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# **A Review on the Leading Indicator Approach towards Economic Forecasting**

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## **Introduction**

Demonstrating the significant role of each industry for economic prosperity is always associated with existing or previous comprehensive research. Research providing the position and historical performance of the industry enables policymakers and related authorities to gain a clearer insight for strategic planning and decision-making. Illustrating the strengths and weaknesses of an industry using statistics regarding current and future development will pave the way to reforming economic-industrial development. To improve resources allocation and opportunities, it is crucial to perform forecasting analysis and minimize the growth obstacles for each industry.

Economic cycle is defined as the fluctuation of an economy via expansion and contraction periods, influenced by various kinds of macroeconomic indicators. The repeatable movement of economic indicators enables the accurate detection of these cycles with a forecasting approach that aims to improve economic development, especially by specific industries. Thus, economists and researchers have focused on the usefulness of the composite leading indicator in economic forecasting. It is regarded as a good illustration of an economic cycle or trend. This is due to its ease of use during the interpretation process, as several indicators can be aggregated and explained at once. This may provide useful insights for policy planning, risk monitoring and community development using the information gained from macroeconomic aggregates. Research on the composite leading indicator approach has attracted great interest as more information can be enclosed within the existing constrained list of indicators.

## **Literature review on indicator approach**

Following the seminal papers of Arthur Burns and Wesley Mitchell, published in 1938 and 1946 respectively, interest has remained high among both policymakers and academicians regarding the role of leading indicators. The measurement of business cycles has been one of the core research economics topics throughout the past century. Burns and Mitchell (1946) was the foundation of economic indicator analysis at the National Bureau of Economic Research (NBER). However, the concept of growth cycle has emerged and gained popularity following the classical cycle approach in academia. The breadth of literature dealing with ways to develop more sophisticated methods related to the leading indicator approach has been widely discussed (Klein & Moore, 1983; Zarnowitz, 1992; Altissimo et al., 2000; Scheiblecker, 2007; Heij et al., 2011; Abu Mansor et al., 2015; Puah et al., 2016; Soh et al., 2020) for different industries.

During the past two decades, Altissimo et al. (2000) conducted a research on Italian cycle over the period from 1974 to 1998 using the NBER composite leading indicator (CLI) approach, together with the application of band pass filter and bry-boschan dating algorithm. Financial

indicators including inventory of finished goods and bank loan interest rate were discovered as the new leading indicators for the Italian cycle for at least one year. Their findings also revealed that the Italian cycle was preceded by the United States (US) and the United Kingdom (UK) cycles by three quarters. This finding was supported by Artis et al. (2004) as the UK cycle is associated with that of Italy and the US. The recovery period was 21 months whereas the recession period last for 22 months and the cycle duration was recorded at 42 months. The researchers found high predictive power using the leading indicators.

Ong et al. (2004) examined the inter-country linkages on business cycles in the US and the ASEAN-5 countries of Indonesia, Malaysia, the Philippines, Singapore and Thailand for the sampling period 1966 to 1999. Researchers have suggested the existence of strong interdependence among ASEAN economies, and this was further confirmed by the evidence of bi-directional causality among them. Specifically, bi-directional causality has been found among trade and neighbouring countries, particularly Malaysia and Singapore. The study also found strong evidence of a common business cycle among ASEAN countries; all five countries were found to have a significant impact on the output of the US at 5 percent significance level.

Regarding the indicator studies on business growth cycle, the most commonly-used reference series included gross domestic product (GDP) and industrial production index (IPI) that exhibits procyclical behaviour (Rua Nunes, 2005; Seip & McNown, 2007; Heij et al., 2011; Puah et al., 2016). In contrast, Rua Nunes (2005) revealed that unemployment was a lagging and countercyclical indicator in the Euro growth cycle from 1987Q1 to 2001Q1. The researcher also found that interest rate and stock price possess good leading properties and the composite indicator moves one quarter ahead, thus constituting an advance signal for the Euro growth cycle. This finding is inconsistent with Seip and McNown (2007), who found that interest rate indicates lagging behaviour which contradicts the expected outcome. Employing the NBER methodology, the researchers discovered six recessions over the period from 1960 to 1996 for the US growth cycle.

The Malaysian business cycle studies conducted by Ong et al. (2004) and Puah et al. (2014) evaluated the economy from a growth cycle perspective. Puah et al. (2014) found the composite leading index useful in predicting turning points in Malaysian business cycles. This finding was consistent with the study done by Altissimo et al. (2000), Scheiblecker (2007) and Heij et al. (2011). Reviewing the consistent outcomes, Voon et al. (2016) modeled the oscillations of the housing market in Sarawak to predict the boom-bust patterns in the housing cycle using the NBER approach. The constructed housing cycle indicator (HCI) correctly predicted the incidents and was compatible with the cyclical fluctuation in the housing market, with an average leading period of 9.75 months. The constructed HCI was suggested as a sound policy tool to predict the outlook for the housing market in Sarawak.

Apart from NBER methodology applied by Levanon et al. (2015) in constructing a leading credit index, The Conference Board (2000) leading economic index (LEI) construction approach also has been widely applied by economists and researchers. It is designed to signal peaks and troughs in the business cycle by using composite averages of several individual indicators. Heij et al. (2011) and Puah et al. (2016) utilised a similar approach for the global business cycle and Cambodia's business cycle, respectively. Puah et al. (2016) employed monthly data from 2002 through 2012 to forecast the Cambodian cycle. The filtering process

was completed using Hodrick and Prescott's (1997) filter and turning points dated with Bry and Boschan's (1971) technique. They found that the leading ability of the constructed indicator was around 7 months on average, and important incidents that occurred during the years 2004, 2006, 2008, 2009 and 2011 were predicted accurately.

Given the abovementioned studies on the convincing predictive accuracy rate in using The Conference Board (2000) indicator approach, the literature is further extended by the recent study by Puah et al. (2016), Chong et al. (2018) and Soh et al. (2019) on different industries such as property or real estate, energy and tourism. Instead of focusing one of the states in Malaysia in which the study was conducted by Voon et al. (2016), Puah et al. (2016) employed the indicator methodology in constructing a property cycle indicator (PCI) for the Malaysian property market from 1991 to 2013. Using housing price index as the reference series, the constructed PCI with component series including foreign direct investment, tourist arrival, consumer sentiment index, GDP, domestic share price and US share price possess 3.7 months of average lead time regarding the Malaysian housing cycle. The constructed PCI has also detected 10 turning points for meaningful crises, comprising 5 peaks and 5 troughs.

Moreover, the study by Chong et al. (2018) focused on forecasting the movement of West Texas Intermediate (WTI) in Malaysia from January 2001 to June 2016 using a composite leading indicator approach. The researchers employed the NBER indicator construction approach and proved that the constructed indicator moved ahead of WTI on average 3.6 months, and obtained a high accuracy rate of 75 percent in predicting the global oil price. Furthermore, a similar approach used in the study of Chong et al. (2018) has been extended by Soh et al. (2019) to forecast the Maldivian tourism cycle that spanned approximately two decades from 2000 to 2017. The constructed tourism cycle indicator successfully dated 10 turning points with references chronologically tested, and the average lead time was 4.4 months.

At least three prominent approaches have been discovered in measuring the economic cycle and dating its turning point. Starting from the non-parametric NBER approach, followed Stock and Watson's (1989) methodology on the factor-based model; and recently, Hamilton's (1989) approach using the Markov-based regime shifting model, in which each methodology upholds its unique potency and the appropriateness of usage prompted further empirical discussion. As mentioned earlier, the breadth of literature includes the ongoing development of the leading indicator approach using more sophisticated methods have continuously done by numerous researchers (Wong et al. 2016; Puah et al., 2017; Arip et al., 2019; Soh et al., 2019; Voon et al., 2020; Kuek et al. 2020). The review on literature shows the continued search for more reliable forecasting tools of economic cycles to support macroeconomic monetary activity and national risk management.

Wong et al. (2016) was motivated to construct a model-based business cycle indicator for the Malaysian economy instead of relying on the classical approach formulated by Burns and Mitchell (1946). The study period spanned from 1995 through 2012 on domestic stock prices, US stock prices, money supply, exportation, newly registered companies and tourist arrivals. The wave of Malaysian economic activity was proxied by the movement in GDP. The component series used was rather similar and consistent with the study by Puah et al. (2016) using a classical indicator approach. However, Wong et al. (2016) modified the Stock and Watson's (1989) methodology into a novel parametric factor-based model that concisely

summarized the information content into a meaningful business cycle outlook. Researchers revealed that the constructed leading indicator served as a good gauge for Malaysian economic crises by producing satisfactory identification of business cycle turning points. Specifically, the factor-based model has statistically outperformed the national-owned CLI in terms of predictive accuracy to identify the business climate and to forecast impending economic crises in a timely manner.

Furthermore, Puah et al. (2017) assessed Thailand's financial vulnerability by constructing a financial vulnerability indicator (FVI) using the signals approach and composite indicator construction approach. The study period spanned from January 2000 through December 2016 and the noise-to-signal ratio for each of the indicator was identified. Findings successfully outlined the four major financial episodes across the study period and demonstrated the effectiveness of an early warning system by employing the indicator approach. This was in contrast to Puah et al. (2017), Arip et al. (2019) who identified a non-parametric indicator approach in forecasting the Malaysian financial market using the dynamic approximate factor model. Meanwhile, the factor-model based approach is consistent with the study by Wong et al. (2016) on the Malaysian business cycle. Also, Kuek et al. (2020) emphasized the feedback and amplification effects on economic activity in a high-vulnerability regime, while the impact was negligible in a low-vulnerability regime. This study highlighted the usefulness of composite indicators as an early warning mechanism to gauge the Malaysian financial system.

Interest increased once again in the Hamilton's (1989) approach using the Markov-based regime shifting model; numerous studies previously have been focussing into this direction. Recent studies by Soh et al. (2019), Kuek et al. (2020) as well as Voon et al. (2020) have employed the Markov-switching methodology in forecasting economic activity. The fluctuations and dynamic changes of the inbound tourism market for Fiji were investigated by Soh et al. (2019) using a Markov regime-switching model from January 2000 to December 2017. Two distinct phases of the Fijian tourism cycle, the expansion and recession periods, were identified, supported by the transition probabilities that signalled Fijian tourism development. The growth cycle analysis with adequate dating evaluation offered essential information for policymakers and relevant authorities, as well as the community.

Consistently, Voon et al. (2020) employed the NBER indicator approach and time-varying Markov switching model for the Malaysian housing cycle using monthly data, confirming the forecasting ability with average leading period of 9.5 months that reflects the prior movements of the cycle. As seen in previous empirical studies, utilisation of composite leading indicator approach in economic forecasting remains inconclusive yet interesting. The indicator methodologies vary enormously in terms of appropriateness in fulfilling the research objectives. From the non-parametric to the parametric approach, as well as the model-based indicator construction approach, the inconsistent predictive and forecasting performance results thus far encourage more researchers to explore this matter further.

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