CENTRALE BANK VAN SURINAME

A Monthly Economic Activity Index System for Suriname

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Abstract

Advancements in data collection and data processing techniques revolutionized access and availability of high frequency data in macroeconomics. A large body of literature focusses on these high frequency data advancements in advanced economies. However, small less-developed economies often lack adequate and reliable databases of economic indicators on economic performance on a high frequency basis. Therefore, adequate information with regard to the business cycles and other economic phenomena are often not available for decision-making. This study elaborates on the construction of a Monthly Economic Activity Index System (henceforth MEAI) with survey data for Suriname. Using the System of National Accounts and the International Recommendations for the Index of Industrial Production as references to construct the high frequency indicators (henceforth HFIs), a non-model based approach is applied. This paper contributes to the scanty literature and use of HFIs in a less-developed open economy.

Key Words: High Frequency Indicators, Monthly Economic Activity Index, Real Gross Value Added, Real GDP, Business Cycles

JEL Classification: C51, E30, E32

Contents

1. Introduction

Quarterly Gross Domestic Product (henceforth QGDP) is a widely used economic indicator to measure the evolution of economic activity on short-term basis. Usually, the QGDP is published after three months with regard to the reference quarter. Manuelito (2015) provides a concise summary about the use of high frequency indicators in short-term forecasting models in Latin America and the Caribbean. *"At present in Latin America and the Caribbean, approximately nineteen out of thirty-three countries are included in the Economic Commission for Latin America and the Caribbean Report (ECLAC) that regularly publish QGDP. In the majority of these countries, this economic indicator is published with significant delays".* In this regard, modelling and forecasting monthly real GDP is crucial for obtaining information on the state of the economy in an early stage. It is good to note that these exercises are common practices in developed economies. Compiling comprehensive high frequency indicators also gained substantial attention in developing economies, especially after the financial and economic crisis in the turn of the 21st century.

To track the state of the economy in an early stage, a synthetic economic indicator is supplemental with regard to the publication delay of QGDP. In line with this, we propose a MEAI for Suriname. A well-developed MEAI system supports timely adjustment of macroeconomic policy which is frequently subjected to and affected by external shocks. HFIs contain accurate economic information. These indicators are very useful to construct Indexes of Coincident and Leading Indicators following the models of Stock and Watson (1989, 1991); Mongardini and Saadi-Sedik (2003) and Aroba, Diebold and Scotti (2008). These indexes are preferable to analyze the business cycle. However, the first step to construct them is to have optimal access to reliable HFIs. This research also attempts to make an original contribution to the body of knowledge concerning the development and use of HFIs, especially for small less-developed open economies by answering the following research questions:

The central research question is:

How to construct and implement a high frequency indicator system in a less-developed open economy to improve the macroeconomic policy framework?

Specific questions are:

a. *Which are the appropriate methodologies to construct HFIs for Suriname`s economy?*
b. *How can the HFIs be validated on their ability to track the evolution of economic activity in Suriname?*

The remainder of the paper is organized as follow: In section 2, Literature Review, the relevancy of HFIs and methodology are discussed from the perspective of small less-developed economies. In section 3, the selected methodology for the construction of HFIs and the validation procedure are introduced. Section 4 presents the relevancy of the MEAI system and its quality. Finally, the paper concludes and provides recommendations for expanding this study further.

2. Literature Review

Paragraphs 2.1 and 2.2 outline the methodology for developing HFIs. Paragraph 2.3 is a critical review of the literature about the Caribbean, which is used to construct the theoretical framework.

2.1. Model and Non-Model Approach

The construction and analysis of HFIs began at the National Bureau of Economic Research (NBER) in the United States of America with the work of Mitchell and Burns (1946) and Bry and Boschan (1971) (The Conference Board, 2001). The Organization for Economic Co-operation and Development (OECD) (2008, 2012) has also significantly contributed to the methodologies for developing short-term economic indicators. According to The OECD (2008), a high frequency indicator system can be defined as a broad-based quantitative measure derived from economic time series that can reveal the relative positions of economic activity at regular intervals. The Conference Board (2001) produces a wide range of business cycle indicators which are systematically categorized as leading, coincident and lagging indicators. These indicators are constructed on the basis of model-based and non-model based approaches. Marcellino (2006) provides an overview of these approaches.

2.1.1. Model-Based Approach

The pioneering work of Mitchell and Burns (1946) and Bry and Boschan (1971) are still widely used today for the construction of cyclical indicators. In addition, Stock and Watson (1989, 1991) proposed a model to improve the indexes of coincident and leading indicators based on the methodology of the Conference Board (2001). The availability of high frequency data even on daily and weekly basis permits the development of more accurate models for tracking real activity. In this regard, Aroba, Diebold and Scotti (2008) developed a dynamic factor model that permits filtering for assessing the evolving state of the real economy.

2.1.2. Non-Model Based Approach

In general, non-model or accounting based cyclical indicators are easy to build, easy to explain and easy to interpret compared to the model-based indicators. The following are illustrations of non-model based approaches that are used as guide in this study:

The Conference Board (2001) composite coincident index:[1] For each individual indicator denoted as x_{it}, month-to-month symmetric percentage changes (spc) are computed as $x_{it\_spc} = 200 * (x_{it} - x_{it-1)/}(x_{it} + x_{it+1})$. Second, for each indicator x_{it_spc} a volatility measure denoted as, v_t, is computed as the inverse of its standard deviation. Third, each x_{it_spc} is adjusted to equalize the volatility of the components, the standardization factor being computed as $s_t = \frac{v_t}{\sum_i v_t}$. Fourth, the standardized components, $m_{it} = s_i x_{it\_spc}$, are summed together with the equal weights, yielding $m_t = \sum_i m_{it}$. The composite coincident index (CCI) level is thus computed as:

$$CCI_t = CCI_{t-1} * (200 + m_t)/ (200 - m_t) \quad (1)$$

The Index of Industrial Production (henceforth IIP) based on the Laspeyres methodology (L_t) with commodity vector q^0 (UN Statistical Division, 2010).

$$L_t = \frac{\sum_{i=1} P_{i,0} Q_{i,1}}{\sum_{i=1} P_{i,0} Q_{i,0}} = \sum_i \left(w_{i,0} \frac{Q_{i,t}}{Q_{i,0}} \right) \quad (2)$$

[1] www.conference-board.org. The illustration is adapted from Marcellino (2006).

The term $P_{i,o}$ refers to the prices of products in the base period; $Q_{i,0}$ and $Q_{i,t}$ are the quantities of products in the base period and current period; $w_{i,0}$ is the relative share of each product group in the equation. The products are classified by means of ISIC[2] revision 3.1 to structure the calculations in the Excel spreadsheet.

2.2. Seasonal Adjustment of Time Series

Gómez and Maravall (1998) and Deutsche Bundesbank (2017) show that seasonal adjustment has a long and well-documented tradition. The use of model-based seasonal adjustment gained popularity following the publication of Box and Jenkins (1970). The two well-known model-based approaches that followed since then are the TRAMO-SEATS and X-12-ARIMA (Gómez and Maravall (1998, 2000)). Eurostat (2015) has incorporated the model-based approach in the software program JDemetra+. This paper follows Eurostat (2015) for seasonal adjustment of the time series.

2.3. Caribbean Economies

Most of the Caribbean economies have few industries which are depending on traditional export markets (Ruprah, Melgarejo & Siera, 2014). Consequently, the trading partners' economic growth have a positive covariance with growth in these economies. Therefore, a recession in the trading partner`s economy leads to macroeconomic imbalances in the Caribbean economies. In light of this, Jordan and Howard (2015) asserted that systematic prediction of the state of the economy will contribute to timely macroeconomic policy adjustment to reduce negative impact on economic activity. Theodore (2011) shows that many Caribbean economies developed HFIs. But it was problematic to keep them updated rendering only academic value at best but very little practical value for policy. Male (2011) shows that the frequency of business cycles of small states are significantly higher than that of the advanced economies thus urging the need to have access to updated HFIs.

[2] International Standard Industrial Classification of All Economic Activities (UN Statistical Division, 2002).

Other studies that were conducted are: Graigwell and Maurin (2007). The authors analyze the sector-based production cycles of the Barbadian economy in order to define the idiosyncratic components of the business cycles. They utilized the Bry and Boschan (1971) methodology. The study concludes that the turning points in the business cycles are relevant to determine coincident and leading indicators. Cotrie, Graigwell and Maurin (2008). The authors construct coincident and leading indicators for tracking the business cycle of Barbados. They utilized the econometric models proposed by Stock and Watson (1989, 1991) and Mongardini and Saadi-Sedik (2003). The study shows that the selected indicators possess the properties and reflect well on the business cycles. Cotrie, Craigwell & Maurin (2009). The authors state that leading indicators support economic policy in the Caribbean. The absence of leading indicators in the Caribbean urged the need to collect monthly data on a timely manner.

Guerron-Quintana (2013) analyzed the business cycles of less-developed open economies and defines their characteristics as follows: (a) they cannot influence the interest rates on their debt obligations; (b) the volatility of consumption is greater than the volatility of output; (c) interest rate hikes are typically followed by a contraction in output; (d) they rely heavily on commodity export and (e) they have a weak financial system. He utilizes the following parameters to estimate the business cycles: (a) standard deviation of output; (b) standard deviation of consumption to standard deviation of output; (c) standard deviation of investment to standard deviation of output; (d) standard deviation of net export to GDP; (e) correlation of output and net export to GDP and (f) correlation of output and interest rate.

3. Methodology

This section outlines the quantitative procedures for constructing the HFIs. The methodologies of the Conference Board and that of the IIP are applied.

3.1. Steps for Developing the Indicators

Step 1: The large quantity of survey data are organized, arranged and aggregated in an accounting framework in the software package Excel:

$$\sum_{i=1}^{N} p_i^t \, q_i^t = P^t Q^t \quad \text{for} = 1,2,\dots,T \tag{3}$$

The prices and quantities ($p_i^t q_i^t$) of N commodities for period T is aggregated for each time period t. The aggregate price, P^t, represents all of the period t prices $p_i^t, p_2^t, \dots, p_N^t$ and similarly the aggregate quantity, Q^t, represents all of period t quantities $q_i^t, q_2^t, \dots, q_N^t$.

Step 2: The absolute value data ($P^t * Q^t$) are converted into relative value data to facilitate comparison and to form product groups:

$$R_j(T_i) = \frac{Val_j\,(T_{i)}}{Val_j(T_0)} \tag{4}$$

The term $R_j(T_i)$ is the relative value in period T_i for product j; $Val_j\,(T_{i)}$ is the value in period T_i and $Val_j(T_0)$ is the value in period T_0 for product j.

Step 3: If the volume data of certain key commodities are not available, then the volume data are estimated from available value data and corresponding price indices.

$$Vol^{V_j}(T_i) = \frac{Val^{V_j}(T_i)}{p^{I_j}(T_i)} \tag{5}$$

The term $Vol^{V_j}(T_i)$ is the volume in period T_i for product j; $Val^{V_j}(T_i)$ is the value in period T_i and $p^{I_j}(T_i)$ is the best available price index for product j.

Step 4: At this phase, the indicators are normalized by adding relative weights.

$$w_j = {W_j(T_0)}\Big/{\sum_{j\in K} W_j(T_0)} \tag{6}$$

The term $W_j(T_0)$ is the value of product j in the base year; $\sum_{j\in K} W_j(T_0)$ is the value of all products that must be relatively equal to $\sum_{j\in K} wj = 1$.

Step 5: The calculation of the Laspeyres Volume Index (L_t) and the Paasche Volume Index (P_t):

$$L_t = \frac{\sum_{i=1} P_{i,0} Q_{i,1}}{\sum_{i=1} P_{i,0} Q_{i,0}} = \sum_i \left(w_{i,0} \, \frac{Q_{i,t}}{Q_{i,0}} \right) \tag{7}$$

$$P_t = \frac{\sum_{i=1} P_{i,t} Q_{i,t}}{\sum_{i=1} P_{i,t} Q_{i,0}} = \frac{1}{\sum_i w_{i,t} \frac{Q_{i,o}}{Q_{i,t}}} \quad (8)$$

The term $P_{i,o}$ refers to the prices of products in the base period; $Q_{i,0}$ and $Q_{i,t}$ are the quantities of products in the base period and current period; $w_{i,0}$ is the relative share of product groups in the equation. The UN Statistics Divisions (2010) advises that to obtain volumes from the current period values, the deflator should be obtain from the Paasche index.

$$v_n^L = \sum_i (P_{i,t} * Q_{i,t}) / \frac{\sum_i (P_{i,t} * Q_{i,t})}{\sum_i (P_{i,0} * Q_{i,t})} = \sum_i (P_{i,0} * Q_{i,t}) \quad (9)$$

The term v_n^L is the Laspeyres volume index in time t; $\sum_i (P_{i,t} * Q_{i,t})$ is the output value in time t prices; $\frac{\sum_i (P_{i,t} * Q_{i,t})}{\sum_i (P_{i,0} * Q_{i,t})}$ is the Paasche price index for period t; $\sum_i (P_{i,0} * Q_{i,t})$ is the output value for period t in prices of the base period.

Step 6: The chain-linked method is used to introduce new products as well as to remove old products as follows:

$$L_{t=} \sum_i (W_{i,t-1} \frac{Q_{i,t}}{Q_{i,t-1}}) * \sum_i (W_{i,t-2} \frac{Q_{i,t-1}}{Q_{i,t-2}}) * \ldots * \sum_i (W_{i,0} \frac{Q_{i,1}}{Q_{i,0}}) * 100 \quad (10)$$

The term $W_{i,t}$ is the relative share of value added of sector i at time t, and $Q_{i,1}$ is the volume index for sector i at time t.

Step 7: The software program JDemetra + is utilized to decompose the time series into their trend, cycle, seasonal and irregular components following the European Statistical System (ESS) Guidelines on Seasonal Adjustment (2015). In addition, the software program Eviews 10 is utilized to create a standard program to generate the HFIs and the MEAI.

Step 8: At last, the calculation of the 12-months moving average growth rates: this is the rate of change of 12 months in year (t) expressed with respect to the 12 months in the previous year $(t - 12)$. These calculated rates provide insights in the performance of each sector and of the total economy.

3.2. Data Collection

The high frequency data for developing the indicators are being compiled through a survey process. The Central Bank of Suriname in collaboration with the General Bureau of Statistics (henceforth GBS) designed questionnaires for each sector to collect the monthly data.

The data of particular interest are the turnovers of key players by industry, production and employment. These data are available on a monthly basis and as such facilitate the implementation of the MEAI. The survey captures only key respondents that are primarily Limited Liability Companies. The sample contains about 200 key players by industry that covers 94% of economic activity[3].

3.3. Data Sources

- The data sources for the Agriculture Industry are the monthly surveys, the annual data sheet of the Ministry of Agriculture, Animal Husbandry and Fisheries (henceforth AHF), the Foundation for Forest Management and Production Control (henceforth SBB) and the Automated System for Customs Data (henceforth ASYCUDA).
- The data sources for the Fishing Industry are the monthly surveys, ASYCUDA and the Department of Fisheries of the Ministry of AHF.
- For the Construction Industry data are obtained from the monthly surveys, annual reports, ASYCUDA and SBB.
- For the following ISIC Industries Mining; Manufacturing; Electricity and Water; Wholesale and Retail Trade; Hotels and Restaurants; Transport & Communications and Financial Services data are collected from the monthly surveys and annual reports of the key players.
- The data sources for the Government are GBS and the Ministry of Finance[4].

3.4. Deflators

A number of key players in the sample produce heterogeneous products which complicates compiling volume data. To construct the HFIs, we use their reported turnover and a corresponding price index to derive the volumes at constant 2011 prices. Price indices are less variable except in periods of high inflation. Specifically, the building material price indices

[3] Table 1 Appendix I, page 23.
[4] Table 2 Vector of Indicators, Appendix I, page 23.

(BMPI) and consumer price indices are used as monthly deflators[5]. The BMPI data sheet is a product of GBS and it is mailed to the Central Bank in the last month of each quarter. For missing values, we use corresponding extrapolators.

3.5. Benchmarking

A benchmark indicator is a comprehensive standard of reference by which other less comprehensive indicators are evaluated on their ability to track the pulse of economic activity correctly. The real gross value added (henceforth RGVA) of GDP at 2007 prices are used as benchmark indicators for the MEAI. The fundamental assumption is that the HFIs included in the MEAI system should possess the ability to track the changes in the RGVA of GDP in the correct direction. We assume that the 12-month moving average growth rates of the HFIs and that of the MEAI system do not have to be the same as the annual growth rates of RGVA and GDP.

4. Monthly Economic Activity Index for Suriname and Results

This section explains the urgent need of the MEAI system. The business cycle properties of the economy and the reliability of the aggregate index are presented.

4.1. Relevancy of a Monthly Economic Activity Index

Three main reasons for having timely access to a MEAI have been identified: (a) The impact of sudden fluctuations in the international commodity prices on the business cycle of the economy; (b) The lack of a timely short-term indicator system such as QGDP; (c) The lack of a MEAI system to support macroeconomic management.

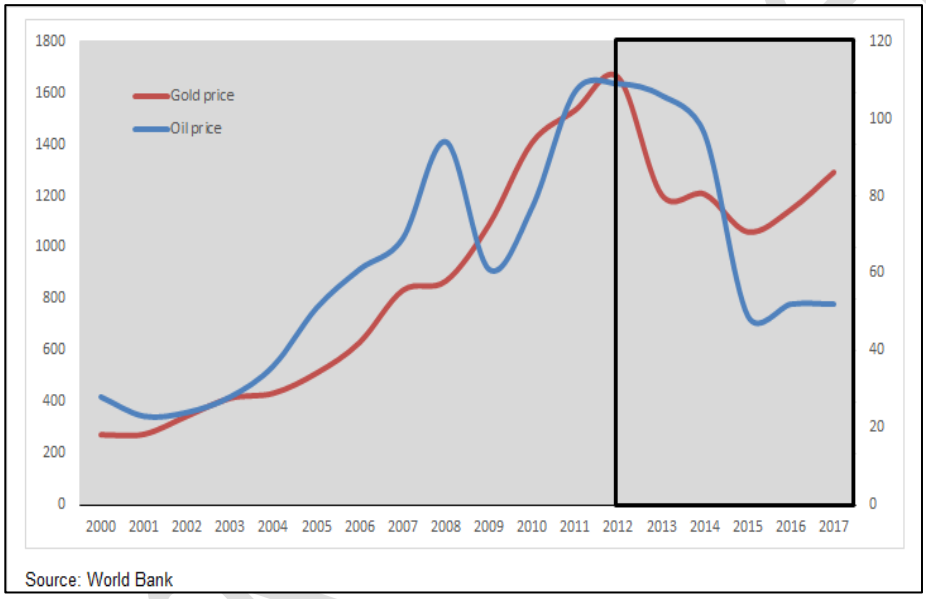
4.1.1. Impact of Volatile Commodity Prices

The Republic of Suriname is a small less-developed open economy with real GDP of approximately US$ 4 billion as of 2016 (in 2013 it was around US$ 5.2 billion). Economic activity is significantly driven by mining-related activities (80%). The international price fluctuations of gold and oil systematically impact the export earnings that in turn influence the dynamics of the foreign exchange market. In recent years, the prices of gold and oil became sequentially under huge pressure (graph 1). Consequently, the economy was plunged into a crisis, with declining growth, high exchange rate depreciation, soaring inflation and declining

[5] Table 3 Deflators and Extrapolators, Appendix I, pages 24-25.

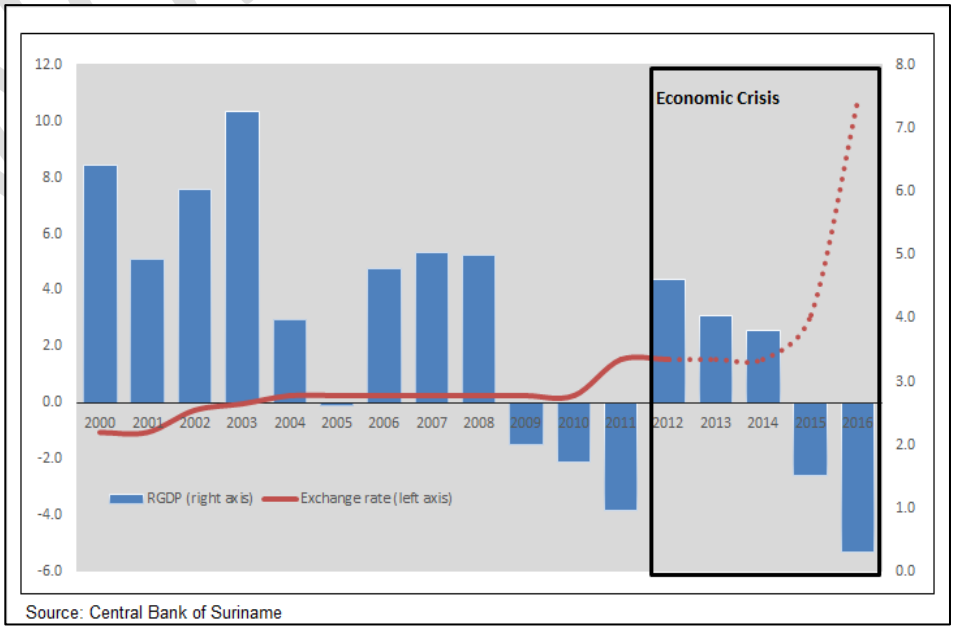
income per capita (Graphs 2 and 3). The income per capita declined almost by 23% from USD 9,000 in 2012 to USD 6,947 in 2016.

Graph 1. International Gold and Oil Price



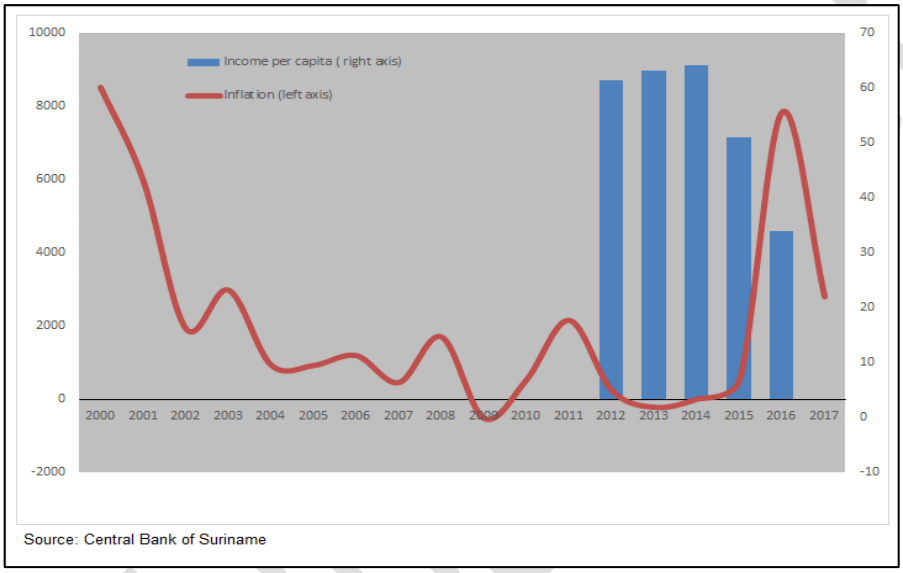
Source: World Bank

Graph 2. Growth and Exchange Rate



Source: Central Bank of Suriname

3. Income per Capita and Inflation Graph



4.1.2. Absence of Quarterly GDP

Due to the absence of a QGDP, the evolving state of the economy is difficult to assess on short-term basis. Added to this shortcoming, the annual GDP figure is released with a lag of eight to nine months. Therefore, the business cycles of the economy cannot be assessed on a timely basis due to the lack of high frequency data. To fill in this gap, the Central Bank started with the collection of monthly data in early 2013.

4.1.3. Compilation of the Monthly Economic Activity Index

The MEAI system is highly accurate in tracking changes in economic activity. Its compilation is, however, less comprehensive than QGDP, but it is preferable as a business cycle indicator (Bloem et al., 2001; United Nations, 2008). A preliminary research of the Statistics Department of the Central Bank revealed that the key players in the economy could effectively supply data

way back from 2011. For this reason, the MEAI uses the structure of the economy in 2011 as base year, whereas the national accounts uses the structure of the economy in 2007. A simple calculation reveals that the structure of the economy has not change from 2007 to 2011[6]. To enhance consistency in compilation methodology, the Central Bank and the GBS agree that growth of the MEAI and GDP at end-year should trend in the same direction, even though growth rates do not have to be exactly the same.

4.2. Results

This paragraph presents the business cycle properties of the economy and the reliability of the MEAI system. The business cycle properties are reported in table 2 following the research of Guerron-Quintana (2013). The results are presented on two levels: (a) HFIs and (b) MEAI. The results of the HFIs[7] are reported in table 3. The MEAI is plotted against the RGDP in graph 4. Table 4 reports the Root Mean Square Errors (henceforth RMSE) of the RGVA of GDP and the HFIs[8] of the MEAI.

4.2.1. Business Cycle Properties

The volatility of GDP is estimated around 4.5 percentage points. This substantial volatility is considered as a characteristic of small less-developed commodity-based economies (Guerron-Quintana, 2013). The volatility of consumption is 2.45 times greater than the volatility of output. Typically, an increase in foreign exchange earnings will usually translate into higher public expenditures and increase in the imports of consumption goods.

The volatility of investments is 12.6 times greater than the volatility of output in the sample period 2000-2016. Three investments shocks were reported: significant investments in the gold industry (2004-2005) and in (2015-2016). Investments in the oil industry (2012-2013). Small less-developed commodity-based economies rely heavily on investments in mining activity. They received a one-time investment shock and thereafter investment goes back to its normal pattern.

[6] Table 4 Structure of the Economy, Appendix I, page 25.
[7] The assessment and the evaluation of the HFIs are extensively reported in Appendix II, pages 26-31.
[8] The RMSE shows how close the 12-month moving average growth rates of the index is to 12-month growth of real GDP.

The net export displays high volatility. In periods of high commodity prices, the current account of the Balance of Payment recovers from previous deficits. If prices are under pressure then otherwise as also indicated by the negative correlation coefficient (-0.32). Furthermore, interest rate hikes, due to various circumstances are typically followed by a contraction in economic activity. These opposing movements in output and interest rate are captured by the negative correlation (-0.50). These economic parameters reinforce the need to develop measures to quantify the business cycles of the economy in advance.

Table 2. Business Cycles of the Economy of Suriname

Parameters	Suriname	New Zealand	Argentina	United States
	SDE*	SDE**	EME***	Developed
Standard deviation of output	4.50	1.99	4.22	1.59
Standard deviation of consumption to standard deviation of output	2.45	0.82	1.08	0.77
Standard deviation of investment to standard deviation of output	12.60	3.32	2.95	4.10
Standard deviation of net exports to GDP	8.70	0.66	0.34	0.64
Correlation of output and net export to GDP	-0.32	-0.06	-0.89	-0.48
Correlation of output and interest rate	-0.50	0.07	-0.63	0.18

Source: Central Bank of Suriname; author`s estimates; Guerron-Quintana (2013)
Data sample: 2000 - 2016 for Suriname (not andjusted for seasonality)
* Small Developing Economy
** Small Developed Economy
*** Emerging Market Economy

4.2.2. Reliability of the Monthly Economic Activity Index

Overall, the growth rates of the MEAI closely track the growth rates of real GDP in the correct direction for the total economy (graph 4). The GDP figure is released with a lag of eight to nine months after closing of the reference year. For the in-between period, the MEAI tracks the business cycle correctly with a delay of $t + 45$ days. For example, the MEAI tracks the business cycle correctly for the 12 months of 2016 and for the 9 months of 2017 in advance of the release of the official GDP figure in August of 2017.

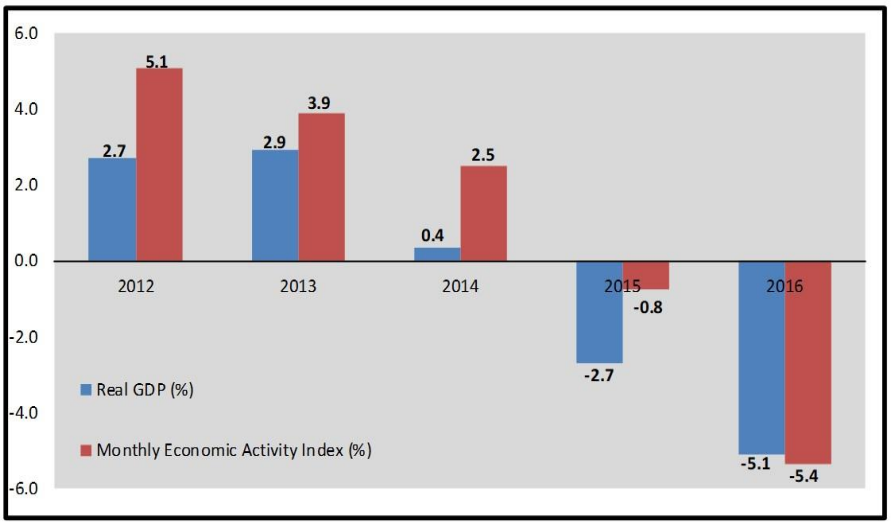
The RMSE as reported in table 4 shows that the differences between the growth rates of GDP and MEAI are small (1.7). However, on the industry level, the differences in growth rates between the HFIs and the RGVA are quite large. This is, however, due to the small sample size (2011-2016). Nevertheless, we assume that the HFIs closely reflect the real development of economic activity based on the following criteria:

- Economic inferences of sector specialists at the Central Bank of Suriname and other Institutions such as the Planning Office and GBS;
- The input data are crosschecked with sources such as annual reports, ASYCUDA and the National Accounts. In addition, an explanation is obtained from the respondents in case of detected irregularities in the reported data.

The HFIs (table 3) indicate for 20 times that growth of economic activity trended in the opposite direction compared to growth of RGVA. In 2014 and 2016: Six times; 2015: Four times and in 2013: Three times. Three main reasons for the inverse growth rates are:

- Some differences in reported data to the GBS and the Central Bank of Suriname;
- Some differences in the methodology for constructing the indicators which are included in the calculations of real GDP and the MEAI system;
- The use of different indicators in certain industries.

Graph 4. Growth Rates MEAI and Real GDP



Sources: GBS and Central Bank of Suriname

Industry	2012		2013		2014		2015		2016	
	RGVA*	Index**	RGVA	Index	RGVA	Index	RGVA	Index	RGVA	Index
Agriculture										
Fishing										
Mining										
Manufacturing										
Electricity and Water Supply										
Construction										
Wholesale and Retail Trade										
Hotels & Restaurants										
Tranport & Communications										
Financial Intermediation										
Government										

Sources: General Bureau of Statistics and Central Bank of Suriname

*) Real Gross Value Added growth as calculated by GBS

**) Industry Index growth seasonally adjusted

1. Green Indicates that growth of RGVA and Industry Index trends in same direction.
   The RGVA is the Benchmark Indicator.
2. Red indicates that growth moves in opposite direction.

Table 3. High Frequency Index vs. Real Gross Value Added

Table 4. Root Mean Square Errors

Industry	RMSE
Agriculture, Hunting and Forestry	12.6
Fishery	9.3
Mining and Quarrying	6.2
Manufacturing	9.9
Electricity, Gas and Water Supply	6.9
Construction	10.0
Wholesale and Retail Trade	14.1
Hotels and Restaurants	14.1
Transport, Storage and Communication	14.2
Financial Intermediation	15.7
Government	12.5
MEAI	**1.7**

Source: Author`s Calculations

5. Conclusions

Developed economies often have advanced data collection systems. In contrast, less-developed economies such as Suriname lacked high frequency data. Consequently, the high volatility of the business cycles cannot be tracked correctly. The calculations, based on the approach of Guerron-Quintana (2013), indicate that the high volatility of economic activity urged the need for collecting monthly data on a timely basis and compiling high frequency indicators (HFIs). In light of this, the Central Bank of Suriname commenced the construction of HFIs and a Monthly Economic Activity Index (MEAI) system for the total economy in early 2013.

For this purpose, the compilation methodologies of the Index of Industrial Production of the UN Statistical Division (2010) and that of the Composite Coincident Index of the Conference Board (2001) were followed in order to estimate the aggregate index. Thus, the non-model based

approach is applied with survey data that cover 95% of economic activity. The survey data are compiled on a monthly basis from 200 key players in the total economy.

To validate the reliability of the HFIs and the MEAI, the Root Mean Square Error, the Real Gross Value Added of GDP and economic inferences of sector specialists are taken into consideration. These selected evaluation instruments indicate that the MEAI is a reliable economic indicator that provide sound information about the evolving state of the economy and well in advance before the official release of GDP figures.

Finally, high frequency survey data are difficult to obtain on a timely basis, but key for macroeconomic policy-making. This paper contributes to the existing literature in the Caribbean region. In addition, it contributes to a systematic and easy way to develop an aggregate index by applying an accounting approach. This is much easier to build, update and to interpret the results.

6. Recommendations

More detailed analysis of the business cycles are required. With regard to this, multivariate filters should be utilized. The HFIs are useful for developing leading indicators in line with the models of Stock and Watson (1989, 1991); Mongardini and Saadi-Sedik (2003) and Aroba, Diebold and Scotti (2008). These models will aid in predicting the real macroeconomic trends from the last available MEAI update.

The high frequency data of the MEAI system and the annual data of the National Accounts System should be combined by means of the regression model Mixed-Data Sampling (MIDAS) for now-casting QGDP. Currently, the General Bureau of Statistics (GBS) does not compile this economic indicator.

Deepening the cooperation between the Central Bank of Suriname and GBS will result in continual improvement of both the MEAI system and the National Accounts System. The GBS may use the indicators of the MEAI to crosscheck the input data of the National Accounts

System. Likewise, the Central Bank may use the National Accounts data to correct possible errors in the MEAI data and improve the methodology further.

Increasing the timeliness of data collection and construction of the aggregate index to $t + 45$ days is recommendable. This timeline is internationally acceptable. Various international institutions are investigating ways to increase the timeliness even further. Take for example Statistics Netherlands (2013) that shows great interest in reducing the timeliness from $t + 45$ to $t + 30$.

Besides the Central Bank of Suriname, other Institutions may find it useful to have access to HFIs on a timely basis. For example, the Planning Office can use the indicators to improve its data set for the purpose of macroeconomic modelling and forecasting of real GDP. The business sector may use the growth rates of the HFIs by industry for planning and monitoring investments, market demand and supply of intermediates for production activity.

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Appendix I

Table 1. Number of Companies per Industry

Industry	GBS	Bank	Ratio`s	
			Bank/GBS	Bank
Agriculture, Hunting and Forestry	98	4	4.1%	2%
Fishing	16	9	56.3%	5%
Mining and Quarrying	154	6	3.9%	3%
Manufacturing	1375	49	3.6%	25%
Electricity, Gas and Water Supply	8	2	25.0%	1%
Construction	256	14	5.5%	7%
Wholesale and Retail Trade	4467	64	1.4%	33%
Hotels and Restaurants	1544	28	1.8%	14%
Transport, Storage and Communications	491	7	1.4%	4%
Financial Intermediation	82	12	14.6%	6%
Total	**8491**	**195**	**2.3%**	**100%**

Sources: General Bureau of Statistics and Central Bank of Suriname

Industry	Number	Vector of Indicators*								
Agriculture, Hunting and Forestry	5	Bananas	Logs	Chicken	Paddy	Vegetables				
Fishing	1	Fish								
Mining and Quarrying	3	Gold ore	Crude oil	Bauxite						
Manufacturing	7	Mining	Food	Beverage	Wood	Chemicals	Plastic	Concrete		
Electricity, Gas and Water Supply	2	Electricity	Water							
Construction	4	Wood	Paint	Concrete	Imports					
Wholesale and Retail Trade	9	Heavy Equipment	Households	Food & Bev.	Alc. & Tob.	Gardening	Healthcare	Construction	Transport	Furniture
Hotels and Restaurants	2	Hotels	Restaurants							
Transport, Storage and Communications	3	Telecom	Transport	Containers						
Financial Intermediation	5	Central bank	ODCs**	Exchange Off.	MTHs***	Insurance				
Government	1	Employment								

Source: General Bureau of Statistics and Central Bank of Suriname

*) These are aggregate indicators. There are 80 sub-indicators

**) Other Depository Corporations

***) Money Transfer Houses

Table 2. Vector of Indicators for the Monthly Economic Activity Index

Table 3. Building Material Price Index

Construction Materials	Extrapolators
Aluminium profile	international alumina price
Asphalt/bitumen	Staatsolie asphalt price
Bricks	Total CPI
Concrete Mortar	Total CPI
Reinforcement Steel	Carbon steel index
Concrete Broken Stone	Total CPI
Concrete Paint	Total CPI
Concrete Commodities	Total CPI
Fuel	Fuel index
Cement	Total CPI
Galvanized Roofing	internat alumina price
Galvanized Wire Netting	Metals price index
Glass	Intern export price
Hinges	Metals price index
Timber	Intern hardwood (IMF)
Wooden Sheets/Plates	intern softwood (IMF)
Natural Stone	Total CPI
Plate steel	Carbon steel index
Profile Steel	Carbon steel index
P.V.C.	total cpi
Sanitary	Ceramics exp price
Locks	Metals price index
Tiles	Ceramics exp price
Paint	Total CPI
Sand	Total CPI

Source: General Bureau of Statistics

Estimating Deflators: Deriving real turnover: $\boldsymbol{R_t^c = N_t^c / Def_t^{2011} * 100}$, Where R_t^c indexes the real turnover of company c in time t; N_t^c is the nominal value at time t and Def_t^{2011} is the corresponding deflator with base year 2011 in time t. Estimating missing values for deflator $\boldsymbol{P_t^c = p_{t-1}^c * \frac{P_t^{IN}}{P_{t-1}^{IN}}}$, Where P_t is the extrapolated value of product c at time t; x_{t-1}^c is the nominal value of company c in period $t-1$; $\frac{P_t^{IN}}{P_{t-1}^{IN}}$ is a factor derived from corresponding extrapolators.

Extrapolation Methods

1. Extrapolating with historical series:

   $\boldsymbol{x_{ct} = y_{ct-1} * \frac{y_t}{y_{t-1}}}$,

   Where x indexes the extrapolated value, c indexes the respondent and t indexes the period. The factor $(\frac{y_t}{y_{t-1}})$ is estimated for $t-12$ months for company c.

2. Extrapolating with import-related data:

   $\boldsymbol{x_{ct} = y_{ct-1} * (\frac{y_t}{y_{t-1}} * 100\%)}$,

   Where $(\frac{y_t}{y_{t-1}} * 100\%)$ is the monthly growth rate of related imports. The total imports are used when the correlation coefficient between the company data and the total related imports is meaningful.

3. Extrapolating with data from identical respondents:

   $\boldsymbol{x_{ct} = y_{ct-1} * \sum_{i=1}^{n} \frac{y_i}{y_{it-1}}}$,

   Where the factor $\sum_{i=1}^{n} \frac{y_i}{y_{it-1}}$ is derived from a number of identical companies for $t-12$.

Table 4.

Industry	Weights 2007 =100	Weights 2011=100	Difference
Agriculture	7.6	7.1	0.5
Fishing	4.1	3.0	1.1
Mining	8.3	7.8	0.5
Manufacturing	27.1	24.1	3.0
Electricity and Water Supply	1.9	2.1	-0.2
Construction	5.4	6.7	-1.3
Wholesale and Retail Trade	18.5	21.5	-3.0
Hotels & Restaurants	2.8	3.3	-0.5
Tranport & Communications	6.8	6.8	0.0
Financial Intermediation	6.0	5.9	0.1
Government	11.5	11.7	-0.2
Total	**100.0**	**100.0**	**0.0**

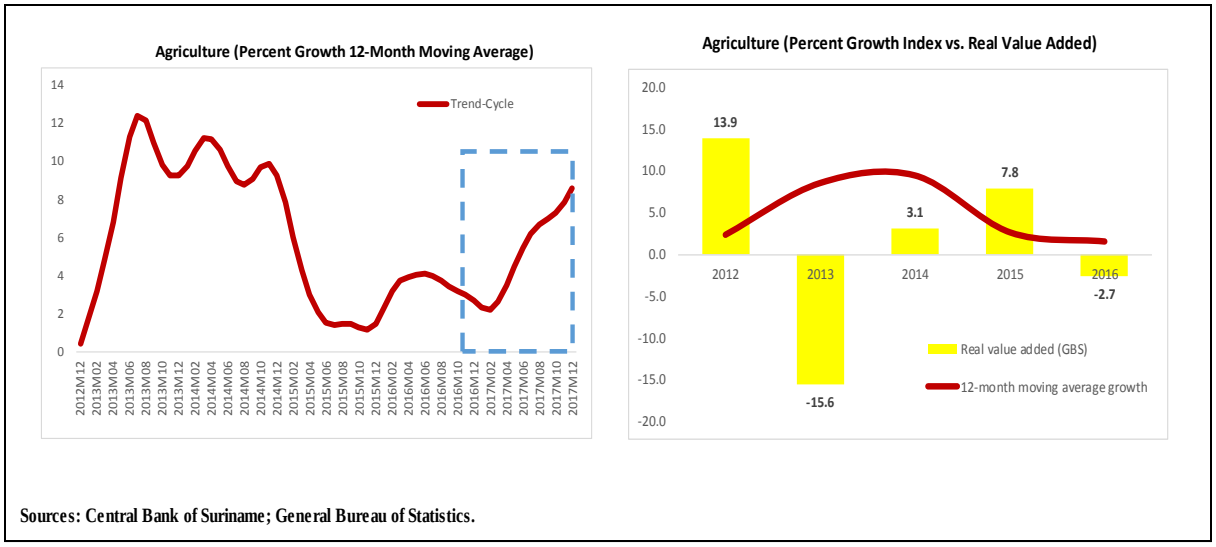
Sources: General Bureau of Statistics and Central Bank of Suriname

Changes in the Structure of the Economy

Appendix II
Assessment of the performance of the High Frequency Indicators

1. Agriculture

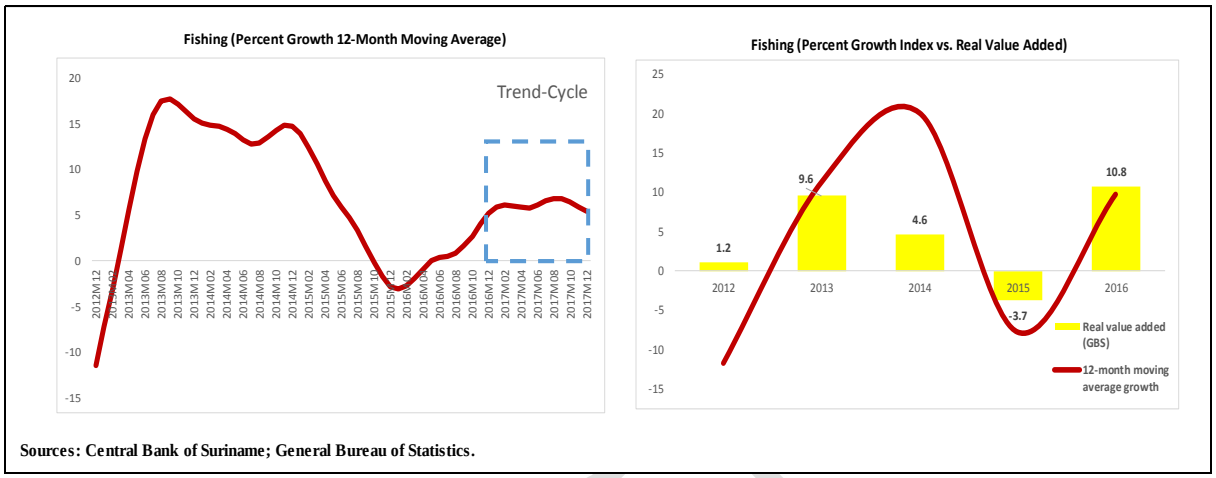
High growth was recorded in 2012 and 2013 due to increase demand of logs from China. As the production of rice and banana weakened significantly in the following years, growth decelerated but picked up again in 2017 close to the level of 2014. The index tracks correctly real growth of gross value added, except in 2013 and 2016.



Sources: Central Bank of Suriname; General Bureau of Statistics.

2. Fishing

Since the last quarter of 2015, activity deteriorated as fish processing companies scaled back investments. Activity rebounded in the last quarter of 2016 accelerating growth. The index tracks

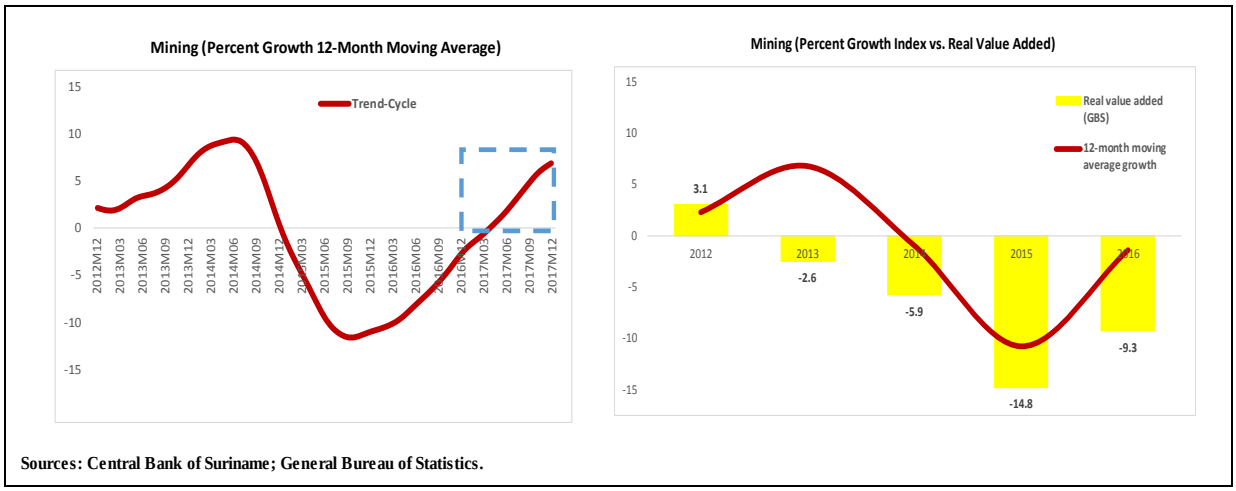


Sources: Central Bank of Suriname; General Bureau of Statistics.

correctly real growth except in 2012.

3. Mining

High growth was recorded in 2013 and 2014, but activity contracted significantly in the following years. A mining multinational gradually closed down operations that impacted significantly on growth. Activity slowly picked up in the last quarter of 2016 as a result of new investments in the oil and gold industry. The index follows the evolution of real growth correctly

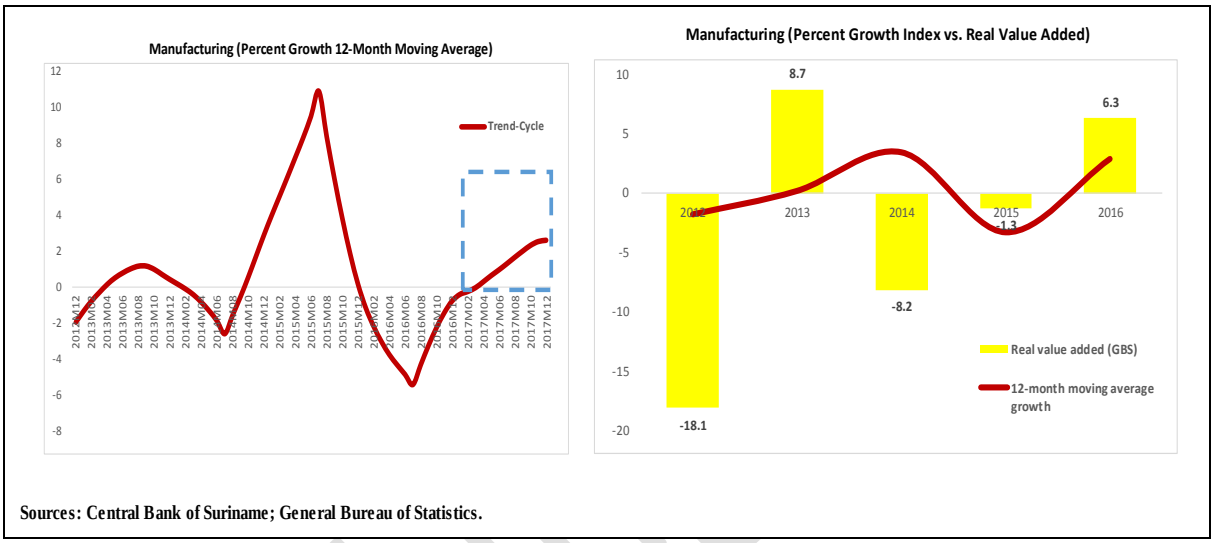


Sources: Central Bank of Suriname; General Bureau of Statistics.

except in 2013.

4. Manufacturing

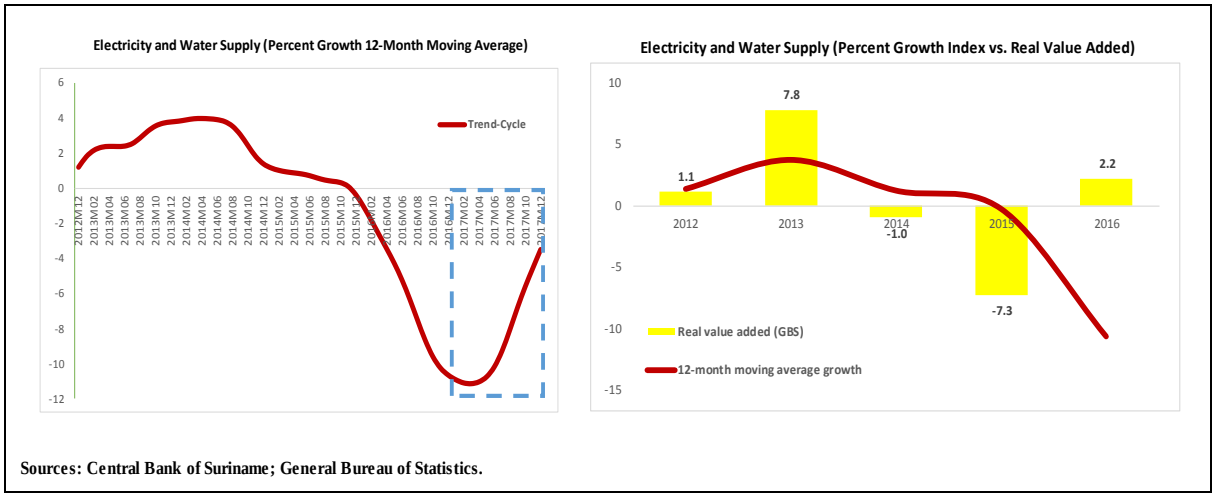
Growth was around 1% in 2013 and 2014 but accelerated and quintupled in 2015 as new investments in the oil industry started to pay off. The cease of alumina production lowered the contribution significantly in 2016 but growth gradually picked up as new gold mines became operational. The index tracks real growth correctly except in 2014.



Sources: Central Bank of Suriname; General Bureau of Statistics.

5. Electricity and Water Supply

Growth was relative stable in 2013 and 2014, but decelerated since 2015. The closing down of the thermal power by a mining multinational impacted on growth. Since the fourth quarter of

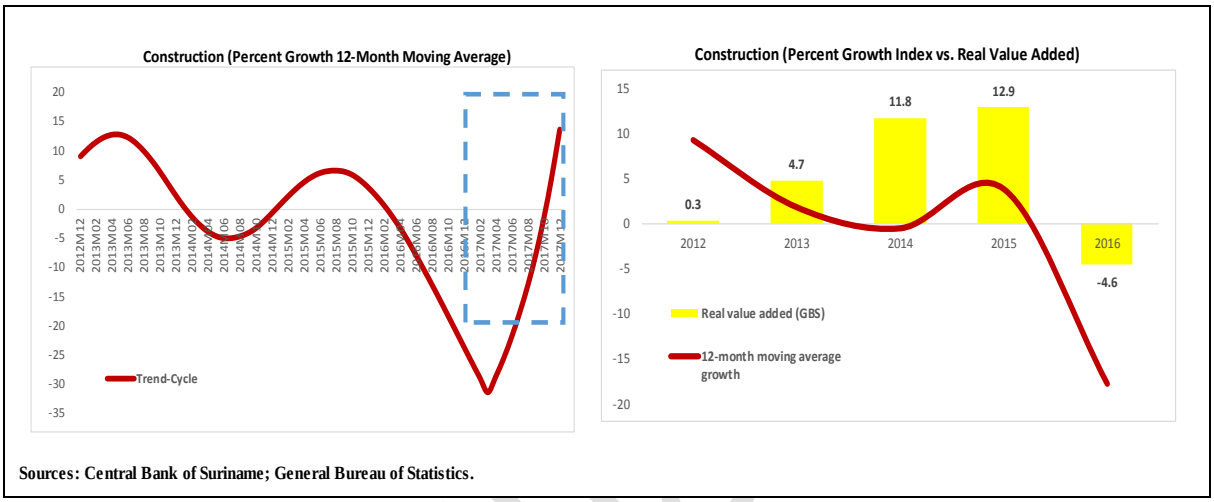


Sources: Central Bank of Suriname; General Bureau of Statistics.

2017 growth is picking up. The index tracks correctly real growth except in 2014 and 2016.

6. Construction

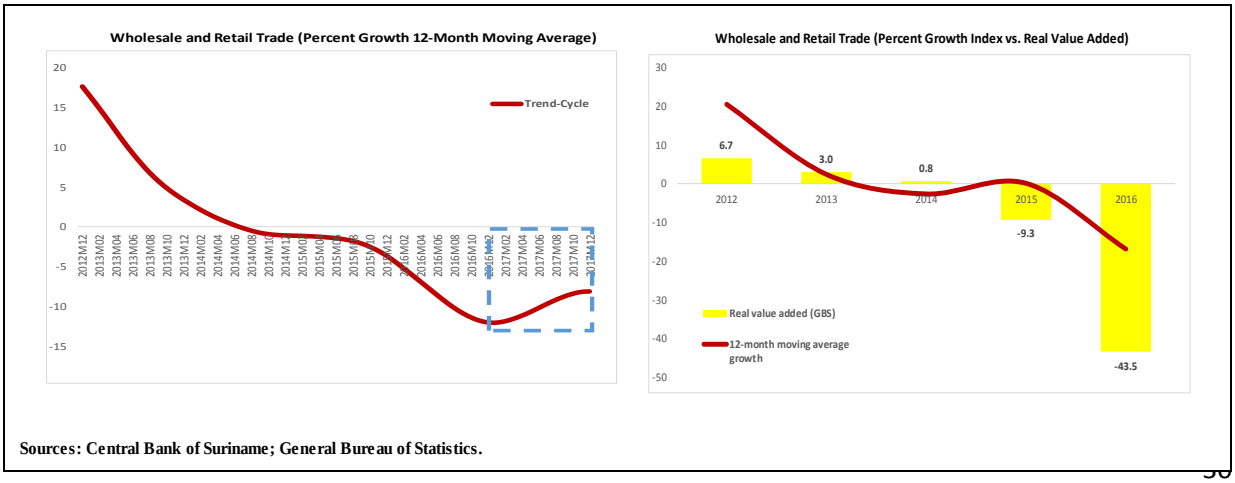
Growth peaked in 2013 due to construction activity in the oil industry. As this activity was gradually coming to a halt, growth decelerated from last quarter of 2015 and contracted further in 2016. Activity rebounded in the last quarter of 2017 due to increasing private investments. The index tracks real growth except in 2014.



Sources: Central Bank of Suriname; General Bureau of Statistics.

7. Wholesale and Retail Trade

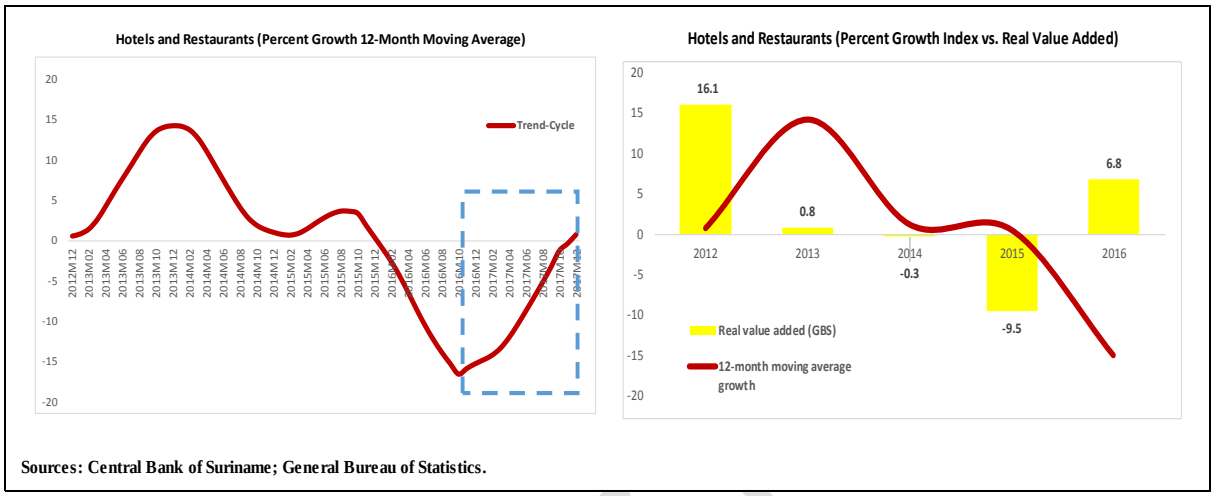
The official devaluation of the exchange rate impacted growth from the last quarter of 2013 and 2014. Growth picked up in 2015 but was below previous level and contracted significantly in 2016 as net purchasing power of private household decreased. Activity rebounded in 2017 but remains below previous levels. The index tracks real growth correctly except in 2014 and 2015.



Sources: Central Bank of Suriname; General Bureau of Statistics.

8. Hotels and Restaurants

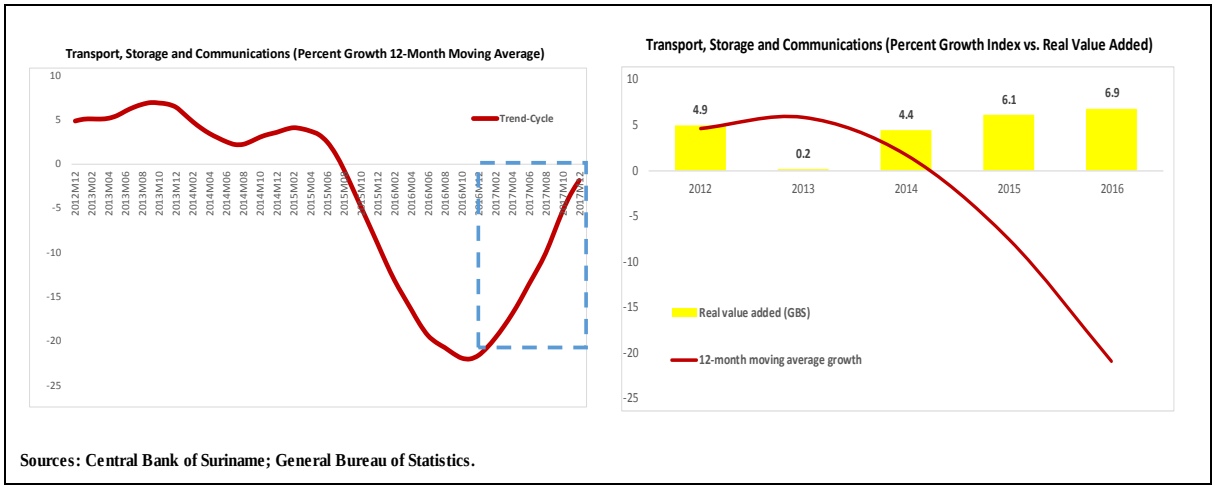
Activity was robust in 2013 and 2014. Growth decelerated since then and activity contracted significantly in 2016. Sign of recovery is evident in 2017 due to increase demand of food away from home by private households. The index does not track real growth during 2014 – 2016.



Sources: Central Bank of Suriname; General Bureau of Statistics.

9. Transport, Storage and Communications

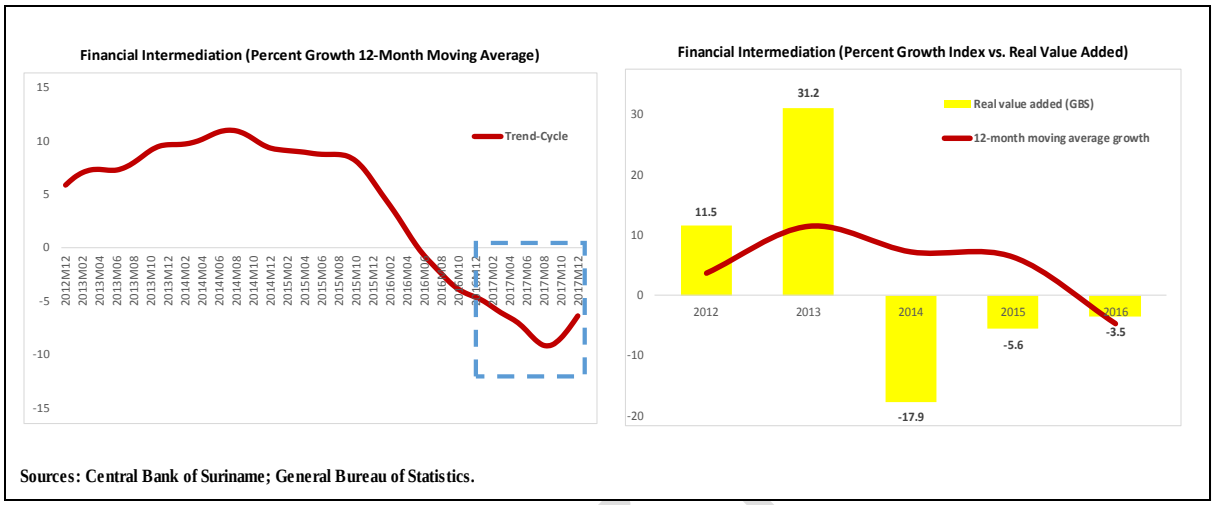
Activity was robust in 2013. However, growth decelerated since 2014 and contracted in the following years. The real turnover of the telecommunications companies was affected significantly by the exchange rate volatility. In addition, the reported number of incoming and outgoing containers decreased as trade contracted. Activity picked up again from quarter four 2017. The index tracks real growth except in 2015 and 2016.



Sources: Central Bank of Suriname; General Bureau of Statistics.

10. Financial Intermediation

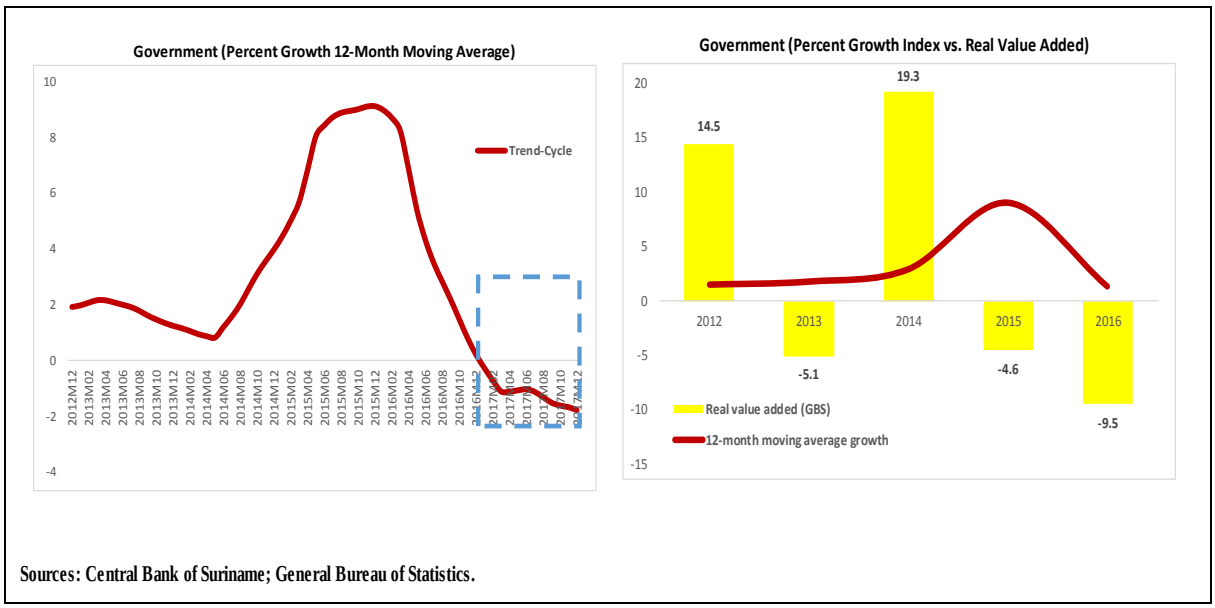
Growth was relative stable during 2013 – 2015 but decreased since the second half of 2016 and contracted further due to slow down in real activity. The index tracks real growth except in 2014 and 2015.



Sources: Central Bank of Suriname; General Bureau of Statistics.

11. Government

The period 2013-2014 shows relative stability in activity. Growth accelerated due to increase spending, but contracted from the second half of 2016 to 2017 due to macroeconomic volatility.



Sources: Central Bank of Suriname; General Bureau of Statistics.

The index track real growth except in 2013 and 2015.