOR SYSTEM OF THE PHILIPPINES

by

Claire Dennis S. Mapa, Divina Gracia L. Del Prado, Plenee Grace S. Castillo, Ibarra Aaron R. Poliquit, Al-Ahmadgaid B. Asaad

ABSTRACT

The Leading Economic Indicator System (LEIS) of the Philippines was developed to provide short-term forecast of the direction of the country's economic performance. However, due to possible changes in the structure of the country's economy since the LEIS methodology was last updated more than a decade ago, the predictive performance of the system has declined. Hence, the interest of this paper is the enhancement of the current methodology of the LEIS.

The proposed methodology uses as reference series the Gross Domestic Product and the following six indicator series, two of which are among the 11 indicator series of the current methodology: Peso/US Dollar Exchange Rate, Stock Price Index, Business Expectation, Gross International Reserves, National Government Revenues, and Universal and Commercial Bank Loan Outstanding. Weights for the computation of the composite leading economic indicator are the standardized partial correlations.

Keywords*: seasonal adjustment, detrending, TRAMO-SEATS, Hodrick-Prescott, composite leading economic indicator, turning point*

1. Introduction

The Leading Economic Indicator System (LEIS) of the Philippines was developed to short-term forecast the movement of the Philippine economy. The various works for the development of LEIS started in 1993. Since the official compilation of leading economic indicators (LEIs) and generation of composite LEI in 1997, the latest revision of the LEIS was in 2002.

The possible changes in the structure of the country's economy since the last updating of the LEIS more than a decade ago might have affected the performance of the current LEIS in predicting the movement of the country's economy as measured by the Gross Domestic Product (GDP). Thus, the focus of this paper is the enhancement of the current LEIS.

The research study started with the investigation of the root problems of the declining performance of the current LEIS. Hence, the main part of the review in terms of methodology was on the validation of the current computational procedures of generating composite LEI based on the suggested methodology cited in the paper of Bersales, Reyes and de Guia (2004), which was the basis of the latest revision of the current methodology. The 11 current indicators were also evaluated as to the need to expand, reduce or totally change them.

2. Limitations of the study

The research undertaking focused on the non-model based approach in forecasting the movement of the GDP because of its simplicity to implement. In comparing the proposed and current LEIs, only data from first quarter of 2002 (2002 Q1) to fourth quarter of 2014 (2014 Q4) were used since these are the only periods where data for both the proposed and current LEIs are available. The training dataset consisted of the data points from 2002 Q1 to 2011 Q4 and the remaining data points served as testing dataset.

3.   The Current Methodology of the LEIS

This section presents the current reference and indicator series as well as the methodology of aggregating the leading indicators to generate the composite LEI.

A.   The Reference and Indicator Series

The reference series used in the current methodology of the LEIS is the non-agriculture Gross Value Added (GVA). Its cycle depicts the same pattern as that of the cycle of the Gross Domestic Product (GDP), unlike the agriculture GVA which shows a different pattern. The advantage of using non-agriculture GVA as reference series is its being free of irregularities that the agriculture GVA contributes to the GDP (Bersales, et al., 2004).

There are 11 leading economic indicators in the construction of composite index as follows:

    (1)   Consumer Price Index (CPI)
    (2)   Electric Energy Consumption (ELECON)
    (3)   Peso/Dollar Exchange Rate (EXCRATE)
    (4)   Hotel Occupancy Rate (HOTOCC)
    (5)   Money Supply (MONSUP)
    (6)   Number of New Business Incorporations (NEWBUS)
    (7)   Stock Price Index (STKPRC)
    (8)   Terms of Trade Index (TTRADE)
    (9)   Total Imports (IMPORTS)
    (10)   Tourist/Visitor Arrivals (TOURAR)
    (11)   Wholesale Price Index (WPI)

The selection of these leading economic indicators were based on two main criteria – economic and statistical.

    The economic criteria are:

    (1)   production time
    (2)   market expectations
    (3)   policy impacts
    (4)   external shocks
    (5)   buffer stocks

    The statistical criteria are:

    (1)   high correlation with reference series
    (2)   timely release of new values
    (3)   high data quality
    (4)   small size revision to provisional data
    (5)   availability of long historical as well as high frequency data
    (6)   trends dominating the irregular component of the series or clear trends instead of high volatility are observed in the historical plots of the series
    (7)   consistency with the general upturns and downturns of the reference series

B. Composite Leading Economic Indicator

The main output of the LEIS is the quarterly composite leading economic indicator (LEI). According to Tabunda (2013), the LEIS of the Philippines falls under the category of simple non-model based technique for the construction of composite LEI described by Marcellino (2006) as it involves the following steps:

(1)   selection of leading indicators based on criteria
(2)   seasonal adjustment and removal of outliers from each of the leading indicators and the reference series
(3)   removal of the trend component from each of the filtered series
(4)   standardization of the cycle values
(5)   aggregation of the components into a composite index using a weighting scheme.

The actual procedures used by the Satellite Accounts Division of the PSA in obtaining the composite LEI are described below:

(1)   Seasonally adjust each of the 11 LEIs and the non-agriculture GVA using DOS-based X11 ARIMA to obtain the trend-cycle of the 11 LEIs and the non-agriculture GVA.

(2)   Remove the trend component from the seasonally adjusted series to obtain the cycle component of the 11 LEIs and the non-agriculture GVA and standardize the cycles. There are two detrending methods used which are as follows:

(2a)   Polynomial trend model using Excel
(2b)   Hodrick-Prescott (HP) filter method from Eviews

(3)   Using the cycles obtained through method (2a), correlate the standardized cycle of each of the 11 LEIs and the non-agriculture GVA to obtain the lead period. The lead period determines the number of quarters the cycle series for each indicator is moved forward when computing the composite LEI.

(4)   Compute the composite LEI (CLEI) which is the linear combination of lagged indicator series where the weights are the simple correlation coefficients of the indicators with the non-agriculture GVA. The CLEI is obtained by the following formula:

$$CLEI_t = \frac{\sum_{i=1}^{11} w_{i,l_i} z_{i,t}}{11}, \quad t = l_i + 1,...,\tau \quad i = 1,2,...,11 \quad l_i = 1,2,...,10 \quad \text{(equation 1)}$$

where l_i refers to the lead period for the ith indicator, w_{i,l_i} refers to the weight which is the correlation coefficient of the non-agriculture GVA and the leading economic indicator i at lead period l_i and $z_{i,t}$ is the standardized cycle of the leading economic indicator i at time t where the cycles are extracted using method (2b).

C. Issues and Challenges of the Current LEIS

The following were the issues and challenges of the current LEIS:

1. Timeliness of Data

As the LEIS provides advance information on the direction of the economy in the short run, timely release of data for the components of the composite LEI is important. However, out of the 11 LEIs used in the current methodology, only four have available data during the scheduled computation of the quarterly composite LEI. These are Consumer Price Index (CPI), Peso/Dollar Exchange Rate (EXCRATE), Stock Price Index (STKPRC), and Electric Energy Consumption (ELECON). In addition, the non-agriculture GVA, which is the reference series, is not also timely in its release.

2. Imputation of data that are not available on time

To address the issue on timeliness of data for the components of the composite LEI that are not available during the scheduled quarterly computation, forecasting/estimation of missing values is done using growth rates or ARIMA models available in X11-ARIMA (Dos-based). However, as pointed out by Bersales, et al. (2004), models used in forecasting/estimating the missing values may not always produce the best forecasts.

Imputed using growth rate are Total Imports (IMPORTS), Money Supply (MONSUP), Tourist Arrivals (TOURAR), and Wholesale Price Index (WPI). Forecasted using ARIMA models are non-agriculture GVA, Hotel Occupancy Rate (HOTOCC), Number of New Business Incorporations (NEWBUS), and Terms of Trade Index (TTRADE).

3. Appropriateness of the Leading Economic Indicators (LEIs)

The 11 LEIs may no longer be relevant and appropriate to analyze and predict economic fluctuations. As mentioned by Tabunda (2012), the current methodology of the computation of composite LEI is sound and not the cause of inadequacy. However she suggested that leading indicators with shorter publication lags and entails less or no revision should be identified to improve the performance of the composite index.

4. Methodology for the Computation of Composite LEI

a. The current LEIS still uses X11-ARIMA (DOS-based) to deseasonalize the reference and indicator series as well as in forecasting missing values instead of TRAMO-SEATS of DEMETRA as suggested by Bersales, et al. (2004). This was recommended in anticipation of the shift of official seasonal adjustment procedure and software of Philippine time series from DOS-based X11-ARIMA to TRAMO-SEATS of DEMETRA. Although the trend-cycle components from the two seasonal adjustment techniques exhibit the same behavior as shown in the paper of Bersales, et al. (2004), the disadvantage for DOS-based X11-ARIMA is that it is not readily executable using other computers since virtually all computers nowadays are windows-based.

b. There are two detrending procedures used in the current methodology – polynomial trend model and HP filter method. As shown in equation (1), the cycles from the polynomial trend model are used to compute correlation coefficients which serve as weights in the computation of composite LEI. The cycles from HP filter method are the ones that are weighted to obtain the composite LEI. Bersales, et al. (2004) have shown that in recent quarters of 2002, the cycles from the polynomial trend model deviated from the behavior of the Non-Agri GVA unlike the HP filter method whose cycles behaved as that of the GDP. Hence, they recommended HP filter method to estimate the cycles of the indicator and reference series.

Correlation coefficients of cycles of indicator and reference series from polynomial trend and HP filter method are not equal. Hence, impact of an indicator to the aggregated LEI is expected to vary for the two detrending methods.

c. The aggregation of the LEIs to construct the composite LEI used double weighting scheme (equation 1). The standardized cycles of the LEIs are first weighted using simple correlation coefficients of the standardized cycles of the LEIs in their lead periods with the non-agriculture GVA. The weighted aggregate of LEIs is again weighted using simple average. The second weighting changes the values of the

composite LEI but does not change the trend as a function of time. However, a second weighting is deemed unnecessary. The more important thing to give attention to are the weights to be used. The paper of Bersales, et al. (2004) recommended standardized partial correlations or simple average as weights in the construction of LEI.

    d.   The composite LEI is not normalized or standardized, hence comparing it to standardized cycle of the reference series (which has a mean equal to 0 and standard deviation equal to 1) is misleading.

5. Automation of Estimation

Currently, the LEIS uses three different statistical softwares in the construction of composite LEI, namely, X11-ARIMA (DOS-based) for seasonal adjustment, Eviews for detrending using HP filter method and MS Excel for the step by step execution of the rest of the procedures in constructing the composite LEI. The step by step execution of procedures using MS Excel includes the detrending of deseasonalized series where the selection of polynomial model (whether linear additive, linear multiplicative, quadratic additive and quadratic multiplicative) used to extract the cycle is done manually by inspecting F-values from the results of regression analyses. The model with the highest F-value is used to extract the cycle component of the deseasonalized series.

Automation of processing and estimation procedures will speed up construction of the composite LEI. It also minimizes errors caused by transferring data from one software to another and those caused by manual adjustments during estimation such as moving the standardized cycles of the indicators forward based on their lead period.

4. The Proposed Leading Economic Indicator System

A. Reference Series

The reference series proposed in this study is the Gross Domestic Product (GDP). The main interest of the LEIS is to predict the movement of the GDP, thus regardless of the volatility of agriculture, the GDP is deemed ideal as the reference series. *Figure 1* shows the GDP and non-agri GVA of the Philippines from first quarter 1991 to fourth quarter 2015 and *Figure 2* depicts their corresponding standardized cycles using Hodrick-Prescott (HP) filter method. The GDP and non-agriculture GVA exhibit the same trend but at some time points, the peak of the cycle of the non-GVA is far lower or higher than that of GDP (e.g. 1998 Q1 and 2010 Q2)

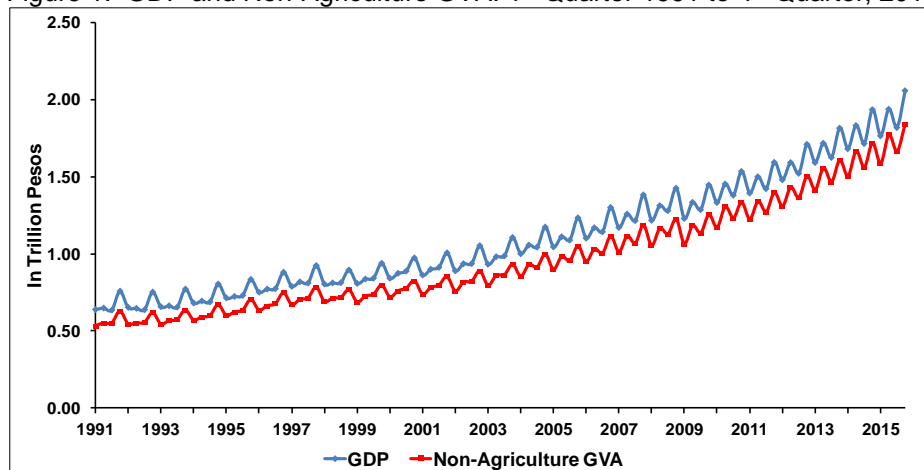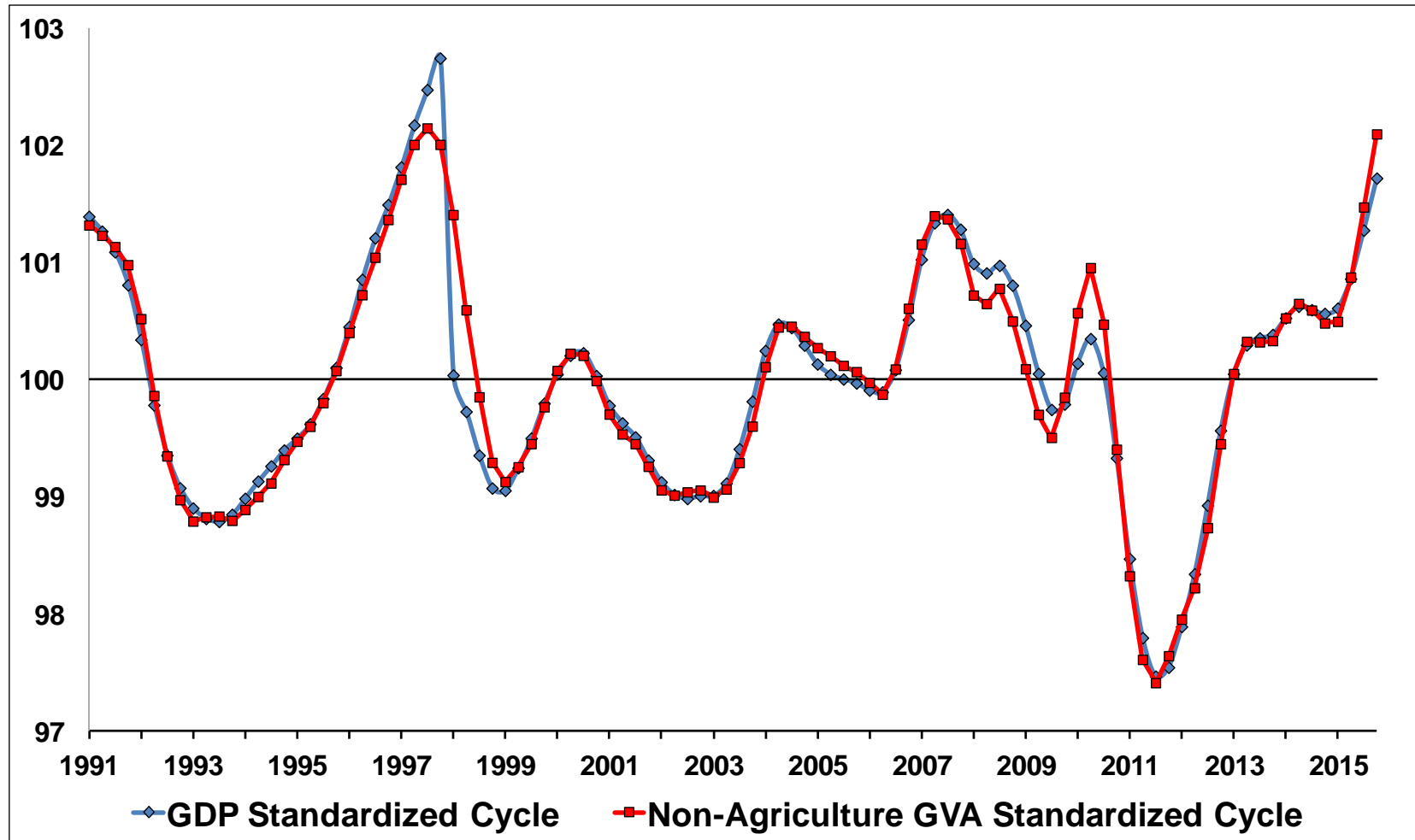Figure 1. GDP and Non-Agriculture GVA: 1st Quarter 1991 to 4th Quarter, 2015

Figure 2. Standardized cycles of GDP and Non-Agri GVA
1st Quarter, 1991 to 4th Quarter, 2015
(using Hodrick-Prescott filter method)

B. Indicator Series

A total of 33 potential economic indicators were investigated in the study, which include the 11 current LEIs and 22 other potential economic indicators. These 33 indicators are:

Current LEIS
1. Consumer Price Index (2000 = 100)
2. Electric Energy Consumption
3. Peso/US Dollar Exchange Rate
4. Hotel Occupancy Rate
5. Money Supply (M1)
6. Number of New Business Incorporations
7. Stock Price Index
8. Terms of Trade Index for Merchandise Goods
9. Total Merchandise Imports
10. Tourist/Visitor Arrivals
11. Wholesale Price Index

Other Indicators
12. Business Confidence Index (Current Quarter)
13. Business Outlook Index (Next Quarter)
14. Export of Goods
15. Government Final Consumption Expenditure (2000 =100)
16. Government Final Consumption Expenditure (Current)
17. Gross International Reserves
18. Lending Rate
19. London Inter-Bank Offered Rate
20. Meralco Sales (GwH)
21. Money Supply (M2)
22. National Government Expenditures
23. National Government Revenues
24. OFW Remittances
25. Savings Deposit Rate
26. Singapore Inter-Bank Offered Rate
27. Time Deposit Rates (Long-Term Rates)
28. Time Deposit Rates (Short-Term Rates)
29. Treasury Bill Rates (364-Day Tbill Rates)
30. Treasury Bill Rates (91-Day Tbill Rates)
31. Universal and Commercial Bank Loan Outstanding
32. Volume of Palay
33. Volume of Production Index

1. Selection of Indicator Series

In order to come up with the best drivers of GDP from the 33 possible leading economic indicators considered in the study, a set of criteria was used.   The criteria were basically the same as the criteria used in selecting the 11 current indicators, with slight modifications in the statistical criteria used. The statistical criteria are:

(1) monthly in frequency is preferred;
(2) no significant revision to preliminary data;
(3) timely release of needed data
(4) long time series with no missing values;
(5) high correlation with reference series; and
(6) capable to lead turning points (using Granger causality test).

The first four criteria are also the practical considerations of the Organization for Economic Cooperation and Development (OECD) in pre-selecting component series for its composite leading indicator (CLI).

To short list the potential indicators, the cut-off for the correlation coefficient was set at 0.25 (absolute value) and tested for capability to lead turning points using Granger causality test. Values of the series that were correlated and tested for Granger causality were the standardized cycles which were obtained using the steps in C.1 to C.3 of this section.

Table 1 shows the indicators that have at least 0.25 correlation coefficients (absolute value) with the reference series, and the corresponding p-values of the lead periods where these indicators are significant at 5 percent or 10 percent level using Granger causality test. Of the 33 potential indicators, only 21 have correlation coefficients of at least 0.25, nine of which are capable of leading the turning points of the reference series. For example, the Stock Price Index (SPI) has a correlation coefficient of 0.2711 and the suggested lead period is four quarters with p-value of 0.0344.

Table 1. Correlation Coefficients of Potential Indicators and Results of Granger Causality Test

Indicators	Correlation Coefficient	Granger Causality Test	
		p-value	Lead Period/s
1. Electric Energy Consumption (EEC)	-0.3419	0.0266	2**
2. Peso/US Dollar Rate (ERATE)	-0.5184	0.0181	2**
3. Hotel Occupancy Rate (HOR)	-0.4011		
4. Money Supply (MSM1)	0.5185		
5. Stock Price Index (SPI)	0.2711	0.0344	4**
6. Terms of Trade Index (TTRADE)	-0.3225		
7. Business Confidence Index, Current Quarter (BESCQ)	0.2652		
8. Business Outlook Index, Next Quarter (BESNQ)	0.2858	0.0768	3*
9. Export of Goods (EG)	0.3586	0.0728	1**
10. Government Final Consumption Expenditure (2000=100) (GFCE1)	0.3596		
11. Gross International Reserves (GIR)	-0.3695	0.0008	1**
12. Money Supply (MSM2)	0.5056		
13. National Government Expenditures (NGE)	0.4635		
14. National Government Revenues (NGR)	0.2546	0.0826	4*
15. OFW Remittances (OFWR)	-0.2499		
16. SDR	-0.6709		
17. UCBLO	-0.4950	0.0006, 0.0035	1**, 3**

*- significant at 10% significance level
**-significant at 5% significance level

2. Proposed indicator series

After considering the timeliness of the data and other practical considerations enumerated in B.1, the results yielded six economic indicators as components of the composite LEI and these are presented in *Table 2*. Two of these indicators (ERATE and SPI) are among the 11 current leading economic indicators.

Table 2: Proposed Leading Economic Indicators

Indicators	Description	Availability
Peso/US Dollar Exchange Rate (ERATE)	Monthly average of Philippine Peso-US Dollar exchange rate. The peso-dollar reference exchange rate is based on the daily weighted average rate of peso-dollar (USD/PHP) spot (trade date plus 1 day) transactions dealt through the Philippine Dealing System (PDS).	Every 2nd workday after the reference month (final data)
Stock Price Index (SPI)	Philippine stock price index (SPI) serves as a measure of the changes in, and the movements of, the average prices of company shares of stock traded in the Philippine Stock Exchange (PSE).	30 days after the reference month (final data)
Next Quarter Business Outlook Index (BESNQ)	This dataset contains the results of the survey to provide advance information on the current and near-term economic and business conditions, and other indicators of aggregate demand that are useful inputs for the formulation of monetary policy including levels of production and economic activity as well as factors that could influence the movement of key economic variables.	Last Friday of the month before the reference quarter (final data)
Gross International Reserves (GIR)	Foreign assets that are readily available to and controlled by the BSP for direct financing of payments imbalances and for managing the magnitude of such imbalances.	Every 19th day of the month after the reference month (final data)
National Government Revenues (NGR)	The National Government Revenues is under the National Government Cash Operations Report and is being produced by the Bureau of Treasury.	20 days after the reference month (final data)
Universal and Commercial Bank Loan Outstanding (UCBLO)	Loans outstanding refer to the unpaid balance of loans granted by universal and commercial banks. The report distinguishes between loans extended by banks to resident borrowers for production purposes and those for household consumption.	30 days after the reference month (preliminary data)

(BSP Website - Metadata) http://www.bsp.gov.ph/statistics/statistics_metadata.asp

C. Proposed Methodology for the LEIS

For simplicity of computation and easy interpretation of results, the suggested procedure follows that of the current LEIS, which is non-model based, but with some revisions to address the weaknesses of the current LEIS. Presented below is the proposed methodology.

(1) Deseasonalization
Seasonally adjust each of the six LEIs and the GDP, which is the reference series, using TRAMO-SEATS of DEMETRA to obtain the trend-cycle of the six LEIs and the GDP.

TRAMO-SEATS detects outlier and correct them (OECD, 2001; Maravall, 2006; Peltola, 2011). Also, the choice between additive and multiplicative model for extracting the trend-cycle component is automatically determined by TRAMO-SEATS.

(2) Detrending
Remove the trend component from the seasonally adjusted series to obtain the cycle component of the six LEIs and the GDP using Hodrick-Prescott (HP) filter method of Eviews.

(3) Standardization
Standardize the cycles of each of the six LEIs and the GDP as follows:

$$z_{cycle} = \frac{cycle - \overline{x}_{cycle}}{s_{cycle}}$$ (equation 2)

where z_{cycle} is the standardized cycle, $\overline{x}_{cycle}$ is the mean of the cycle and s_{cycle} is the standard deviation of the cycle.

(4) Weighting
Using the standardized cycles, obtain the weights of the six LEIs using their standardized partial correlation coefficients. These are actually the individual regression coefficients of the LEIs when fitting a regression line for the reference series given values of the indicator series.

(5) Aggregation
Compute the composite LEI (CLEI) by aggregating the indicator series using the following formula:

$$CLEI_t = \sum_{i=1}^{6} w_i z_{i,t} \qquad t = 1,...,\tau \qquad i = 1, 2,..., 6$$ (equation 3)

where w_i is the weight of indicator i which is obtained in Step (4) and $z_{i,t}$ is the standardized cycle of indicator i at time t which is obtained in Step (3).

5.   Empirical Results

A.   Comparison of Different Weighting Schemes

The standardized partial correlation, which is the proposed weight in aggregating the indicators, was compared with the current weight and three other possible weights. The comparison was focused on the predictive ability of the composite LEI using these weights. The three other possible weights are as follows:

(1) Simple Average – average of the standardized cycles of the indicator series. With this as weight and using the six proposed leading economic indicators, the composite leading economic indicator is obtained as:

$$CLEI_t = \frac{\sum_{i=1}^{6} z_{i,t}}{6}, \quad t = 1,...,\tau \qquad i = 1, 2,..., 6 \qquad \text{(equation 4)}$$

where $z_{i,t}$ is the standardized cycle of indicator i at time t

(2) Correlation at One quarter Lead period (**1 quarter lead period**) – correlation of the standardized cycles of the reference series and the indicator series at one quarter lead period. The composite leading economic indicator is:

$$CLEI_t = \sum_{i=1}^{6} w_i z_{i,t}, \quad t = 1,...,\tau \qquad i = 1, 2,..., 6 \qquad \text{(equation 5)}$$

where w_i is the correlation of the standardized cycles of the reference series and the indicator series at one quarter lead period

(3) Correlation at One to Four Quarters Lead period (**1 to 4 quarters lead period**) – highest correlation of the standardized cycles of the reference series and the indicator series within one to four quarters lead period. The formula for the composite leading economic indicator is similar to equation (5). However, the basis for the weight is extended until four quarters, depending on what lead quarter has the highest correlation.

The assessment was done by comparing ability to forecast quarter-to-quarter movement of the GDP. The direction of GDP, whether upward or downward, was observed at different weighting schemes. Using the 11 current LEIs, the percentage of correctly predicting the movement of GDP was obtained for each of the alternative weighting procedures.

Table 3 shows the summary of prediction performance from 1991 Q1 to 2014 Q4. Of the four proposed weighting schemes, the standard partial correlation obtained the highest percentage of correctly predicting the movement of GDP at 71 percent.   Using cross correlation as weight came next where one quarter lead period was better than the one to four quarters lead period. The current method of weighting had the lowest percentage of correct prediction of 58 percent, which is equal to the percentage of correct prediction for simple average. It can be noted that the 11 current indicators could have been better in terms of predicting quarter-to-quarter movement of GDP if the weights used were the

standardized partial correlation coefficients as suggested in the paper of Bersales, et al. (2004).

Table 3. Summary of Quarter-to-Quarter Forecast of GDP Movement at Different Weighting Schemes: 1st Quarter 1991 to 4th Quarter 2014

Current LEIs

INDICATOR	WEIGHTING PROCEDURE				
	Current Method	Simple Average	Cross-Correlation (1 Qtr. Lead Period)	Cross Correlation (1 to 4 Qtr. Lead Periods)	Standardized Partial Correlation
Number of Correct Predictions	53	53	62	61	65
Number of Quarters	92	92	92	92	92
Percentage of Correct Predictions	58%	58%	67%	66%	71%

Using the new 6 LEIs, standardized partial correlation did not emerge as the best procedure when applied to the training dataset which covers the period 2002 Q1 to 2011 Q4 (*Table 4*). However, when applied to the testing dataset (2012 Q1 to 2015 Q4), the standardized partial correlation was the best weight with 75 percent correction prediction of GDP movement *(Table 5)*.

Table 4. Summary of Quarter-to-Quarter Forecast of GDP Movement at Different Weighting Schemes: Training Dataset (1st Quarter 2002 to 4th Quarter 2011)

Proposed LEIs

INDICATOR	WEIGHTING PROCEDURE			
	Simple Average	Cross-Correlation (1 Qtr. Lead Period)	Cross Correlation (1 to 4 Qtr. Lead Periods)	Standardized Partial Correlation Coefficient
Number of Correct Predictions	21	25	25	20
Number of Quarters	38	38	38	38
Percentage of Correct Predictions	55%	66%	66%	53%

Table 5. Summary of Quarter-to-Quarter Forecast of GDP Movement at Different Weighting Schemes: Testing Dataset (1st Quarter 2012 to 4th Quarter 2015)

Proposed LEIs

INDICATOR	WEIGHTING PROCEDURE			
	Simple Average	Cross-Correlation (1 Qtr. Lead Period)	Cross Correlation (1 to 4 Qtr. Lead Periods)	Standardized Partial Correlation
Number of Correct Predictions	9	11	10	12
Number of Quarters	16	16	16	16
Percentage of Correct Predictions	56%	69%	63%	75%

B. Comparison Between Current and Proposed LEIs

The predictive ability of the proposed LEIs was compared with the current LEIs in terms of forecasting the movement of the GDP and the turning points of the GDP.

Figure 3 shows the standardized cycles of the GDP and the composite LEI with the 11 current indicators and the 6 proposed indicators. Finally, to view the complete cases with respect to the time points of the proposed LEIs, *Figure 4* zoom *Figure 3* by starting at year 2002 first quarter.

Figure 3: Estimated GDP Cycle and Composite LEI using Current and Proposed LEIs using Standardized Partial Correlation Coefficients as Weights
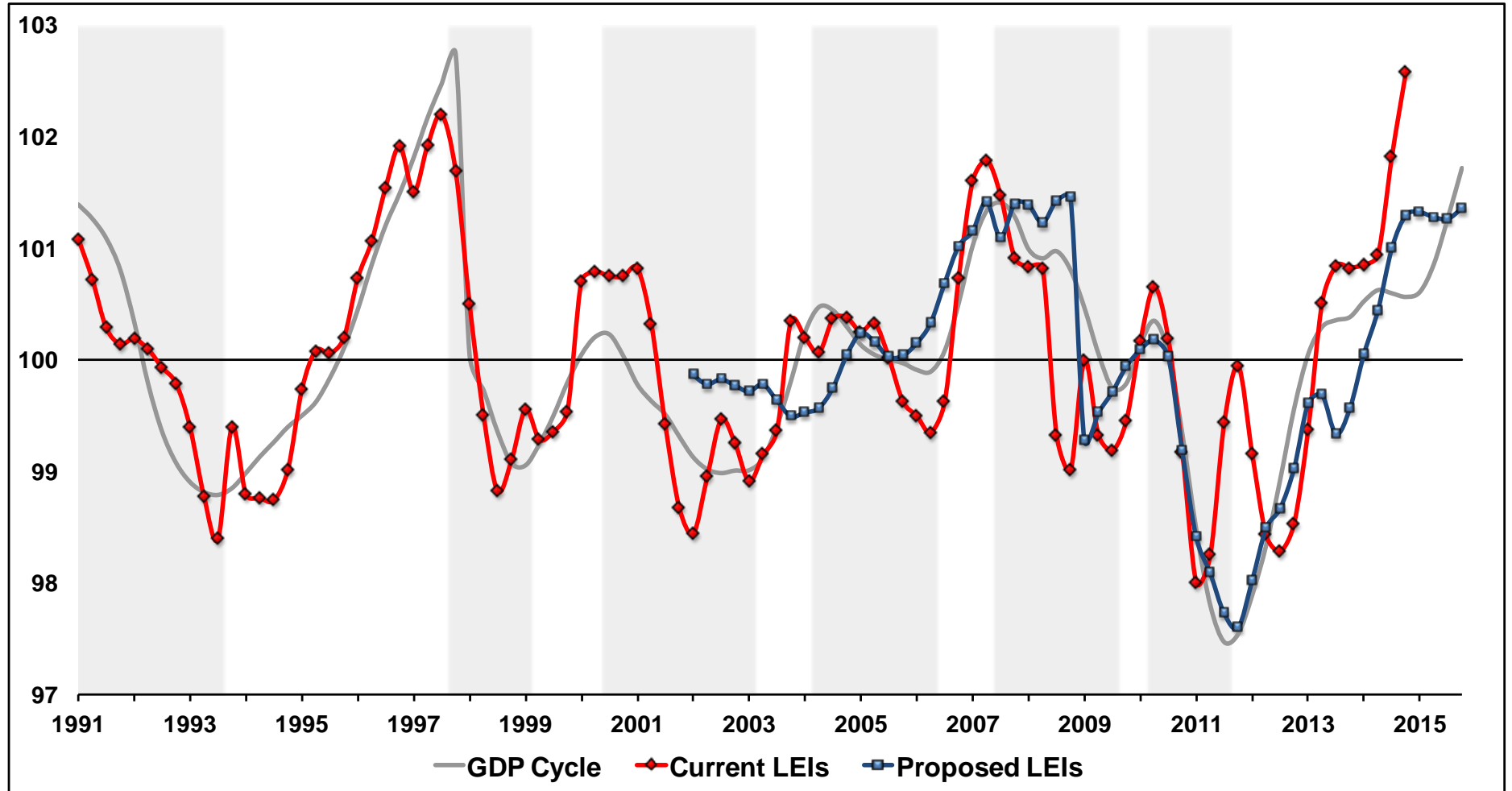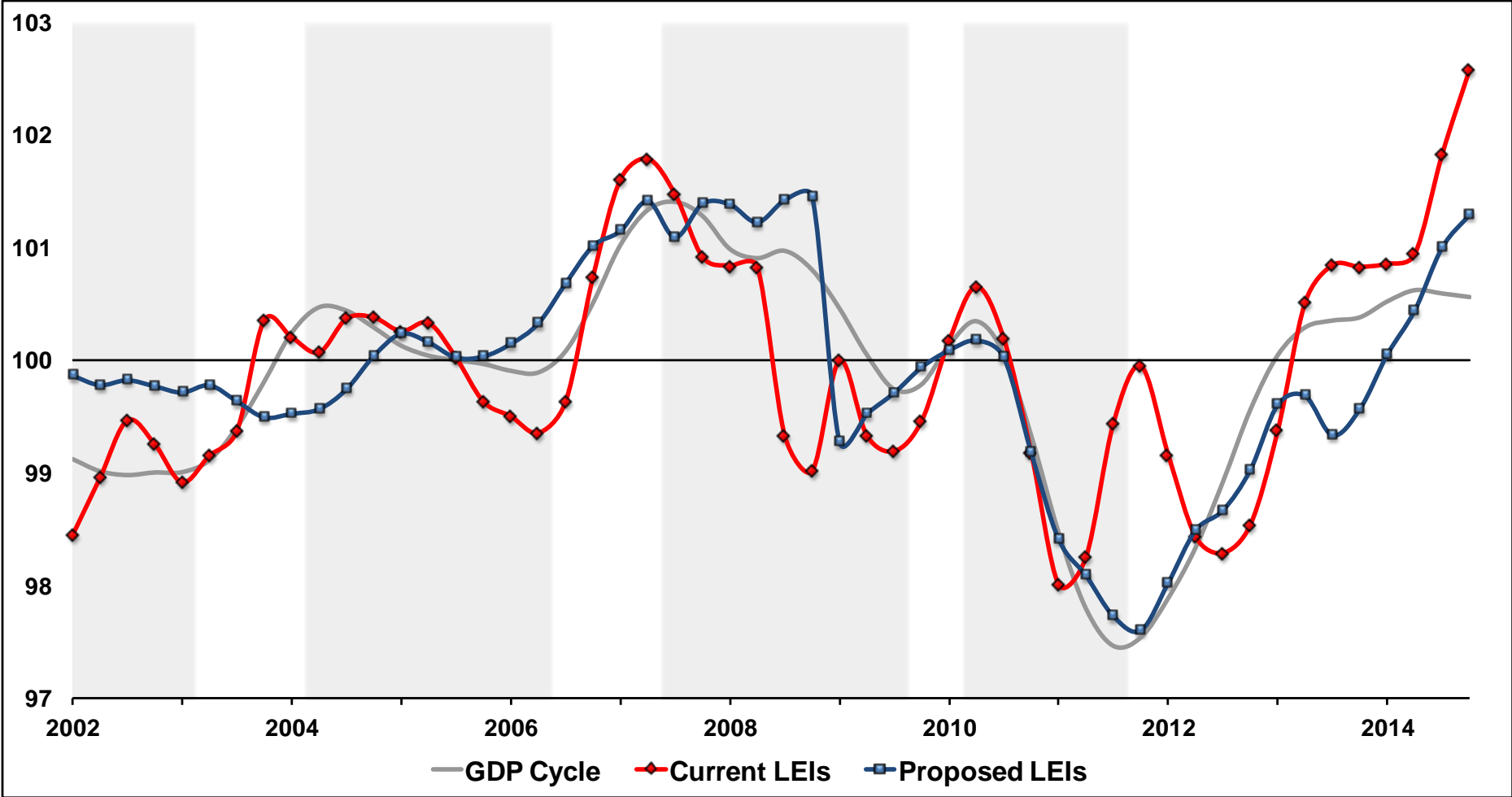
Figure 4: Estimated GDP Cycle and Composite LEI using Current and Proposed LEIs using Standardized Partial Correlation Coefficients as Weights (1st Quarter 2002 – 4th Quarter 2014)

1. Forecasting of Quarter-to-Quarter Movement of GDP

In terms of forecasting the movement of GDP, the composite LEI, using the proposed indicators, was better for all weighting procedures, except for standardized partial correlation *(Table 4)*. However, using the testing dataset, the proposed indicators performed better than the current indicators for the two cross-correlations and equally for the standardized partial correlation at 75 percent percentage of correct prediction of movement of GDP *(Table 5)*.

2. Forecasting Turning Point of GDP

The turning points of the standardized cycles of GDP and the composite leading indicator were determined through visual inspection. A possible peak must be preceded by a trough and vice versa. However, a possible peak associated with negative values of the standardized cycle (values below 100 for the adjusted standardized cycles) and their associated troughs are not considered as possible turning points (Tabunda, 2013).

Tables 6 and 7 show the possible turning points of the standardized cycles of the GDP and the composite LEI at different weighting schemes using the 11 current leading indicators and the 6 proposed indicators, respectively. In terms of forecasting peak and trough of cycles of GDP, the performance of the 11 current indicators outshone that of the proposed indicators. For the suggested weighting method, which is the standardized partial correlation, the median lead for trough was 0.5 using the proposed indicators while 2 for the current indicators. For the peak, the median lag period using the proposed indicators was 2.5 while the median lead period using the current indicators was 0.5.

Table 6. Summary of Possible Turning Points of Standardized Cycles of GDP and Composite LEI at Different Weighting Schemes
1st Quarter 2002 - 4th Quarter 2014

Current LEIs

Possible Turning Point (PTP)	GDP	Composite LEI						Standardized Partial Correlation Coefficient	
		Simple Average		Cross-Correlation Coefficient					
				1st Lead Period		1st to 4th Lead Periods			
		PTP	Lead (+) or Lag (-)	PTP	Lead (+) or Lag (-)	PTP	Lead (+) or Lag (-)	PTP	Lead (+) or Lag (-)
Trough	2003Q2	2002Q3	3	2003Q1	1				
Peak	2004Q2	2002Q4	6	2003Q4	2	2003Q4	2		
Trough	2006Q2	2003Q2	12	2005Q4	2	2006Q1	1	2005Q4	2
Peak	2007Q3	2005Q3	8	2007Q4	-1	2007Q4	-1	2007Q2	1
Trough	2009Q3	2008Q1	6	2008Q4	3	2009Q1	2	2008Q2	5
Peak	2010Q2	2008Q3	7	2010Q2	0	2010Q2	0	2010Q2	0
Trough	2011Q3	2009Q2	9	2011Q1	2	2011Q1	2	2011Q3	0
Median									
Trough			7.5		2		2		2
Peak			7		0		0		0.5

Table 7. Summary of Possible Turning Points of Standardized Cycles of GDP and Composite LEI at Different Weighting Schemes
1st Quarter 2002 - 4th Quarter 2015

Proposed LEIs

Possible Turning Point (PTP)	GDP	Composite LEI							
		Simple Average		Cross-Correlation Coefficient				Standardized Partial Correlation Coefficient	
				1st Lead Period		1st to 4th Lead Periods			
		PTP	Lead (+) or Lag (-)	PTP	Lead (+) or Lag (-)	PTP	Lead (+) or Lag (-)	PTP	Lead (+) or Lag (-)
Trough	2003Q2	2002Q4	2						
Peak	2004Q2	2005Q1	-3						
Trough	2006Q2	2005Q4	2	2004Q2	8	2004Q2	8		
Peak	2007Q3	2007Q3	0	2007Q4	-1	2007Q4	-1	2008Q4	-5
Trough	2009Q3			2009Q1	2	2009Q1	2	2009Q1	2
Peak	2010Q2			2010Q3	-1	2010Q3	-1	2010Q2	0
Trough	2011Q3	2009Q1	10	2011Q4	-1	2011Q4	-1	2011Q4	-1
Median									
Trough			2		2		2		0.5
Peak			-1.5		-1		-1		-2.5

6. Summary, Conclusion and Recommendations

The focus of this paper is the enhancement of the current LEIS which covers the selection of reference and indicator series as well as the methodology of aggregating the indicator series into a composite index. The suggested methodology for the enhanced LEIS follows that of the current LEIS, which is non-model based, but with some revisions to address the weaknesses of the current LEIS.

For seasonal adjustment and detrending methods, TRAMO-SEATS of DEMETRA and Hodrick-Prescott (HP) of Eviews, respectively, were found better than the current methods. The best weights were the standardized partial correlations which were obtained by regressing the reference series and the indicators series. There are six proposed leading indicators, two of which are in the current LEIs and the reference series is the GDP. These proposed indicators showed good prediction performance on the movement of GDP especially in recent periods. Aside from being fewer in number, these six proposed indicators have the advantage of being timely and free from imputations compared to the 11 current indicators.

7. Recommendation

It is recommended that the generation of composite LEI be automated to speed up computation and minimize errors.

There are other indicators that are potential as leading indicators as shown in the computed correlation coefficients and results of Granger Causality Test. However, timeliness issue was a hindering factor for the inclusion of these indicators in the set of new LEIs. For future enhancement exercise for the LEIS, it is best if the PSA and the sources of potential indicators can have collaborative efforts in improving timeliness and data quality so that these indicators can be included in future works in exploring the best leading indicators for GDP.

There should be a parallel run for one year of the current and proposed methodology and comparison of results be made and documented to serve as reference for the next improvement of LEIS.

The possibility of using model-based technique should also be investigated and compared with non-model based.

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