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A Composite Leading Economic Indicator for the Philippines

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A Composite Leading Economic Indicator for the Philippines[1]

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Lisa Grace S. Bersales, Ph.D.[2], Regina S. Reyes [3], and John Frederick P. de Guia [4]

ABSTRACT

In 2002, the National Statistical Coordination Board of the Philippines called for the enhancement of its Leading Economic Indicator System. As a result, a procedure using TRAMO-SEATS for seasonal adjustment, Hodrick-Prescott for detrending, forecasting unavailable data using either ARIMA models or Exponential Smoothing, and constructing the composite indicator using unweighted mean of indicator series cycles. Additional data transformation and turning point analysis which were not done before are suggested.

The reference series is the Non-agriculture Gross Value Added while the indicator series used are: Consumer Price Index, Electric Energy Consumption, Exchange Rate, Hotel Occupancy Rate, Money Supply, Number of New Business Incorporations, Stock Price Index, Terms of Trade Index, Total Imports, Tourist/Visitor Arrivals, and Wholesale Price Index.Empirical analysis was done using quarterly data from the first quarter of 1981 to the first quarter of 2003.

Keywords: seasonal adjustment, detrending, growth cycle, business cycle, Hodrick-Prescott filter, TRAMO-SEATS, X11-ARIMA, ARIMA models, exponential smoothing procedures, reference series, indicator series, composite indicator, turning point

I. Introduction

In 1993, de la Cruz and Deveza(1993) developed a composite leading index of economic performance for the Philippines which was refined by the National Statistical Coordination Board(NSCB) and the National Economic Development Authority(NEDA). The result of the refinement is the Leading Economic Indicator System (LEIS) which has been implemented by NSCB since 1998. The main output of the LEIS is the quarterly Leading Economic Indicator (LEI), a composite index derived by getting the linear combination of eleven economic time series whose behavior generally precede expansion or contraction of overall economic activity. The LEI is then used by NEDA to forecast Philippine Gross Domestic Product (GDP) and its growth rate.

Considering the importance of the LEI in the assessment, surveillance and forecasting of the performance of the economy, the National Statistical Coordination Board, in 2002, evaluated its LEIS. This paper shall present a

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[1] A paper for presentation at the 9th National Convention of Statistics, Manila. This paper is a result of an NSCB project managed by the SRTC.

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documentation of the Philippine LEIS, the current LEIS, the suggested LEIS, and some empirical analysis comparing the current and the suggested procedures.

II. The Current Leading Economic Indicator System of the Philippines

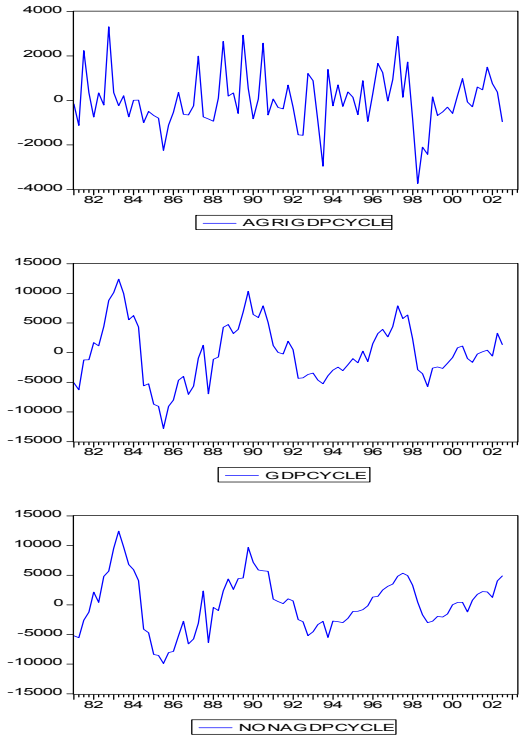
The leading economic indicator system of the Philippines estimates growth cycles and not classical business cycles. This is the current practice of in almost all countries. Zhang and Zhuang (2002) list the reasons that Niemira and Klein(1994) enumerated for this practice. These are:

(1) growth cycles lead their comparable business cycle peaks;
(2) growth cycles are more systematic in length and amplitude than business cycles;
(3) growth cycles are closely tied to inflation cycles; and,
(4) the U.S.A. Commercial Department's composite index of leading indicator has a better track record in forecasting than business cycles.

The construction of the LEI officially started in 1997 although NSCB started its development in 1993.

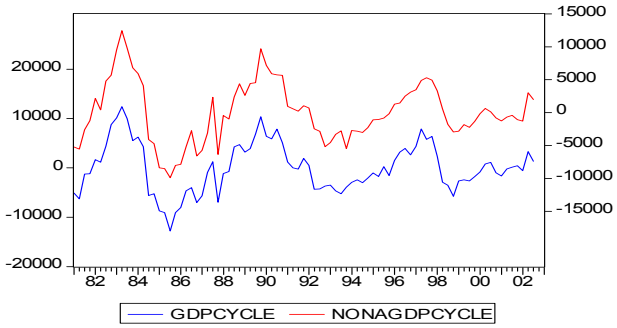
II.1 The Reference Series

The reference series used in the current Leading Indicator System is the Non-agriculture GVA. It is noted below that the cycles of GDP and Non-agriculture GVA are the same while the cycle of Agriculture GVA is different from them:



A closer look at GDP cycle and Non-agriculture GVA cycle below clearly shows the same cycle. The advantage of using Non agriculture GVA cycle is that it does not have the irregularities that the Agriculture GVA contributes to the GDP

cycle. This indicates that cyclical analysis of GDP maybe focused on Non-agriculture GVA.



II.2 Criteria in the Choice of Indicator Series

There are two main criteria in the choice of indicator series - economic and statistical.The usual economic criteria (de Leeuw(1991) and Yap(2001) as quoted by Zhang and Zhuang(2002) are based on the economic rationales:

(1) Production time. Indicators that record production intentions, such as new production orders or imports of raw materials, could give advance warnings of changes in the direction or tempo of economic activity.
(2) Market expectations. Indicators that reflect the anticipations of future economic activity may signal changes in economy. Some of these are business expectations or confidence, stock prices, futures prices.
(3) Policy Impacts. Indicators that measure the extent of effectiveness of fiscal and monetary policies that were instituted to improve economy may also be used to lead economic performance.
(4) External shocks. Indicators of external factors that affect domestic performance may also be used to signal changes. Examples are changes in global demand, terms of trade, or global interest rates.
(5) Buffer stocks. Variables that indicate the manufacturers' reaction to unanticipated changes in demand may also be used as leading indicators. These are levels of stocks, factor utilization, overtime. These indicate the reaction of producers before they hire new workers, buy new machines, purchase new raw materials.

The statistical criteria are:

(1) high correlation with reference series
(2) timely release of new values
(3) high data quality
(4) having 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
(8) ability to lead turning points of the reference series

II.3 The Current Indicator Series

The eleven time series used in the current LEIS are:

a. Consumer Price Index (CPI)

b. Electric Energy Consumption (ELECON)
c. Exchange Rate (EXCRATE)
d. Hotel Occupancy Rate (HOTOCC)
e. Money Supply (MONSUP)
f. Number of New Business Incorporations (NEWBUS)
g. Stock Price Index (STKPRC)
h. Terms of Trade Index (TTRADE)
i. Total Imports (IMPORTS)
j. Tourist/Visitor Arrivals (TOURAR)
k. Wholesale Price Index (WPI)

II.4 The Composite Indicator

The following methodology is used in the computation of the composite leading economic indicator:

1. Seasonal adjustment of each indicator series using X11ARIMA to obtain the trend cycle of each of the eleven leading indicators and the non-agriculture component of the GDP.

2. Removal of the trend component from the seasonally-adjusted series to obtain the cycle component by using estimated trend from a polynomial function of time.

3. Correlation of the cycle of each indicator with the cycle of 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 for the composite indicator.

4. Computation of the composite indicator as the linear combination of lagged indicator series with the simple correlation coefficients of the indicators with the non-agriculture GDP as weights. Lagging is determined by how the indicator series leads the reference series.

II.5 Issues and Concerns on the Current LEIS and How these were Addressed by the Study

The following issues and concerns were identified in the evaluation of the current LEIS.

A. Choice of Indicator Series/Data Concerns

1. Cut-off for acceptable correlation when choosing the indicator series. A concern is that some of the current indicator series have low correlations with the reference series. It is ideal that the correlation of each indicator series with the reference series be significant and be high. Alternative indicators were considered to look for those that provide higher correlation with the reference series. However, the current eleven indicator series eventually still satisfied the criteria for indicator series.

2. Housing starts, foreign investments and car sales were specifically identified as indicator series for inclusion in the LEIS. However, data on housing starts are not available. Data on foreign investments data and car sales, on the other hand, are short series. Series of new car registrations were considered as substitute for car sales data. However, it shows high volatility.

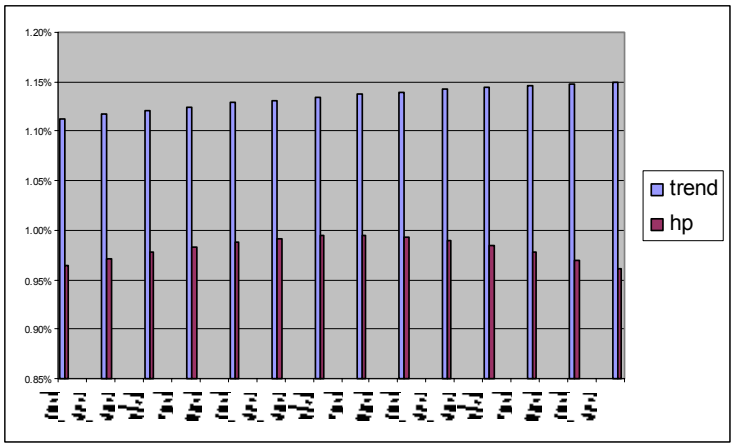
3. Availability and timeliness of the data are important criteria to take into consideration in the choice of the indicator time series. Some indicator series do not satisfy these. Thus, forecasting is included in the construction of the LEI to impute the data points which are not immediately available during the scheduled computation of the quarterly LEI. These indicator series were mentioned earlier as Electric Energy Consumption, Money Supply, Terms of Trade Index, Total Imports, New Business Incorporations. This problem is addressed by forecasting these values using the ARIMA models built in the X11ARIMA procedure. Other imputations done used growth rates to address undercoverage(done for ELECON). The problem with this is that these models may not always produce the *best* forecasts. A suggested alternative is forecasting using the exponential smoothing procedure. The length of forecast data depends on the number of quarter lags for a particular data. Data for new business incorporations, for instance, has an average lag period of 6 quarters, which is attributed to the inadequacy of the current information system to generate data at a more timely basis. Thus, the most recent data adopted for new business incorporations included in the dataset used for the study was the Q1-2002 figure; values from Q2-2002 to Q1-2003 were forecast using the ARIMA model available in X11-ARIMA. Meanwhile, electric energy consumption is either undercovered or underreported due to non-coverage of/non-reporting by some independent power producers (IPPs) in the previous years preceding an internal reorganization at the data source.

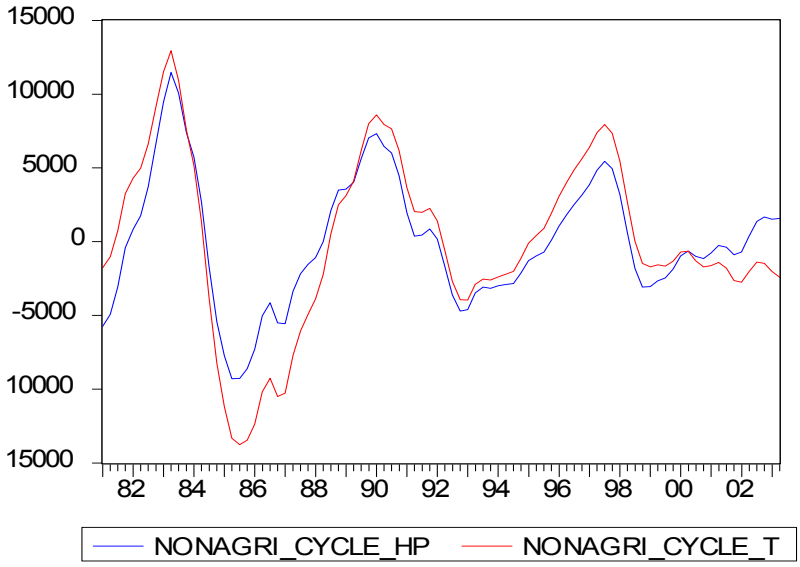
B. Concerns in Methodology in Construction of the Leading Economic Indicator

4. Evaluate the frequency of the evaluation of the seasonal adjustment of each series. Seasonal adjustment is currently done every time the LEI is constructed. This is called concurrent seasonal adjustment. An alternative is to use seasonal factors which will be determined at the start of the year. The current procedure, although, more time consuming, is better since it uses the seasonal factors estimated with the most updated data. Thus, the suggested methodology retains concurrent seasonal adjustment.

5. The method for detrending in the current LEIS is the polynomial trend model. There is indication that this method does not provide the anticipated estimate of the trend. An alternative detrending procedure is the Hodrick Prescott (HP)Filter. The graph below shows that the estimated trend from a polynomial trend model, referred to as “trend”, shows increasing trend in the recent quarters. This is opposite to that of the estimated trend from the HP filter, referred to as “hp”. The analysis of

economists of the trend of GDP in recent quarters is consistent with the one being shown by hp.



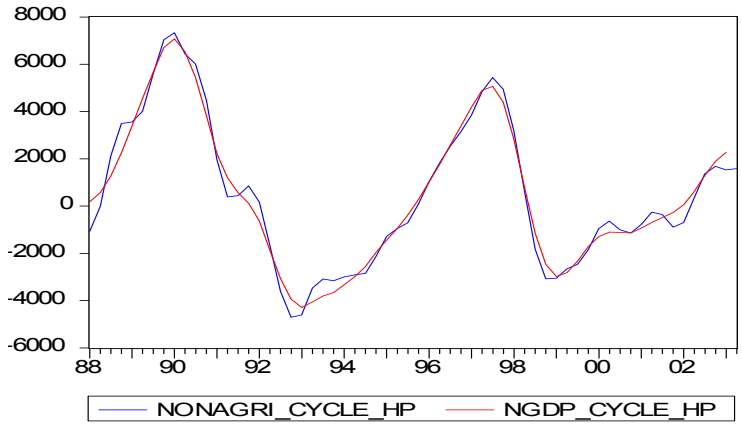


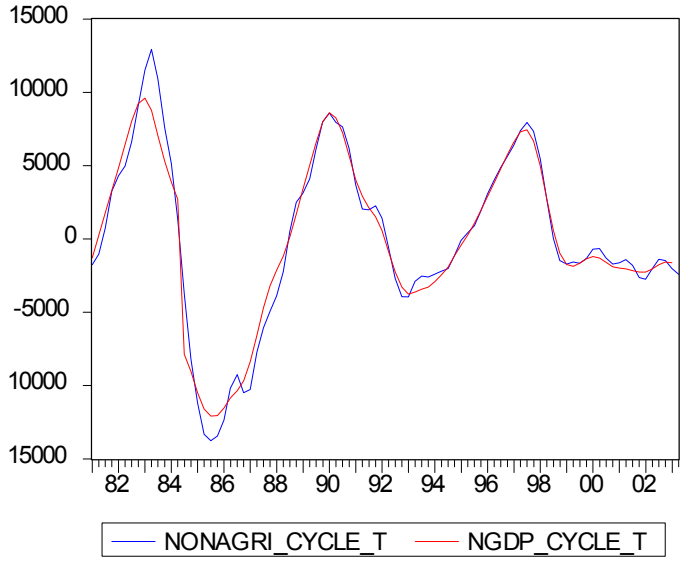
6. There is no standardization or normalization of the cycles of the reference series as well as the indicator series. It should be noted, however, that the detrending procedure using the polynomial trend model produces standardized residuals after detrending. These are what the current LEIS uses as the estimated values of the cycle.

7. The correlation vector of the lagged values of the indicator series with Non-agriculture GVA is used when determining the lead of the indicator series over the reference series. This is not incorrect. However, a suggested alternative is the use of the cross-correlogram.

8. The weights used in the computation of the composite indicator are the simple correlations of the indicator series in its lead period with the current Non-agriculture GVA. A suggested alternative is the use of standardized partial correlations which are simply the respective regression coefficients of the indicator series when fitting a regression of the reference series with the indicator series.

9. The current LEIS uses X11ARIMA of Statistics Canada for seasonal adjustment and forecasting of unavailable data and EXCEL for detrending, computation of correlations and computation of the composite indicator. It is suggested that TRAMO-SEATS of DEMETRA be eventually used for seasonal adjustment and estimation of the Trend-Cycle component of the series. This shall be in anticipation of the shift of official seasonal adjustment of Philippine time series to the said procedure and software. It should be noted that the Trend-Cycle components from X11ARIMA and TRAMO-SEATS exhibit similar behavior. This is consistent with the SRTC project comparing the two procedures. The graph below shows the cycle components(NON AGRI GDP comes from X11ARIMA while NGDP comes from TRAMO-SEATS) both from detrending using Trend model and detrending using HP filter.





C. Analysis

10. Interpretability of the composite indicator should be aimed at. It should be interpreted as an index number (no negative values and 100% is a reference point). This suggestion was not addressed in the study since the usual analysis done using LEI is the analysis of turning points. Such analysis does not look at the values of the LEI for interpretation.

11. The current analysis does not include turning point analysis. It is suggested that such analysis of turning points using summary statistics as Median and Standard Deviation be added to the LEIS analysis**.**

12. The current LEI is used as a predictor variable for GDP using a simple regression equation. It is suggested that it be used to predict turning points, instead. Zhang and Zhuang(2002) suggest the use of the Sequential Probability Model and evaluated using the Quadratic Probability Score.

III.An Alternative Leading Economic Indicator System

After evaluation of the current LEIS and construction of time series of potential indicator series for the LEIS, some modifications in the current LEIS were developed.

III.1The Reference Series

The reference series remains the Non-agriculture GVA of GDP.

III.3 The Indicator Series

Analysis using alternative indicator series for which data were collected is expected to be completed by end of October 2003. A major problem encountered with the alternative data series are unavailability of data for the period of analysis, First quarter 1981 to First quarter 2003. Furthermore, for available time series, the problems encountered are structural changes of the time series within the period of study, presence of outliers, delayed release of *current value*, timeliness, low correlation with the reference series.

Thus, the indicator series remain the eleven indicator series of the current LEIS:

The main problem of timeliness is solved by extrapolating the series using appropriate exponential smoothing procedures.

III.4 Suggested Methodology for the LEIS

The following suggested procedure contains the same basic steps as the current LEIS but with modifications which address the issues and concerns mentioned in the earlier section:

1. Seasonally adjust each series using TRAMO-SEATS to obtain the TREND-CYCLE of each of the leading indicators and the non-agriculture GVA.
   For each series mentioned in step 1, remove the trend component from the TREND-CYCLE using the Hodrick Prescott filter. This will produce the CYCLE. (implemented starting Q1, 2004)
2. Standardize the CYCLES by using:

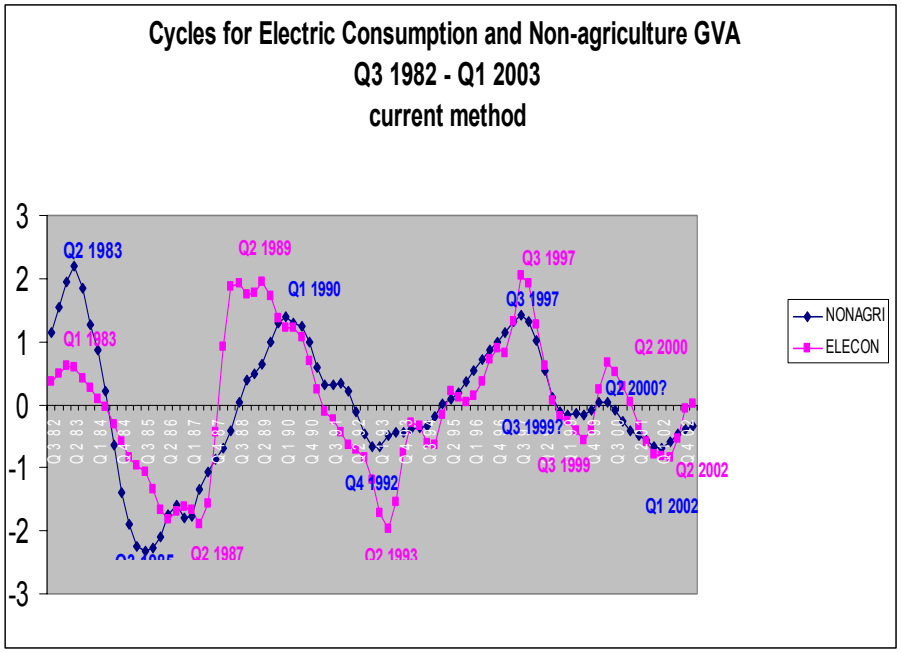
Standardized CYCLE=(CYCLE-mean(CYCLE))/(standard deviation(CYCLE))
   (implemented starting Q1, 2004)
3. Construct the cross-correlogram of the CYCLE of each indicator with the cycle of the non-agriculture GVA to obtain the lead period. The lead period determines the number of past quarters the indicator CYCLE series is considered in the construction of the composite indicator.
4. Forecast missing values in the indicator series using appropriate forecasting methods, e.g., ARIMA models and Exponential Smoothing procedures. (NEWBIS and ELECON are the series which require many forecasts, TTRADE also required forecasts)
5. The index is computed as the mean of the CYCLES of the indicators. The index may be normalized to produce its final form.
   (implemented starting Q1, 2004)

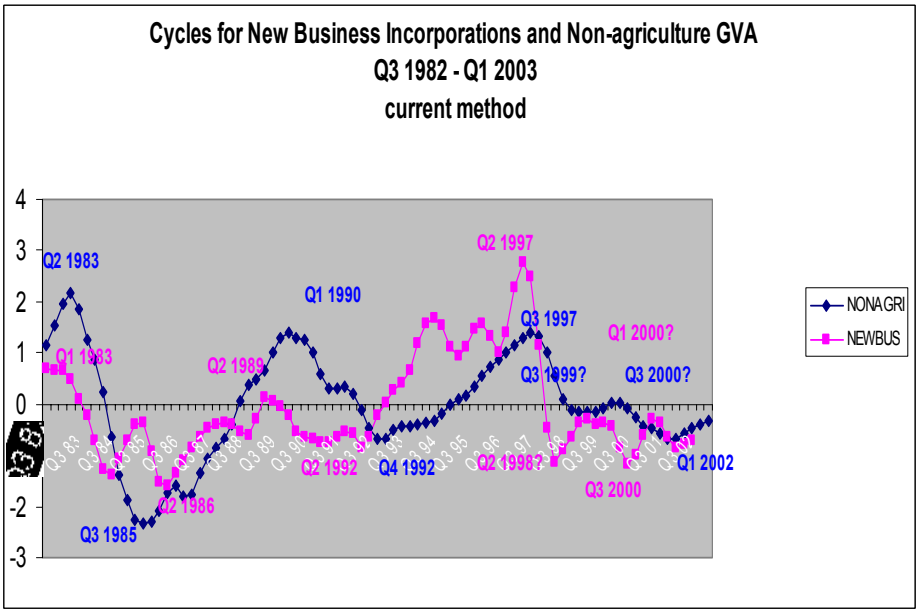
Turning points shall be identified for all the cycles produced. An additional analysis that shall be done is the construction of a forecast equation for GDP using the LEI. This analysis is a major contribution when implemented since it illustrates the use of the leading economic indicator.

IV. Empirical Analysis

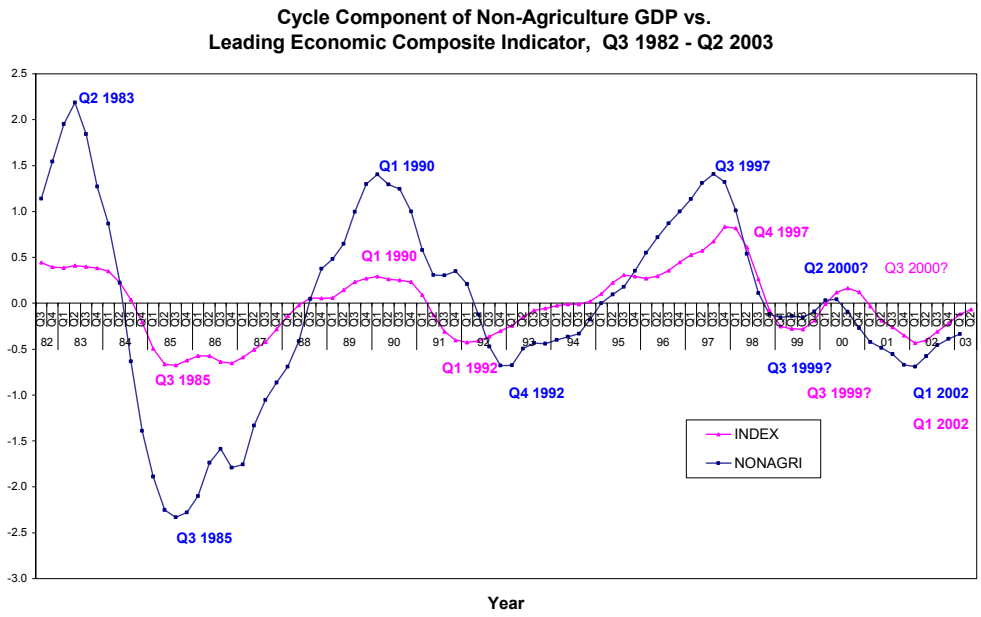
Empirical analysis was done on data from 1982 to second quarter 2003. The following graphs show the cycles of the indicator series versus the cycle of

non-agriculture GVA. Turning points are indicated: The following graphs illustrate the identification of the turning points.

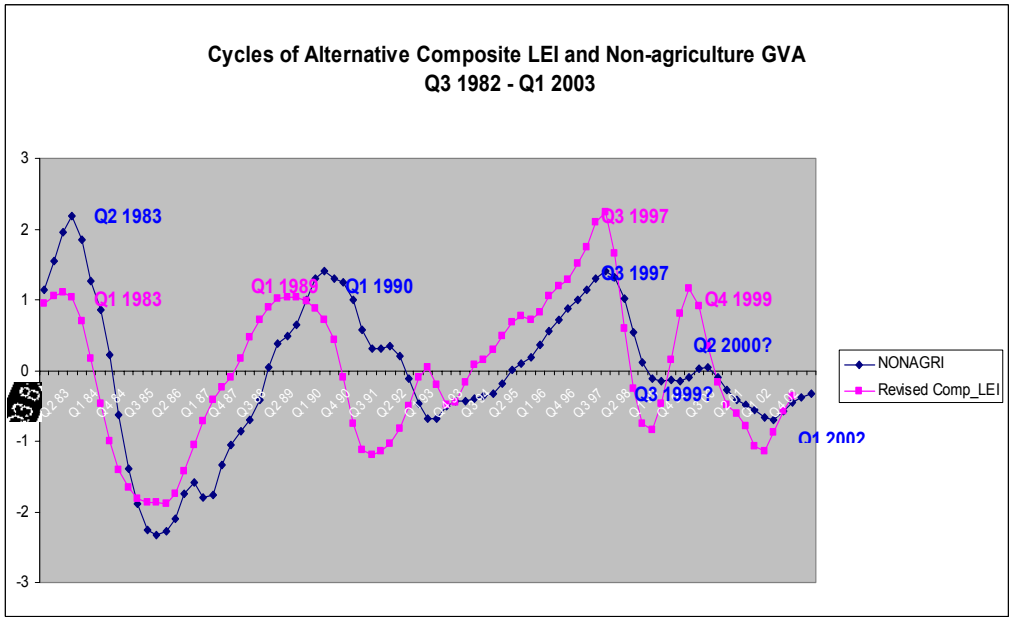




The following shows the cycles for the current composite LEI:

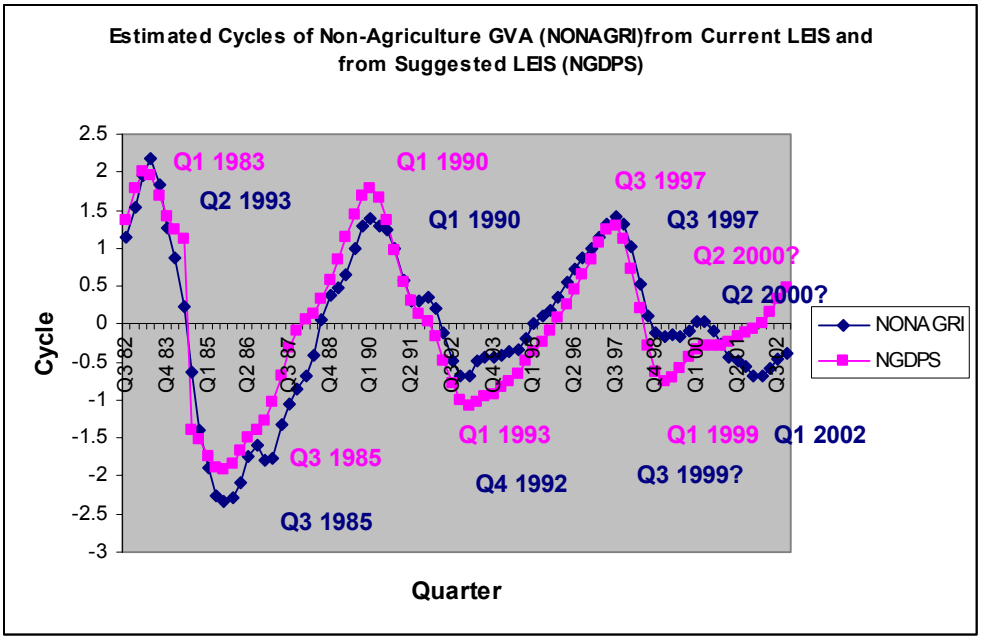


The current composite LEI is a linear combination of lagged cycles of the indicator series. Because of the lagging, it is noted that the composite indicator does not lead the non-agriculture GVA. An alternative composite LEI, mean of cycles without lagging, is constructed and produced the following:



It is noted that this new composite LEI leads the reference series.

The estimated cycles of Non-Agriculture GVA using the current methodology and using the suggested methodology produced the following:

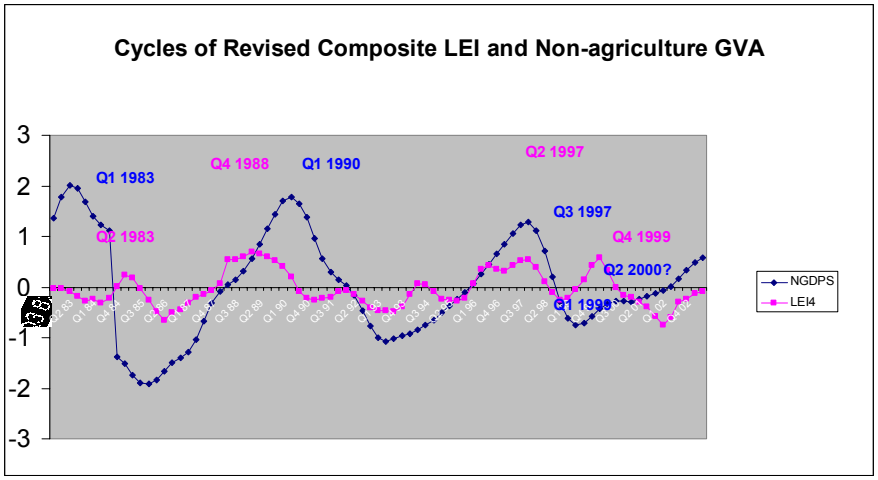


It is noted that the cycles have very similar behavior except in recent years wherein the increase in cycle is steeper for the suggested period than for the current one. The source of this difference is the difference in the trend estimates produce by the two methods. The current method produced higher growth rates in the trend estimates while HP does not. Consequently, after detrending the cycles exhibited the noted behavior.

The following table shows a summary of the peaks and troughs:

Turning Point	From NGDPS (suggested method)	From NONAGRI (current method)
Peak	Q1 1983	Q2 1983
Trough	Q3 1985	Q3 1985
Peak	Q1 1990	Q1 1990
Trough	Q1 1993	Q4 1992
Peak	Q3 1997	Q3 1997
Trough	Q1 1999	Q3 1999?
Peak	Q2 2000?	Q2 2000?
Trough		Q1 2002

The following are the cycles of the composite LEI and the Non-Agriculture GVA using the suggested procedure:



The following table shows the performance of the Composite LEI:

Turning Point	From LEI (suggested method)	From NGDPS (suggested method)	Lead
Peak	Q2 1983	Q1 1983	-1
Trough	Q1 1985	Q3 1985	2
Peak	Q4 1988	Q1 1990	5
Trough	Q1 1991	Q1 1993	2
Peak	Q2 1997	Q3 1997	1
Trough	Q3 1998	Q1 1999	2
Peak	Q4 1999	Q2 2000?	2
Trough	Q4 2001	-	
Median Lag			2

If we use the performance above to predict a dip, we would say that a dip is expected on Q2 2002.

V. Findings and Recommendations

The study worked within the theoretical framework of the current LEIS(i.e., the cycle constructed is a growth cycle, the reference series is the non-agriculture GVA, the economic and statistical criteria used in choosing the indicator series were maintained) and enhancement targeted issues on indicator series for inclusion, data generation, and methodology.

The goal of adding to or replacing some of the current indicator series was not achieved. The main obstacles to achieving the goal were data availability and quality of available data. The study produced a monthly database of potential indicator series. The series, however, are still short – 10 years of data or less. Timeliness also is a problem since many series are not released in time for the LEI computation. A more difficult problem, however, is the quality of data. The data produced were highly volatile especially in the more recent periods. This may just be a reflection of the volatility of the economic environment in the Philippines. However, this may be a symptom of how the data are collected and

generated. It is recommended that the staff maintain and update the monthly database of potential indicators and regularly evaluate the potential series for inclusion in the LEI construction. This evaluation may be done every two years. Furthermore, NSCB should meet with the data producers to discuss how the series are generated and make suggestions on how to improve data quality and timeliness. In the meantime, the suggested LEIS incorporates a forecasting step which addresses the issue of timeliness of some of the indicator series.

The suggested methodology introduces the following changes – detrending from trend models to the use of the Hodrick-Prescott filter, seasonal adjustment from X11ARIMA to TRAMO-SEATS, additional data transformations such as smoothing and standardization of the time series, forecasting of untimely data from the built-in ARIMA models of X11-ARIMA to exponential smoothing procedures, change in the construction of the composite leading economic indicator from a weighted sum of lagged cycles of the indicator series to a simple averages of the cycles of the indicator series, and production of turning points analysis as part of the LEIS quarterly report.

It is suggested that probability models such the Sequential Probability Model be considered as a forecasting method to forecast peaks and troughs. In the study, the use of Median Lags was done to do such forecasting.

It is recommended that the computations be done in EVIEWS and not in EXCEL.

It is also recommended that, if the suggested LEIS is to be adopted, a transition phase be done first wherein both the current and suggested LEIS are done and a comparison is documented. The suggestion for the transition phase is 1 year – 2004.

Since a monthly leading economic is feasible, it is suggested that NSCB construct one using the suggested methodology for the quarterly LEIS.

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