KENYA SCHOOL
OF MONETARY
STUDIES (KSMS)

COMPOSITE INDICATORS FOR FORECASTING ECONOMIC ACTIVITY IN KENYA

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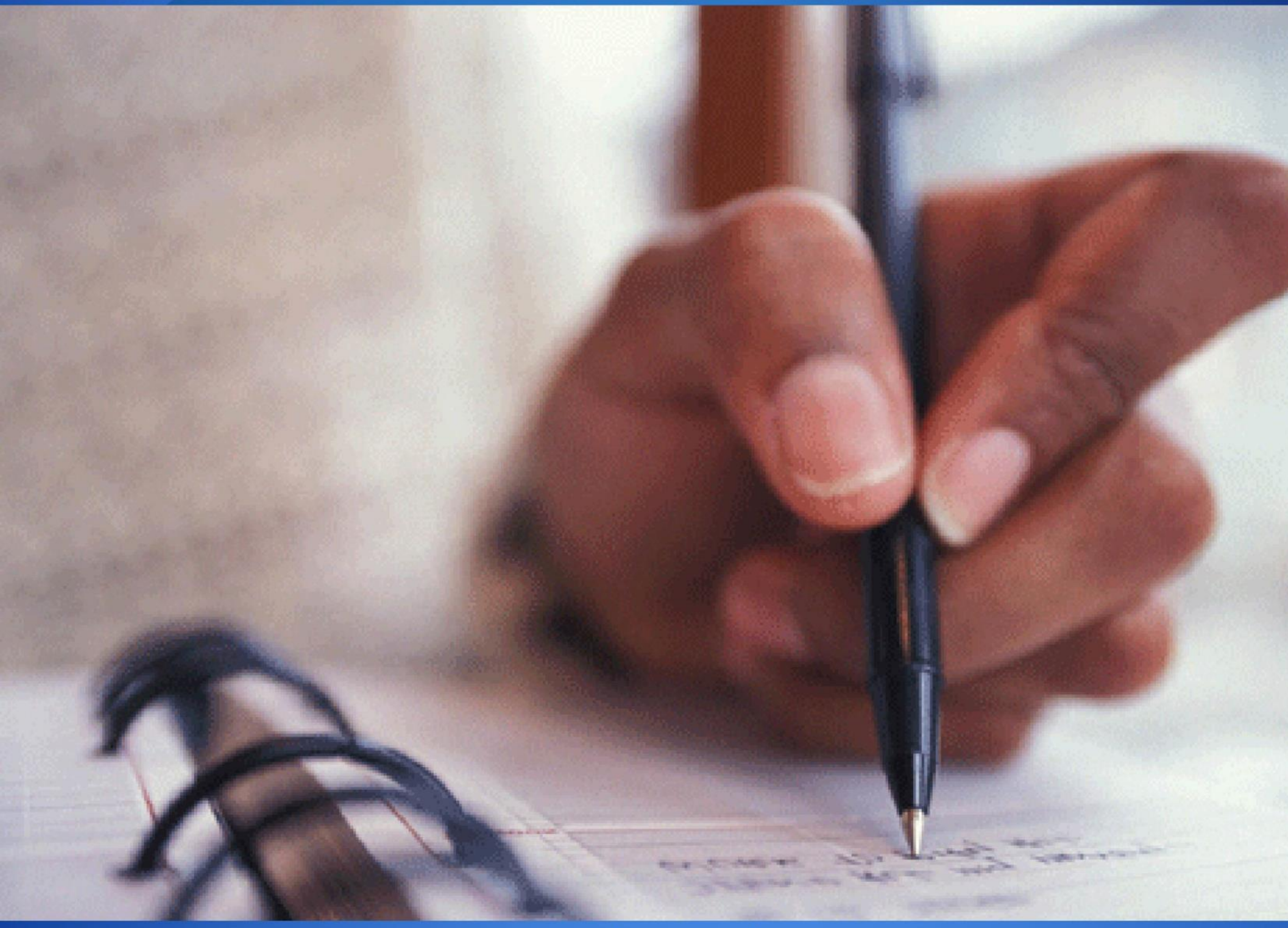
WORKING PAPER ***No. WP/ 2014 / 002***



Composite Indicators for forecasting Economic Activity in Kenya

Lydia Ndirangu*, Moses C. Kiptui*, Ciliaka Gitau† and Conrado Garcia‡

Abstract

Policymakers need up to date information on the state of the economy. The demand for real time, high frequency and accurate estimates becomes even more urgent as economic policy increasingly becomes target oriented. Unfortunately, for many countries, most variables, such as the national accounts, which are required for forward looking policy decision making, come with a lag. Furthermore, large and unpredictable revisions are often made to such estimates, which may reduce their effectiveness in policy analysis. In light of this policy need, many countries analyze and report an array of economic indicators that are supposed to give an indication of the state of the economy. The economic indicator approach is based on the idea that business cycles are driven by repetitive sequences, and that certain economic variables or combinations of variables underlie these sequences. This paper examines the contribution economic indicators can make to forecasting measures of real economic activity in Kenya. The paper uses the widely applied Conference Board Technique to derive composite indicators using real-external sector variables and financial indicators. It is shown that it is possible to tract quarterly GDP using monthly composite indicators quite well and that there is need to explore the forecasting performance of monthly composite indicators.

JEL Classification: E32, E37, C22.

Key Words: Composite Indicator of Economic Activity, Forecasting.

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1. Introduction

The Composite Indicator of Economic Activity (CIEA) is a single summary statistic that tracks the current state of the economy (Amoah et al, 2003). It helps provide useful information that informs researchers in identifying when the economy is in an expansionary phase of the business cycle. The composite indicator is a key element in an analytical system designed to anticipate the direction in which the economy is heading. Composite indicators tend to smooth out a good part of the volatility of the individual series and thereby serve as a handy summary measure of the business cycle. A composite index reflects a broader spectrum of the economy comprising real, monetary, fiscal and external sector data (Mongardini and Saadi-Sedik, 2003). Fluctuations of economic activity can be due to supply, demand and policy shocks.

The CIEA should include variables contained in GDP. The idea is to construct a group of high frequency indicators that closely track the overall GDP (Anguyo, 2011). The composite index of economic activity commences with the choice of a reference series in this case the GDP which is usually given in quarterly frequency. The monthly CIEA therefore has to be transformed into the quarterly frequency by taking the average of monthly observations within a quarter and hence comparing it directly with the quarterly GDP series. This is important for monetary policy implementation since in a number of countries, monetary policy is set with reference to expectations of output growth and thus requires the gap between actual and potential output even though the final target of monetary policy is the control of inflation (Camba-Mendez et al, 2001).

It is not reliable to use only one indicator for short term forecasting as some leading indicators may produce false signals (Atabek et al, 2005). Composite indicators are based on a basket of economic indicators that show a relationship with economic activity. Composite indicators enable governments and businesses to track economic performance and forecast this performance over the near term.

Extensive literature exists on the composite index of economic activity both in developed and developing countries and in some cases they've been quite informative on policy making process. Several methods exist in the literature that can be used to develop a composite index *inter alia;* the NBER business cycle dating approach (Bry and Boschan, 1971), the OECD methods of composite index and the Stock and Watson's business cycle indicators. Stock and Watson (1989, 1993) business cycle indicators apply the tools of modern time-series econometrics to develop a technique that is able to construct leading and coincident indices, and to detect turning points of economic activity, and to predict the probability of a recession. The Stock and Watson methodology was criticized for not having detected the U.S. recession in the 1990-91, and as such other authors have attempted to improve on it, while keeping the formal building block of the structural econometric model. For instance, Chauvet (1998) improves on it by incorporating regime switching along the lines of

Hamilton (1989), with the view to capture asymmetries between economic expansion and contractions. Other extensions to the Stock and Watson approach are proposed in Forni et al., (1999, 2000) and applied by Seerattan and Jhinkoo (2013), who construct a dynamic-factor model based on current and lagged coincident series (as opposed to just using current coincident series).

There exists a fair amount of empirical evidence in both developed and developing countries, which apply the above mentioned approaches to construct composite indicators of economic activity, and how the indices help to forecast economic growth.

In their work, Bandholz and Funke (2003) construct a composite leading economic indicator of economic activity in Germany using the dynamic factor model with and without regime switching. Their study covers the period 1971–2002. The results show that the two-state regime switching procedure they adopt leads to a successful representation of the sample data, and provides an appropriate tool for forecasting business conditions in the country.

A composite leading indicator (CLI) that would crucially provide earlier signals of turning points between economic expansions and slowdowns for the Turkish economic activity is constructed by Atabek et al., (2005). The selected variable components constituted a balanced subset of demand, supply, and policy variables. A growth cycle approach is used to construct different CLIs, and the best-performing indicator is selected based on cross-correlations, Granger causality, and peak/trough analysis. It is found that the constructed CLI leads the GDP (or the measure of economic activity) and has a similar cyclical pattern. Furthermore, whereas the demand-side indicators have longer lead times (hence, giving a more useful signal) supply-side indicators have the shortest lead time. This implies that economic growth responds more quickly to supply shocks than to demand shocks.

Albu (2008) builds a composite indicator for the Romanian economy using the OECD methodology with the view to obtain short-term forecasts for economic activity over the period 2000-2007. The results indicate that the preliminary composite index built for Romania, IEF-RO (Institute for Economic Forecasting – RO), fairly reflects the evolution of the economic activity and business cycle. In a separate study on the U.S. economy Clements and Galvao (2009) evaluate the predictive power of composite leading indicators to predict quarterly output growth. The indicators were found to have significant predictive ability.

Ryan and Shinnick (2011) analyze the causality relationships between key leading economic indicators and economic growth based on quarterly data from 1970:01 to 2010:03, covering the UK, France and the US. They examine a wide range of indicators are examined, ranging from financial variables (e.g., asset prices, stock prices and interest rates) to confidence indicators, to standard macroeconomic variables of economic activity. They find that, while many indicators do not help to explain current movements in GDP growth, the lags of these indicators *Granger-cause* changes in

GDP. Furthermore, the direction of the change and the size of the change in the lagged economic indicators, particularly for housing indicators, are significant in many cases.

Isslery et al., (2013) develop an aggregate coincident indicator for the Latin American economy (comprising: Argentina, Brazil, Chile, Colombia and Mexico) which weights individual country composite indices. They do so by back-casting several individual country series which were not available in a long time-series span. The composite regional index is found to track reasonably well the region's economic activity, although not all countries follow the behavior of the composite index. When compared with the coincident indicator (The Conference Board - TCB) of the U.S. economy, it is found that U.S. indicator *Granger-causes* the Latin American indicator. Other results showed that, for the countries considered, on average, recessions are more frequent than in the U.S., (with the exception of Chile).

Empirical evidence from Africa is limited. Anguyo (2011) develops a CIEA for Uganda using monthly data on eight variables, notably, exports, imports, credit, VAT, PAYE, excise duty, cement production and sales for selected products. The author finds that the constructed indicator correlates well with these variables, and more importantly, with quarterly GDP series, suggesting that the index could provide a good framework for forecasting economic activity on a more regular basis. Further results indicate a general upward trend in economic activity, and a similar trend expected going forward. The study recommends the adoption of the current CIEA in Uganda and proposes continuous improvement with more data. For the Rwandan economy, eight variables[1] are used in the construction of the CIEA (National Bank of Rwanda, 2012).

Amoah et al., (2003) construct a CIEA[2] for Ghana, for the purpose of guiding the Bank of Ghana's Monetary Policy Committee in its bi-monthly reports and interest rate setting. The results show that, while the constructed indicator correlates well with the variables used in the index, economic activity in Ghana stagnated between February and April 2003.

The aim of this paper is to develop a CIEA for Kenya, by using the approach adopted in Anguyo (2011) using Conference Board technique with features similar to the Moore-Shiskin methodology. A similar approach has been applied by Amoah et al, (2003) for Ghana. Indeed The Conference Board

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[1] These variables are, notably, cement, breweries and production of electricity as a proxy for the industry sector, credit to private sector as a proxy for the financial sector, total turnovers as a proxy for the wholesale and retail trade, imports and exports reflecting domestic and external demand respectively and VAT reflecting change in output.

[2] The CIEA is a composite of 10 indexes (which comprise: Electricity Consumption, Commodity Exports, Commodity Imports, Sales of key selected companies in Ghana, Employment Growth, Tourist Arrivals, Port Harbour Operations, Cement production, Domestic VAT and Deposit Money Banks credit to the private sector), which reflect the business and economic activity in Ghana.

approach has been applied widely. We derive a monthly composite indicator of economic activity using various indicator variables which will form the basis for forecasts of economic growth. Though it is straightforward to understand why output components would positively be related to GDP it is important to note that financial indicators could also provide useful signals since they may anticipate different aspects of future developments in the real economy.

The rest of the paper is organized as follows: section 2 presents the methodology, section 3 derives and analyzes the composite index of economic activity while section 4 concludes.

2. Methodology

The Conference Board (TCB) approach we use in this study is fairly empirical and works well in practice, yet it requires no estimation of a formal econometric model. The TCB approach for calculating composite indicators as adopted in this study involves the following statistical steps:

(i) Symmetric percentage change formula is used to compute month-on-month changes of each component. Let m_i be the variable component for which percentage change is computed. The symmetric percentage change is computed as follows:

$$\Delta m_{it} = 200 * (m_{it} - m_{it-1}) / (m_{it} + m_{it-1}) \quad (1)$$

(ii) In the second step, the month-on-month change is adjusted to ensure that more volatile variables do not dominate the composite indicator. Consequently, more volatile components contribute proportionately less to the final index. Hence, the standard deviation of the changes of each component is calculated. Denoting the standard deviation of each component as δ_i, the process involves taking an inverse of the standard deviation, summing up the inverse value for all components to be able to give weights to each component/ series of month–on–month changes, i.e.,

Inverse volatility, $IV = \frac{1}{\delta_i}$

Sum of IV across components: $T = \sum_i^n IV_i$

Weight computation: $w_i = IV_i / T$, hence weights sum to one since this can be restated as:

$$w_i = \frac{1/\delta_i}{\sum_{i=1}^{n} 1/\delta_i} \tag{2}$$

month-on- month changes for each component are adjusted (to yield DM) by multiplying with the weights:

$$DM_i = w_i \Delta m_{it} \tag{3}$$

(iii) The composite indicator of economic activity (CIEA) is derived by aggregating month-on-month changes across components over specific periods:

$$CIEA_t = \sum_{i=1}^{n} DM_{it} \tag{4}$$

(iv) The composite indicator of economic activity is then converted into a composite index by setting the initial value of the index equal to 100 and using symmetric percentage change formula recursively to compute index levels for the rest of the period.

Index computation: $I_1 = 100$, $I_2 = \frac{I_1 * (200 + DM_2)}{(200 - DM_2)}$, $I_3 = \frac{I_2 * (200 + DM_3)}{(200 - DM_3)}$, and so on.

3. Derivation and analysis of the composite indicator of economic activity

The study uses monthly data over the period 2005:1 to 2013:12 obtained from the Central Bank of Kenya. The data comprises real sector, external sector and financial sector indicators. Real sector data include production statistics on cement, horticulture and tea. Services include tourism and electricity. Financial indicators comprise real exchange rate, money supply, M3, credit to private sector and NSE share price index. External sector variables include total exports and imports of goods and services. Production statistics are in real terms. Those variables given in nominal terms are deflated using the monthly CPI over the same period. Production and external sector variables are seasonally adjusted.

The study began by deriving a composite indicator using real and external sector variables. The monthly composite indicator is displayed in Figure 1. The same procedure is applied to arrive at a composite indicator using financial variables only. The derived composite indicator is shown in Figure 2. Figure 3 displays the composite indicator derived from using all the variables, both real-external and financial variables. In Figure 4 we show the composite indicator derived when selected variables are used in the derivation of the indicator. The percentage symmetric change in the composite indicators are compared and shown to move closely together as displayed in Figure 5.

Figure 1: Monthly Composite Index of Economic Activity and symmetric percentage change of the composite index (Real and external Sector variables)

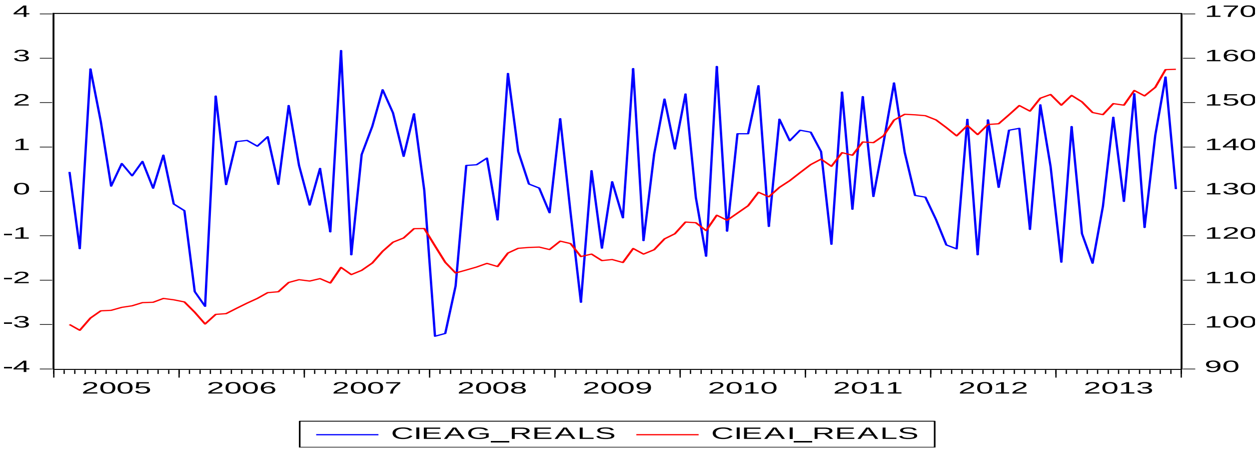


Figure 2: Monthly Composite Index of Economic Activity and symmetric percentage change of the composite index (Financial variables)

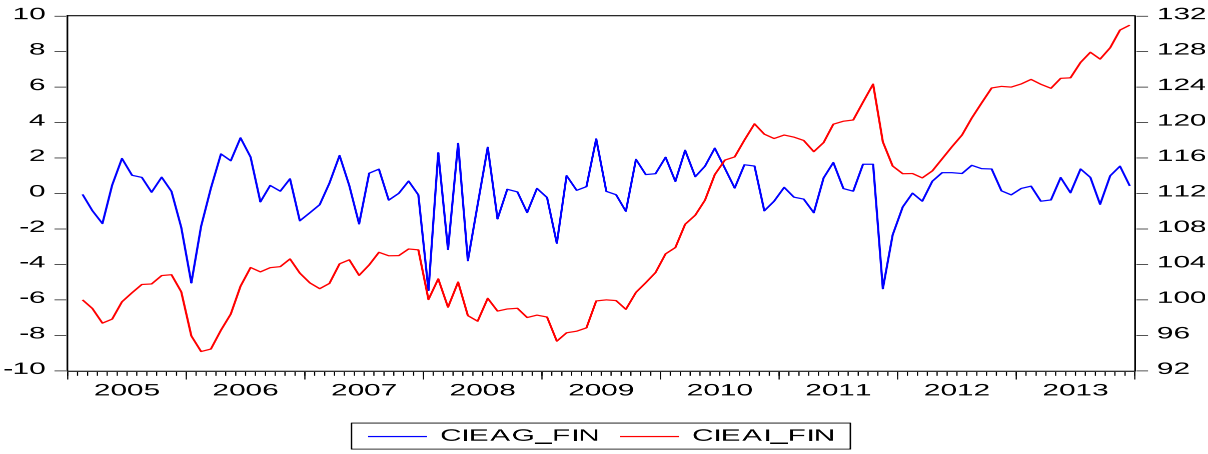


Figure 3: Monthly Composite Index of Economic Activity and symmetric percentage change of the composite index (all variables)

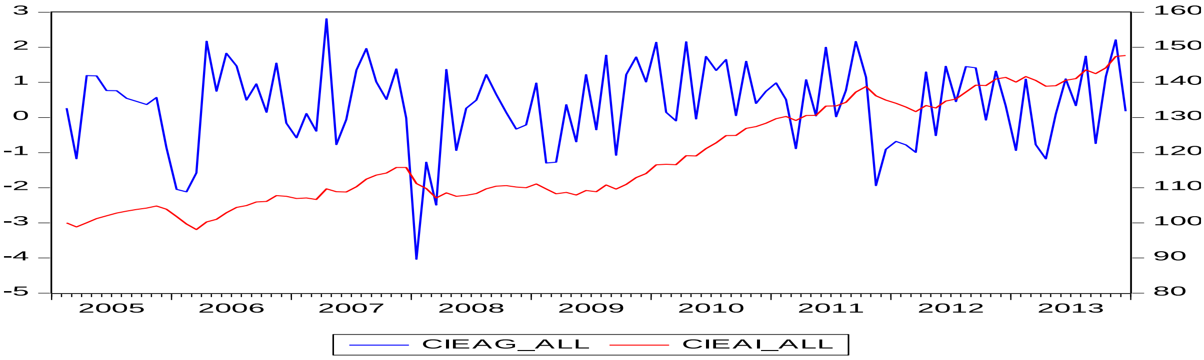


Figure 4: Monthly Composite Index of Economic Activity and symmetric percentage change of the composite index (selected mix of variables)

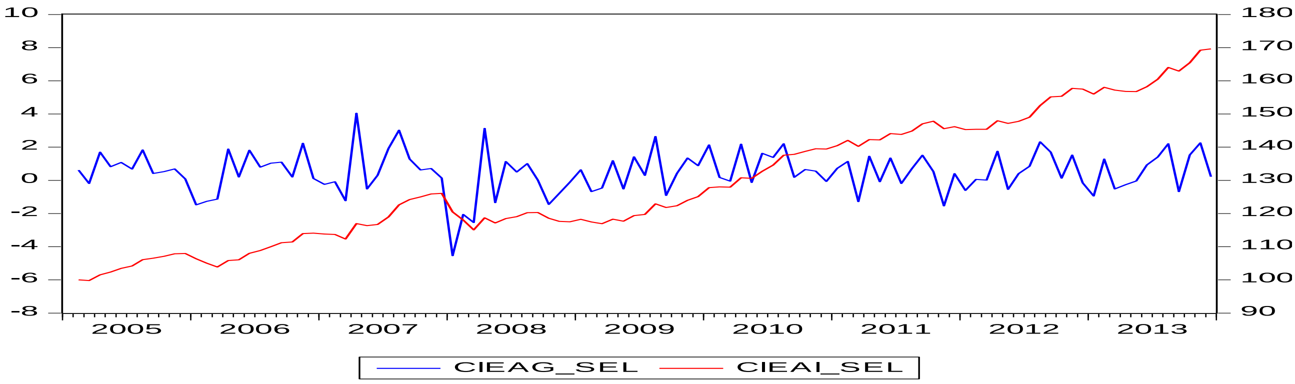
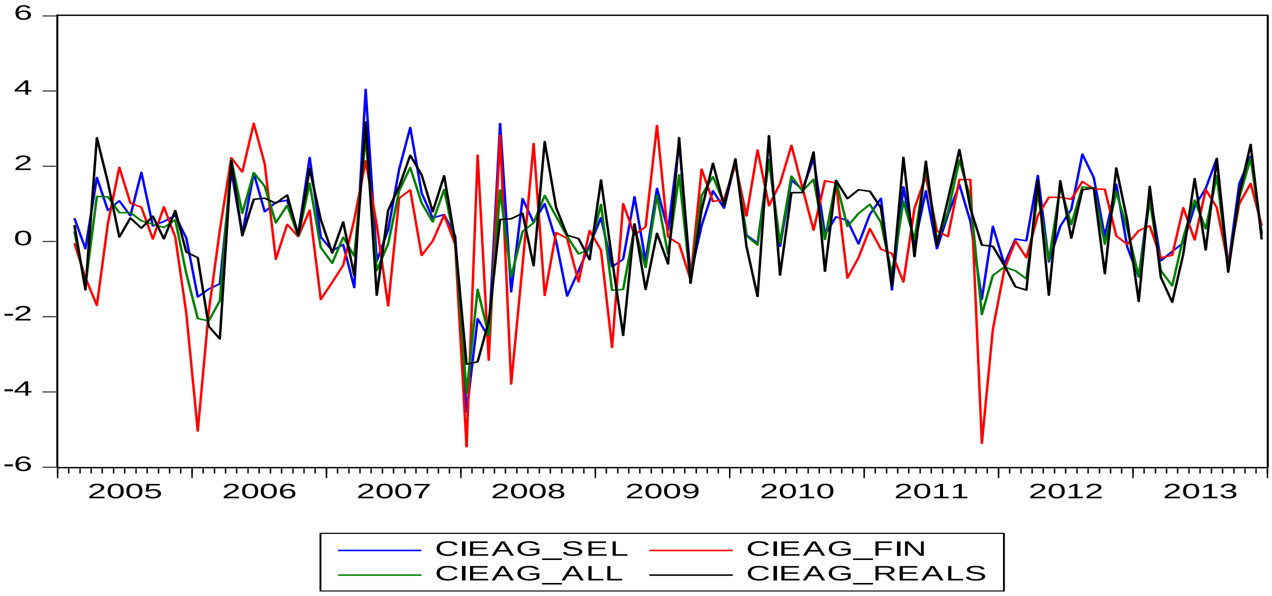


Figure 5: Comparing symmetric percentage change of the composite indicators



To have a much clearer picture of the fit between the monthly composite index and the reference series which in this case is the GDP, the composite indicator has to be converted to quarterly series by averaging the monthly series over the quarter. The derived series is then compared with the quarterly GDP series which is also converted into an index form for ease of comparison. This is shown in Figure 6. A similar procedure is carried out using financial indicators. This is displayed in Figure 7. In Figure 8, all components are included in the derivation of the composite index. Both real and external sector variables as well as financial indicators are included in this case. Finally Figure 9 shows the use of selected indicators, both real sector and financial sector indicators.

Figure 6: (a) Composite indicator (Real and external sector variables) and quarterly GDP compared, and (b) the percentage changes compared

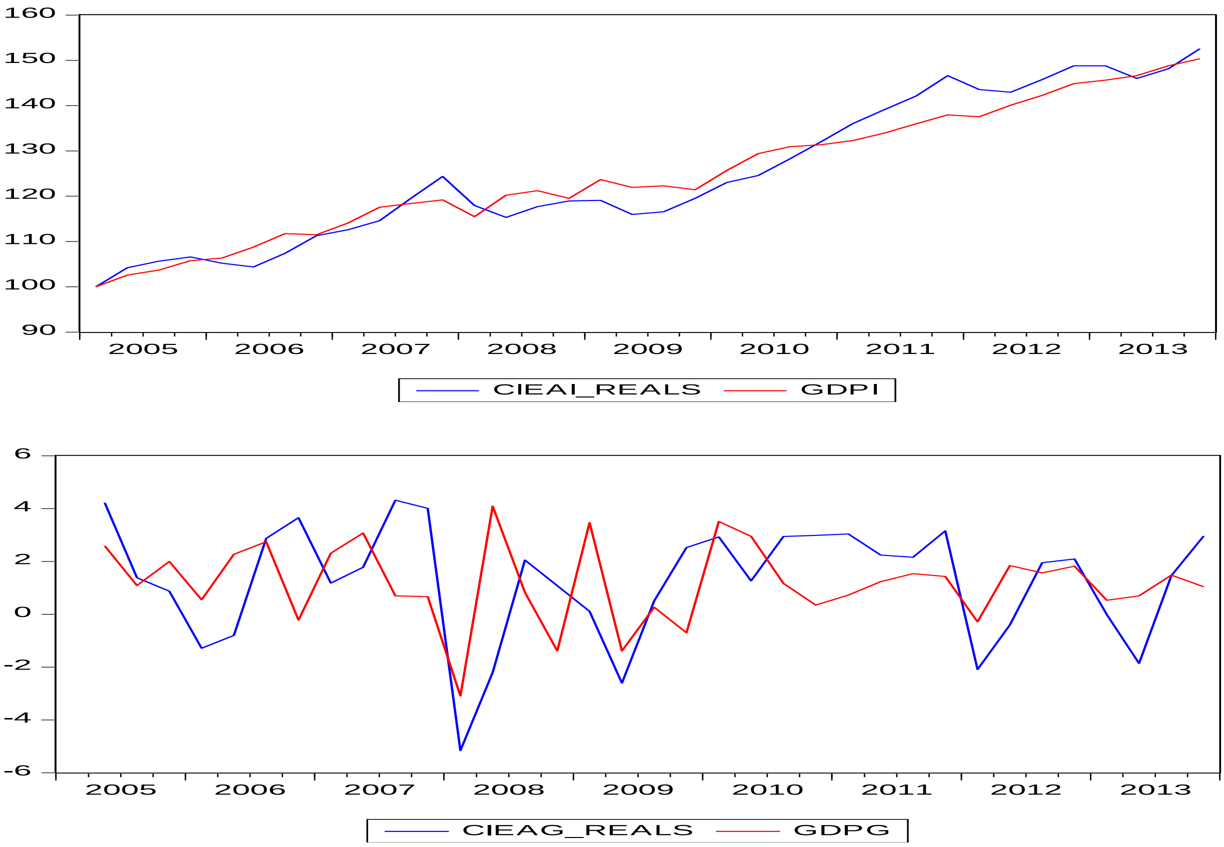


Figure 7: (a) Composite indicator (financial variables) and quarterly GDP compared, and (b) the percentage changes compared

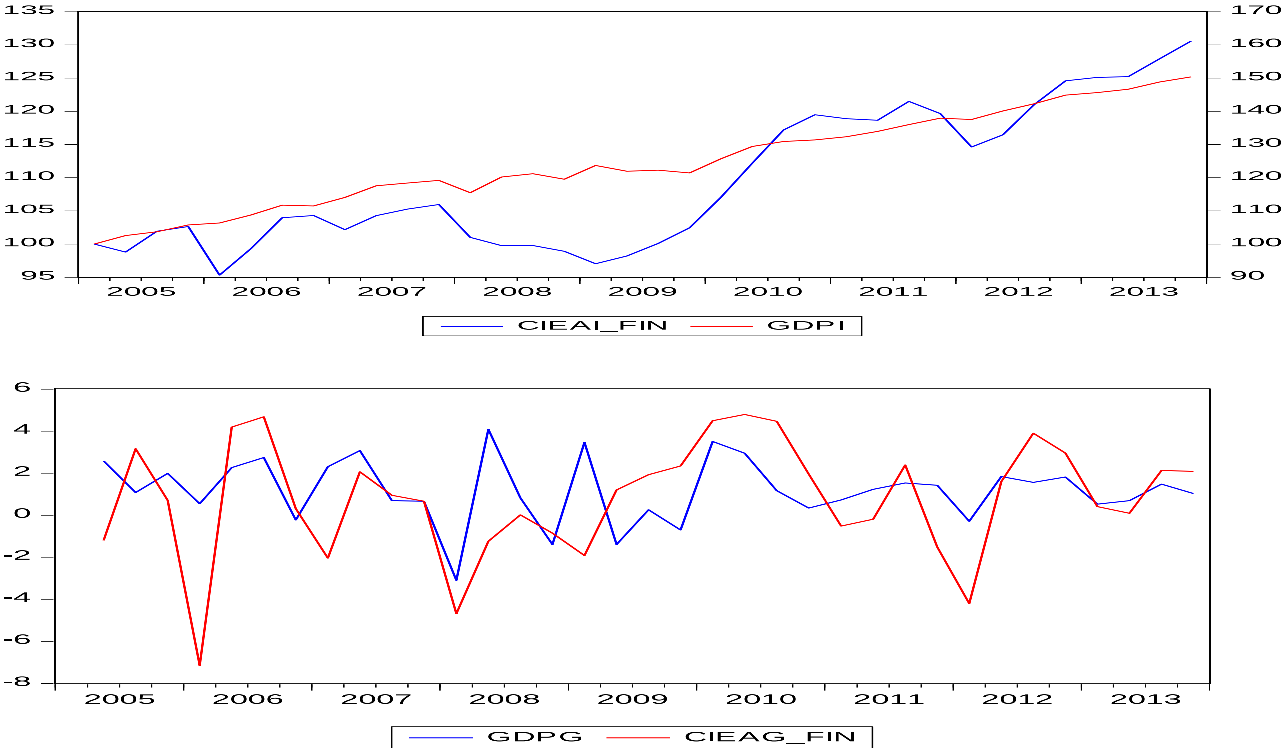


Figure 8: (a) Composite indicator (all variables) and quarterly GDP compared, and (b) the percentage changes compared

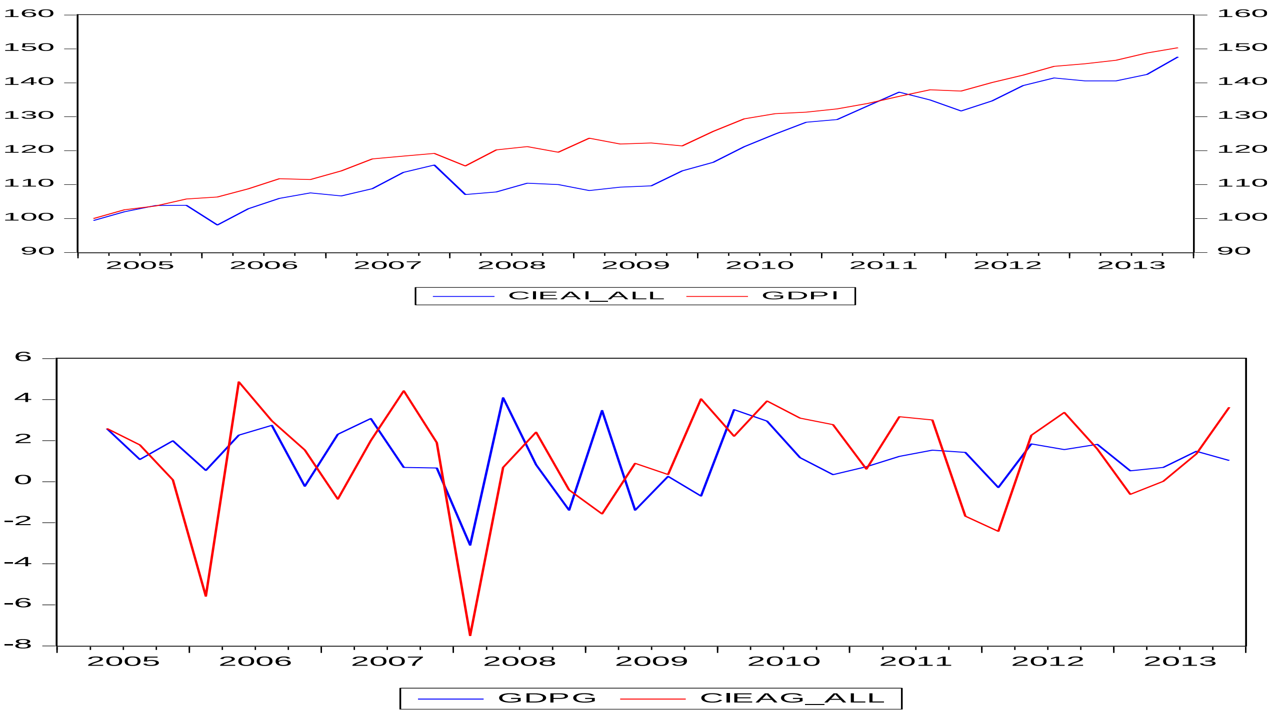


Figure 9: Composite indicator (selected mix of variables) and quarterly GDP compared, and (b) the percentage changes compared

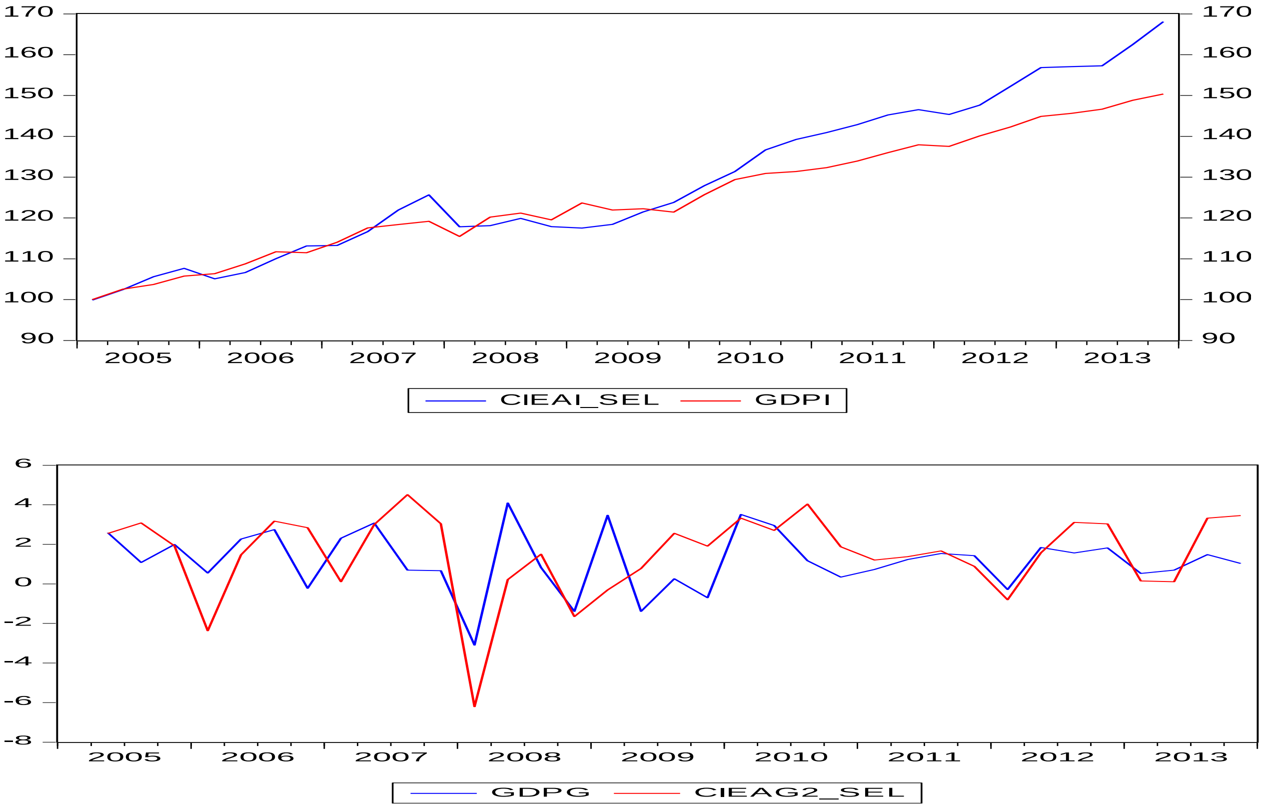
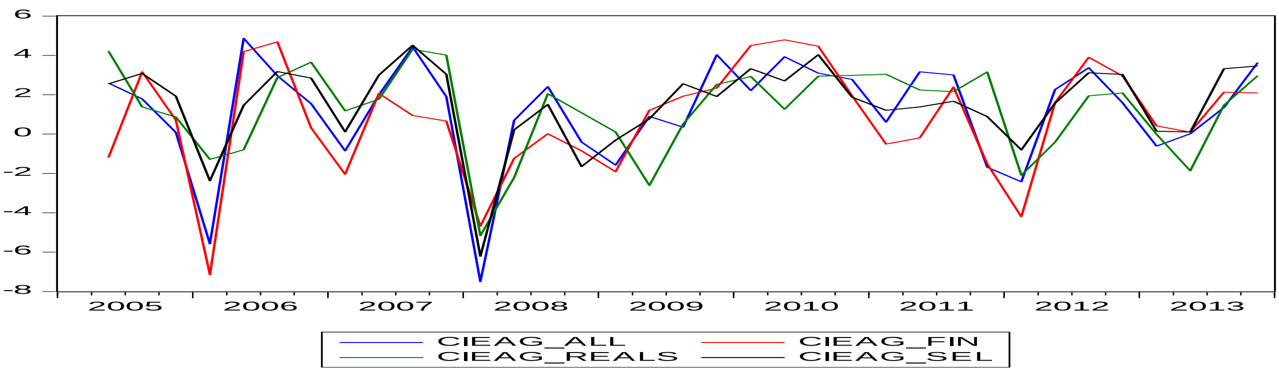


Figure 10: percentage changes of quarterly composite indicators compared



The above analysis has shown that the monthly composite indicators are useful tools for assessing the performance of the economy since the indicators can track the quarterly GDP series. Moreover a simple correlation analysis exercise shown in Tables 1 and 2 below indicates relatively strong correlation between the composite indicators and GDP in levels and also strong correlation between GDP growth and percentage changes in the composite indicators. A careful selection of the variables to include in the derivation of the indicator boosts the degree of association between the composite indicator and the real GDP both in level and percentage change.

Table 1: Correlations between the percentage change of the composite indicators and GDP growth

	CIEAG2_SEL	CIEAG_ALL	CIEAG_FIN	CIEAG_REALS	GDPG
CIEAG2_SEL	1	0.845	0.771	0.760	0.468
CIEAG_ALL		1.000	0.821	0.631	0.389
CIEAG_FIN			1.000	0.443	0.347
CIEAG_REALS				1.000	0.291
GDPG					1.000

Table 2: Correlations between the composite indicators and real GDP in levels

	GDPI	CIEAI_ALL	CIEAI_FIN	CIEAI_REALS	CIEAI_SEL
GDPI	1				
CIEAI_ALL	0.964	1.000			
CIEAI_FIN	0.893	0.968	1.000		
CIEAI_REALS	0.976	0.985	0.922	1.000	
CIEAI_SEL	0.985	0.990	0.946	0.987	1.000

4. Conclusion

The study sought to derive composite indicators of economic activity for the Kenyan economy by examining the effect of using real–external sector variables, financial variables, all the variables and a select mix of the variables. It is shown that if the variables are carefully selected based on the strength of association with GDP, the composite indicator derived would be strongly correlated with the GDP series and would therefore perform better as an indicator of economic activity. This study can be extended to assess the forecasting performance of the monthly composite indicators derived in the study. Further work is required to partition the components into leading and coincident components and to derive leading and coincident composite indicators accordingly.

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