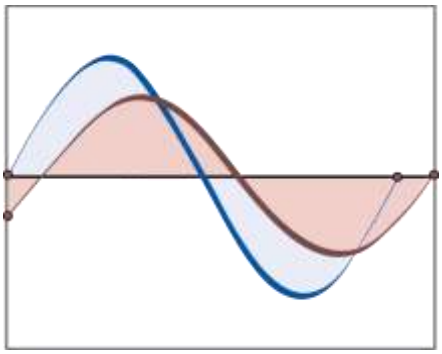
CENTRAL BANK OF TRINIDAD & TOBAGO

Working Papers

WP 03/2017 Sep 2017



Financial Cycles in Small Island Developing States: The Case of Trinidad and Tobago

Yannick J. Melville
Research Department

The paper investigates and determines the financial cycle for Trinidad and Tobago over the period June 1995 to September 2015. Similar to Drehmann et al (2012), advancement of the Trinidad and Tobago financial cycle involves the application of the turning point algorithm and the frequency-based filter. A range of *financial indicators* were considered, but through specification tests centered on volatility, persistence and co-movement, variables which best reflected the *medium-term* periodicity of the financial cycle were utilised. These included; credit-to-GDP, residential property prices, the TTSE composite index and open market operation treasury bill issuances. The results of the study suggest: (i) financial cycle movements mirrored major macroeconomic developments in Trinidad and Tobago; (ii) the Trinidad and Tobago financial cycle during 1995-2015 experienced more expansions (43) than contractions (35) and, (iii) the speed of recoveries (upturns) exceeded the intensity of recessions (downturns).

JEL Classification Numbers: C58, D53, E32

Keywords: turning point algorithm, frequency based filter, medium-term, short-term, credit measure, asset price measure, capital market development, bond market development

Financial Cycles in Small Island Developing States: The Case of Trinidad and Tobago

Yannick Melville

1.0 Introduction

"*Gyrations in financial markets have greatly influenced real activity around the world over the past two decades*" (Claessens, Kose and Terrones 2011). That is, while all economies have experienced varying levels of depressed economic activity, in recent years a common feature of these recessions has been that they were accompanied by various types of financial disruptions. For example, in the early 1990s Japan experienced a severe asset market crash marking the start of the "Lost Decade" (Kristjánsdóttir 2010); in the second half of the 1990s, hot money flows drove asset prices to unsustainable levels forcing many Asian emerging economies into deep financial crises (Radelet and Sachs 1998); speculative trading in the internet sector precipitated the 2001 Dotcom stock market crash (Doms 2004); finally, the implosion of elaborate mortgage-related securities in the U.S. housing market transformed a mild financial disruption into the global financial crisis (GFC) of 2008 (Mishkin 2010). These cases highlighted that, in instances of "good times" financial institutions and their clients have a tendency to underestimate the risks associated with their economic decisions. When these economic agents misconstrue temporary cyclical improvements in the economy as long-term increases in productivity, systemic risk builds-up (Frait and Komárková 2011). When unobserved systemic risk builds-up, these vulnerabilities manifest themselves during "bad times" as negative spirals in economic activity, forcing economic agents to realize that disparities in their balance sheets need to be restructured (Borio 2012).

To circumvent this problem and provide useful support for macroprudential analysis, this paper aims to evaluate the properties and determinants of the financial cycle for the Small Island Developing State (SID) of Trinidad and Tobago. More so, as the financial sector has emerged as the diversification imperative to traditional energy efforts in Trinidad and Tobago, in keeping with the 2020 vision of becoming the Pan Caribbean Financial Centre, measures of the state of financial markets should be particularly valuable in guiding policymakers' decisions on appropriate economic and structural policies.

The remainder of the paper is organised as follows. Section 2 reviews the relevant literature on financial cycles. Section 3 provides an overview of the domestic macro-financial environment. Section 4 presents the methodological structure used to capture financial cycles. Section 5 discusses the results of the model, highlighting its consistency with previously noted works. Section 6 presents the financial cycle for Trinidad and Tobago and section 7 discusses the policy implications of the financial cycle and concludes.

2.0 Literature Review

Although there is no consensus on the definition of the financial cycle the term usually denotes "*self-reinforcing interactions between perceptions of value and risk, attitudes towards risk and financing constraints, which translate into booms followed by busts*" (Borio 2012). Under this paradigm, the determinants that conceptualise the financial cycle focus predominantly on various measures of: credit (for example credit-to-GDP ratios); asset prices, (for example, real estate prices); and equity and bond market developments (ECB 2014). In the empirical literature there are three approaches to modelling financial cycles:

- The first empirical approach assesses the financial cycle using turning point analysis (TPA). This method dates back to Bry and Boschan (1971) and was adapted to quarterly data by Harding and Pagan in 2002 as the Bry Boschan quarterly algorithm (BBQ). While originally used to analyse business cycles, the recent studies of Claessens et al. (2011) and Drehmann et al. (2012) adopted TPA to investigate financial cycles.
- The second prominent approach is frequency-based filters (FBF) which are usually based on Baxter and King (1999). This technique studies the behaviour of cyclical movements by isolating the cyclical pattern of the underlying time series. In recent literature, two dominant types of frequency-based filters are used to visualise cyclical behaviours: the Hodrick-Prescott filter (HP)[1] and the band-pass filter (BP)[2].
- Finally, by extracting the principal components from data on: interest rates, exchange rates, risk spreads, asset prices, financial strength and credit aggregates, the financial cycle can be portrayed as a composite index (English, Tsatsaronis and Soli 2005, Ng 2011).

The distinguishing features of the financial cycle, as put forward by these studies, are:

i. Financial cycle duration and amplitude are considerably longer and larger than that of the classical business cycle (Claessens, Kose and Terrones 2011). Drehmann et al. (2012) note that traditionally business cycles involve high frequencies from 1 to 8 years[3], however the financial cycle operates at lower, medium-term frequencies, with a cycle length between 8 to 30 years. The extended length of the financial cycle reflects the gradual build-up of macro-financial instability (Strohsal, Proaño and Wolters 2015).
ii. The peak of the financial cycle estimate is closely related to real life financial crises (Borio, 2012). This close link between the estimated financial cycle and financial crises, allows the estimated financial cycle to act as an early warning system that can help detect potential financial distress risks.
iii. The length and amplitude of the financial cycle is affected by the prevailing financial, monetary and real-economy conditions (Borio 2012).

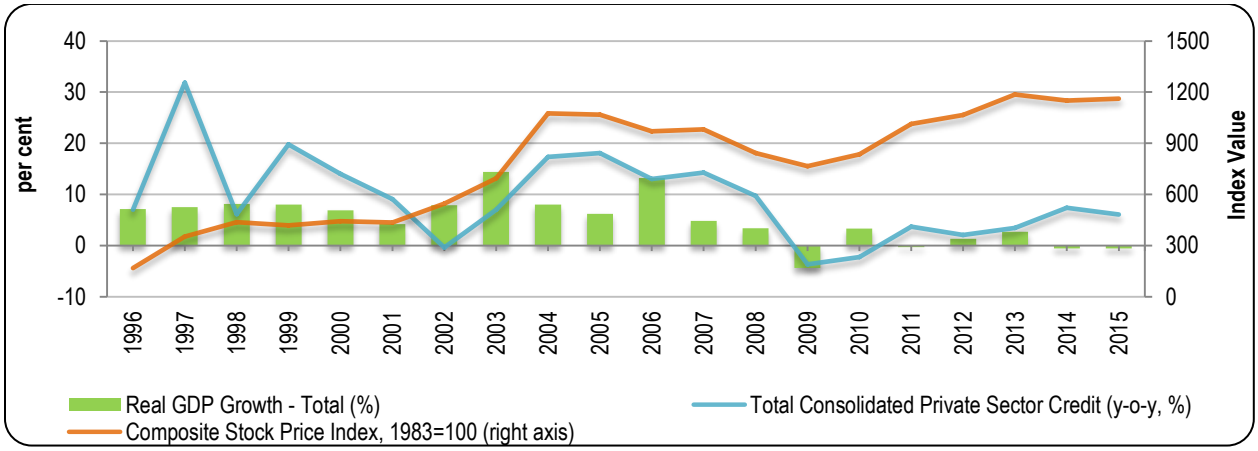
Despite progress in this field of research, due to the lack of consensus on the fundamental characteristics of the financial cycle the greatest shortcoming of existing insights of financial cycles are that they are quite descriptive and in most cases do not allow the testing of the hypothesised characteristics of the financial cycle (Strohsal, Proaño and Wolters 2015).

[1] The HP filter, developed by Hodrick and Prescott (1981,1997), splits the data series into trend and cycle components by applying a criterion function to penalise deviations from the trend using pre-specified weights (Comin and Gertler 2003).
[2] The BP filter developed by Christiano and Fitzgerald (2003) is basically a two-sided moving average filter isolating certain frequencies in the time series.
[3] Reid et al (2012) assume that the real business cycle length may in fact be shorter. They believe that government authorities created artificially long business cycles through aggressive monetary and fiscal policies. However, as time has passed, the effectiveness of fiscal and monetary policy regimes has diminished with (for example); high information transmission networks, financial innovation (Minsky, 1990) and low interest rate environments forcing a return to more normal length, shorter business cycles.

3.0 Background

The transformation of the financial services landscape from an embryonic stage to playing a pivotal role in channeling capital throughout the Caribbean, is a result of the combined efforts of the Central Bank of Trinidad and Tobago (CBTT) and the Government of the Republic of Trinidad and Tobago (GORTT) (IADB 2011). That is, the liberalisation of the financial system in 1993[4], along with the divestment of a number of state enterprises by GORTT (World Bank 2000) created the enabling environment for an exponential boost in financial intermediation and capital markets (Figure 1). This pattern of financial sector development however, petered out between 2000 and 2002 following public discontent on predatory banking practices[5]. While buoyant energy prices (Figure 2) buttressed aggregate demand during 2003 to 2007, subsequent turmoil in global financial markets threatened commodity prices in 2008. Furthermore, downward pressures intensified in 2009 following the collapse of two major financial institutions, the Hindu Credit Union in October 2008 and the CL Financial Group in January 2009. As the GORTT battled to contain the slowdown in real GDP growth (Figure 1) and limit the contagion effects of this systemic crisis, banking system lending started to retreat with institutions exhibiting a preference to maintain liquidity levels (Figure 3) in this uncertain economic environment. CBTT intervention served to reinforce GORTT efforts to support the domestic economy as, easy monetary conditions[6] (as reflected by several cuts in the repo rate) and robust liquidity management schemes[7] allowed financial markets to move towards a path of recovery at the beginning of 2014. However, downward pressures re-emerged in the second half of 2014 as shrinking output and sharp declining oil prices dampened domestic economic activity. In line with the slowing economy, a low risk appetite amongst economic agents has stagnated credit growth levels and capital market development for 2015.

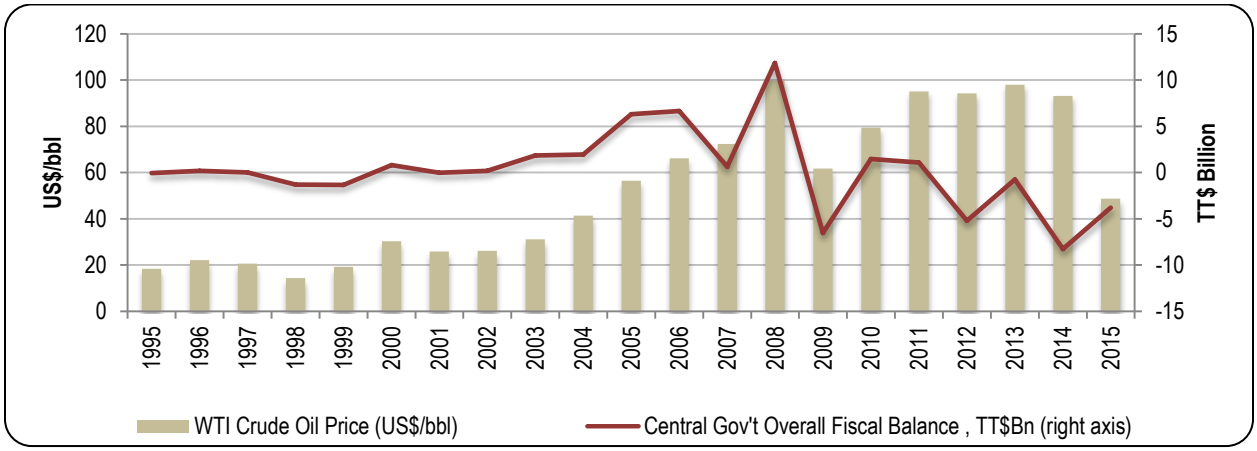
Figure 1
Selected indicators of the credit market environment (1996 – 2015)



Source: Central Bank Trinidad and Tobago.

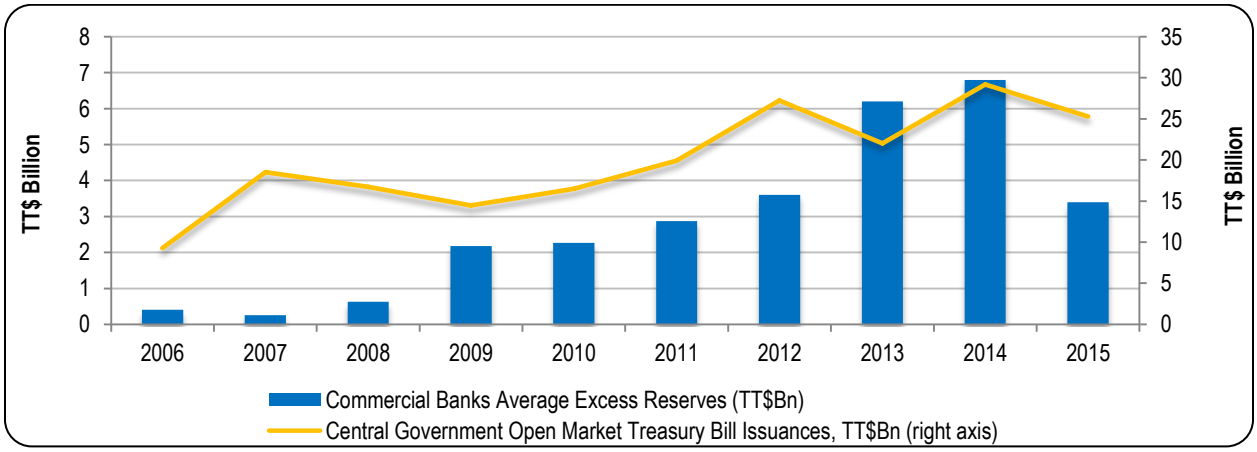
[4] In the late 1990s innovation and liberalisation facilitated the introduction of multiple banking service providers (Forde, et al. 2009).
[5] "During the first quarter of 2002, there was a public outcry against the range and level of bank service fees as well as the relatively high and exorbitant profits of commercial banks" (Forde, et al. 2009).
[6] The accommodative monetary policy stance by the CBTT was deemed "appropriate" by the IMF during the Trinidad and Tobago: 2010 Article IV Consultation (IMF 2011).
[7] In particular aggressive net open market operations combined with consecutive repo rate hikes (as at October, 2015) halved existing liquidity levels to a daily average of $3.2 billion (as compared to the $6.7 billion daily average that existed in the previous, 2014 corresponding period).

Figure 2
Selected indicators on capital market developments (1995 – 2015)



Source: Central Bank Trinidad and Tobago.

Figure 3
Selected indicators on the domestic liquidity conditions (2006 – 2015)



Source: Central Bank Trinidad and Tobago.

4.0 Methodology

4.1 Data

The empirical literature (Drehmann, Borio and Tsatsaronis 2012, ECB 2014, Schüler, Hiebert and Peltonen 2015), conceptualised the financial cycle through various measures of **credit** (for example, credit-to-GDP ratios); **asset prices**, (such as, real estate prices); and **capital** (for example, stock exchange indices) and **bond market developments** (such as, bond yields). Additional studies (Stremmel 2015) also incorporate bank balance sheet data, variables that directly characterise the behaviour of banking institutions. These measures provide an impression of financial flows analogous to that of the flows of goods and services in business cycle research, with a basis that captures all main financial market segments (ECB 2014). Although there have been many studies covering various aspects of fluctuations in financial markets, research on financial cycles is in its embryonic stage as compared to literature on business cycles (Claessens, Kose and Terrones 2011). In fact, these studies mirror the methodology used in the large body of business cycle research (**turning point and frequency based analysis**). The main difference here is that financial cycles are assumed to possess medium-term periodicities due to the gradual build-up of macro-financial imbalances (Strohsal, Proaño and Wolters 2015). Otherwise stated, the parameter settings used to analyse the **short-term** periodicity of business cycles are inappropriate for **medium-term** financial cycles. Using common parameters and assumptions in Drehmann et al. (2012), the following coincident indicators[8] were analysed over the period 1995 (quarter 2) to 2015 (quarter 3)[9]:

i. gross domestic product (GDP) (as the measure of the business cycle);
ii. WTI crude oil prices (as the measure of the long-term super cycle);
iii. private sector credit-to-GDP and private sector credit-to-non-energy GDP (as credit developments)[10];
iv. residential property prices (as asset price measures);
v. TTSE market capitalisation, TTSE composite stock price index and mutual funds under management (as equity market developments);
vi. open market treasury bill issuances (as bond market developments[11]);
vii. and non-bank liquid asset-to-total assets, total assets of life Insurance companies and non-core liabilities (as bank balance sheet data).

The short-term business cycle (through real GDP[12]) and the long-term commodities super cycle (crude oil prices[13]) were estimated to evaluate the properties of the Trinidad and Tobago financial cycle against the domestic economic environment.

Data transformations similar to those undertaken by Craigwell and Maurin (2007), Drehmann et al. (2012), Stremmel (2015) and Hiebert et al. (2015) were employed:

[8] Given that financial cycles are longer than business cycles (Drehmann, Borio and Tsatsaronis 2012), the focus on longer cycles, advocates for a long data set which, ruled out a number of financial indicators.
[9] Time frame determined by data availability.
[10] Private sector credit is comprised of lending to the private sector (i.e. consumers, businesses and real estate) by the consolidated financial system (i.e. banks and non-banks).
[11] Open market operations entail the purchase and sale of government securities by the CBTT and is the main policy tool for influencing the level of liquidity in the domestic financial system. Its role in the securities market along with the added benefit to sterilize banking system liquidity makes OMOs an ideal measure for bond market developments.
[12] As the business cycle is related to aggregate economic activity, a popular indicator of the business cycle in recent literature (Anas and Laurent 2004, Craigwell and Maurin 2007, Drehmann, Borio and Tsatsaronis 2012) has been the gross domestic product (GDP).
[13] Source of data http://chartsbin.com/view/oau.

Equation 1: Turning Point Analysis Transformation

$$Transformation\ for\ TPA: Raw\ Data \rightarrow Deflate \rightarrow Log \rightarrow Normalisation$$

Equation 2: Frequency Based Filter Transformation

$$Transformation\ for\ FBF: Raw\ Data \rightarrow Deflate \rightarrow Log \rightarrow Normalisation \rightarrow Annual\ Difference$$

That is, to ensure comparability of results with previously noted works this paper: deflates the nominal variables by the GDP Deflator to yield real values; converts all series by logs (except for ratio variables and indices[14]); and normalises variables by their respective log value[15] (Table 1). FBF contains an additional step of applying a four quarter difference (an annual difference) to the data as is consistent with studies on medium-term cycles (Comin and Gertler 2003, Drehmann, Borio and Tsatsaronis 2012, Gómez-González, et al. 2013, Growiec, McAdam and Mućk 2015).

Table 1
Definitions of key variables

Acronym	Variable	Source	Transformations[4]
QGDP[1]	gross domestic product at current prices (TT$Mn)	CBTT	-
HPRICE[1]	median residential property prices (TT$Mn)	CBTT	-
MCAP	TTSE market capitalisations (TT$Mn)	CBTT	-
CINDEX	TTSE composite stock price index (1983=100)	CBTT	-
NBLATTA	non-Banks liquid assets to total assets (%)	CBTT	-
MFUNDS [1 2]	mutual funds under management (TT$Mn)	CBTT	-
INS[1]	total assets of life insurance companies (TT$Mn)	CBTT	-
PCTGDP	private credit-to-GDP (%)	CBTT	consolidated lending to the private sector / gross domestic at current prices
PCTNEGDP	private credit-to-non-energy GDP ratio (%)	CBTT	consolidated lending to the private sector / non-energy gross domestic at current prices
OMO[3]	central government open market treasury bills outstanding (TT$Mn)	CBTT	-
NCL	non-core liabilities (TT$Mn)	CBTT	-

Source: Author.

Note: [1] Quadratic-match average method[16] was used through EViews to interpolate the annual data to a quarterly frequency.

[2] Monthly data was converted to quarterly data using the average observations method through EViews.

[3] Central government open market operation treasury bill issuances for 1995 q2 – 1999 q4 were estimated through back-casting under the R package.

[4] This column includes additional transformations to the data apart from those listed in equation 1 and equation 2.

4.2 Model

Drehmann et al (2012) focused on decomposing and analysing the statistical properties of individual coincident indicators before developing their final aggregate measure for the financial cycle. The properties of these coincident

[14] For FBF an additional step is taken as ratios are expressed as percentage points (Drehmann, Borio and Tsatsaronis 2012).

[15] The point of reference for normalisation is determined through the Chow Test (Harun, et al. 2014). See Appendix 1 for more information.

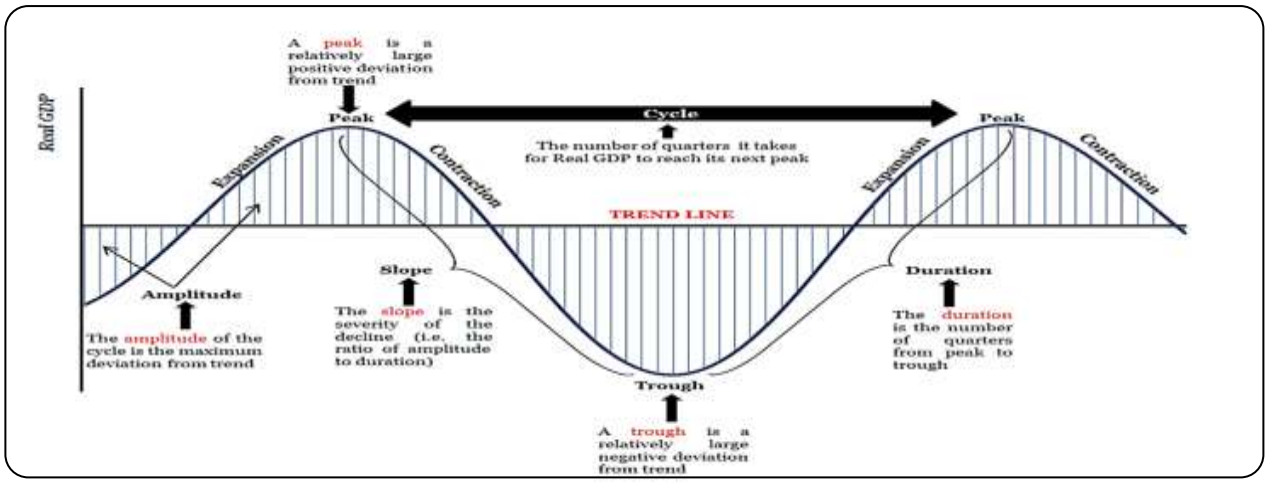
[16] Interpolation methods are used for the conversion of low frequency data to high frequency data – that is, for temporal disaggregation whenever no additional source of high frequency data is available to facilitate the conversion. Although there are different econometric disaggregation techniques, such as the Denton (1971) and Chow and Lin (1971) the preferred choice for interpolation was the quadratic-match average method given that the quadratic-match method is less sensitive to outliers (Grossman and Mack 2014) .

indicators were derived through applying the TPA and FBF to the transformed data (equation 1 and equation 2 above).

Turning Point Analysis: TPA yields peaks and troughs of a cycle through the Bry-Boschan (BB) Algorithm. BB algorithm first identifies potential peaks and troughs which are higher and lower compared to their respective surroundings. Potential peaks and troughs are subjected to various tests before final peaks and troughs are established. In the first step, a potential peak is identified at time t if it obeys the rule $(y_t - y_{(t-i)}) > 0$. Similarly, a potential trough occurs at time t if it obeys the rule $(y_t - y_{(t-i)}) < 0$. The second step in the BB algorithm involves subjecting the identified potential peaks and troughs to censoring rules. Censoring rules ensure that length of a phase (from peak to trough and vice versa) and a cycle (from peak to peak or from trough to trough) meets the minimum requirement. The final output (Figure 4) from the BB algorithm focuses on:

- **Duration:** the number of quarters in a phase.
- **Amplitude:** the steepness of the cyclical phase.
- **Slope:** the speed of upturns and downturns.

Figure 4
Interpreting the Cycle



Source: Author.

Frequency-Based Filter: The aim of this filter is to isolate a specific range of frequency of macroeconomic data. Data is first changed from time domain to frequency domain using Fourier Transformation then the filter process takes place, passing only frequency higher than the low frequency threshold and lower than the high frequency threshold (the intended cycle length). A band pass filter with duration of 5 to 32 quarters (1 to 8 years) represents the short-term cycle component; 32 to 80 quarters (8 to 20 years) represent the medium-term cycle component; and 80 to 280 quarters (20 to 70 years) the super cycle (Zelllou and Cuddington 2012).

4.3 Procedure

Following Drehmann et al (2012), the BBQ algorithm was first used to isolate the turning points[17] (locally absolute maxima and minima that meet censoring rules) in the log level transformation (equation 1) of each individual *financial indicator.* Following this, the log level data was converted into growth rates (apart from all ratios and indices) through annually differencing the data (equation 2); then the band-pass (CF[18]) filter was used to find the short-term, medium-term[19] and long-term components as appropriate[20]. Both methods were employed using algorithms in Microsoft Excel (for TPA) and EViews (for FBF). Once this was completed, the behaviour of the short-term and medium-term cycles in each individual financial indicator was then explored. The messages from these analyses informed the choice for the aggregate financial cycle (the simple average of the medium-term FBF results and the common cycle from the TPA results).

[17] For the short-term cycle, the minimum length for a phase is 2 quarters and 5 quarters for a cycle (Harding, 2008). For the medium-term cycle, the minimum length for a phase is 9 quarters and 20 quarters for a cycle (Harun, et al. 2014).

[18] The rationale behind choosing the BP-filtered over the HP-filter and the BK filter is that: the HP filter would have to be used twice to deliver an appropriate frequency band; and the BK approximation incurs a loss in the number of observations in the filtered series (Growiec, McAdam and Mućk 2015).

[19] Due to data availability, the duration of the medium-term cycle component is adjusted from the 32 to 80 quarters in Zellou and Cuddington (2012); Harun, Taruna, Nattan, & Surjaningsih (2014) and Gómez-González, Ojeda-Joya, Tenjo-Galarza, & Manuel Zárate (2013) to 32 to 78 quarters (78 quarters being the end of the time series analysis in this paper).

[20] To draw sharper and more robust conclusions on the financial cycle the TPA and FBF results should validate one another (Drehmann, Borio and Tsatsaronis 2012). Consequently, as in Growiec et al (2015), to facilitate comparisons between TPA and FPF all filtered results were demeaned and cumulated (this process converts the FBF results into log levels).

5.0 Results

5. 1 Turning Point Analysis: Short-Term & Medium-Term Cycles

Tables 2 and 3 summarize the results from the turning-point dating algorithm[21]:

Table 2
Characteristics of the short-term components identified by the Bry-Boschan quarterly algorithm

Short-term Component	Duration				Amplitude		Slope	
	Number of quarters				In Percent		In Percent	
	Average duration of contractions	*Average duration of expansions*	*Cycle*		*Average amplitude of contractions*	*Average amplitude of expansions*	Contraction	Expansion
			Peak - Peak	*Trough - Trough*				
real GDP	5	23.7	21	21	-0.1	1.4	-0.02	0.06
residential property prices	4.6	9.7	13.5	13.8	-0.7	0.95	-0.14	0.1
market capitalisations	6.6	9.6	19.3	18.8	-0.4	1.2	-0.06	0.12
composite index	4.2	10	15.3	15.3	-9.0	22.8	-2.14	2.28
non-banks liquid assets-to-total assets	4.5	6.4	9.2	11	-17.8	24.9	-3.95	3.87
mutual funds	5	11.2	21.3	18.3	-2.4	5.7	-0.49	0.51
insurance	6.3	14	11	20	-1.5	2.6	-0.24	0.18
private credit-to-non-energy GDP	9.4	5.7	13	16.5	-5.4	5.2	-0.57	0.91
private credit-to- GDP	11.4	4.8	9.7	8.3	-6.1	6.5	-0.53	1.36
open market operations	3.3	10.2	12	13.5	-11	13.2	-3.31	1.29
non-core liabilities	5.42	5.37	11	11.67	-.5551	1.0264	-0.102	0.191

Source: Author.

Table 3
Characteristics of the medium-term components identified by the Bry-Boschan quarterly algorithm

Medium-term Component	Duration				Amplitude		Slope	
	Number of quarters				In Percent		In Percent	
	Average duration of contractions	*Average duration of expansions*	*Cycle*		*Average amplitude of contractions*	*Average amplitude of expansions*	Contraction	Expansion
			Peak - Peak	*Trough - Trough*				
real GDP	6.5	34	21	-	-0.01	2.05	-0.0018	0.0604
residential property prices	6	23	27	35	-0.86	1.36	-0.14	0.06
market capitalisations	14	8	29	27	-0.55	1.37	-0.04	0.16
composite index	13	27.5	34	-	-9.65	55.56	-0.74	2.02
non-banks liquid assets-to-total assets	15	25.5	55	-	-37.61	53.59	-2.51	2.1
mutual funds	10.5	20	50	64	-1.28	6.29	-0.12	0.31
insurance	12	15	22	27	-1.75	3.22	-0.15	0.21
private credit-to-non-energy GDP	17	10	20	33	-5.87	7.2	-0.34	0.74
private credit-to- GDP	16.5	16	30	33	-18.96	13.34	-1.15	0.83
open market operations	4	24	50	54	-19.57	17.27	-4.89	0.71
non-core liabilities	-	-	-	-	-	-	-	-

Source: Author.
Note: Blank cells imply that there were not enough observations to effectively estimate the medium-term cycle properties of that coincident indicator.

[21] Note: Results produced from Excel coding by James Engel see http://www.ncer.edu.au/data/documents/BBQEXCELINSTRUCT.pdf.

For purposes of this study, a cycle is defined as the average number of quarters from peak to peak. The turning-point dating method identified 150 short-term cycles[22] (Table 2) and 489 medium-term cycles (Table 3). Short-term coincident indicators lasted between 2.3 and 5.3 years (a typical short-term cycle lasts between 1 and 8 years). Medium-term cycle coincident indicators lasted on average between 5 and 13.75 years (a typical medium-term cycle lasts between 8 and 20 years). In particular, medium-term components, non-banks liquid assets-to-total assets, had the longest cycle, 55 quarters (13.75 years), while private credit-to-non energy GDP had the shortest cycle of 20 quarters (5 years).

Expansions (the average number of quarters from trough to peak) lasted 4.8 to 23.7 quarters for the short-term components and 8 to 34 quarters for the medium-term components. Contractions (the average number of quarters from peak to trough) on the other hand lasted 3.3 to 11.4 quarters for the short-term components and 4 to 31.5 quarters for the medium-term components. Asset price (residential property prices) and bond market (open market operations) expansions lasted on average twice as long as their respective contractions.

The amplitude of the turning points evaluates the degree to which, or how the coincident indicators deviated from trend. The results for the medium-term components indicate that:

- Booms in the private-credit-to-GDP ratio and open market operations are more pronounced than busts;
- Busts in residential property prices, market capitalisation, the composite index, mutual funds, insurance, non-banks liquid assets-to-total assets and private credit-to-non-energy GDP, are more pronounced than booms.

The slope of the coincident indicator is the ratio of its amplitude to its duration. That is the slope measures the intensity of booms or busts. While contractions in the medium-term components for residential property prices, open market operations, private credit-to-GDP and non-bank liquid assets-to-total assets are more intense than their expansions (both in the short-term and medium-term), the converse holds for total assets of the insurance sector, mutual funds, private credit-to-non energy GDP, the composite index and market capitalisation.

To summarize, over the period June 1995 to September 2015, the BBQ algorithm revealed that:

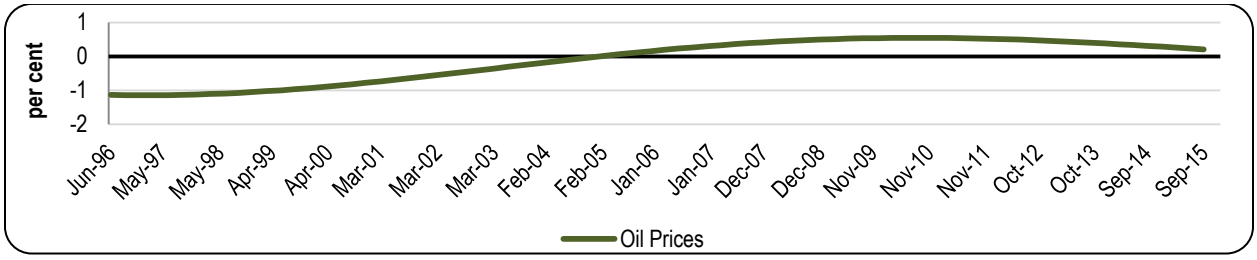
- **Credit Measures:** private credit-to-GDP and private credit-to-non-energy GDP possessed the longest contractions out of all the other coincident indicators. In particular, the high average amplitude of contractions for private credit-to-GDP hints at an economy where financial intermediation contractions are more pronounced than expansions.
- **Asset price measures:** expansions in the medium-term component for this measure (residential property prices) lasted at least twice as long as contractions.
- **Capital market development:** mutual funds, TTSE composite index and market capitalisations hint at a positively skewed capital market (given that the magnitude of the expansionary phases exceeds the magnitude of contractionary phases).
- **Bond market development:** expansions in the medium-term component for this measure (open market operations) lasted at least 6 times as long as contractions.
- **Bank balance sheet data:** the high average amplitude of expansions in non-bank liquid assets-to-total assets and total assets of the insurance sector indicate a developing financial sector.

[22] Given the purpose of this paper, most of the discussion here will focus on the medium-term cycle results.

5.2 Frequency Based Analysis Short-Term, Medium-Term & Long-Term

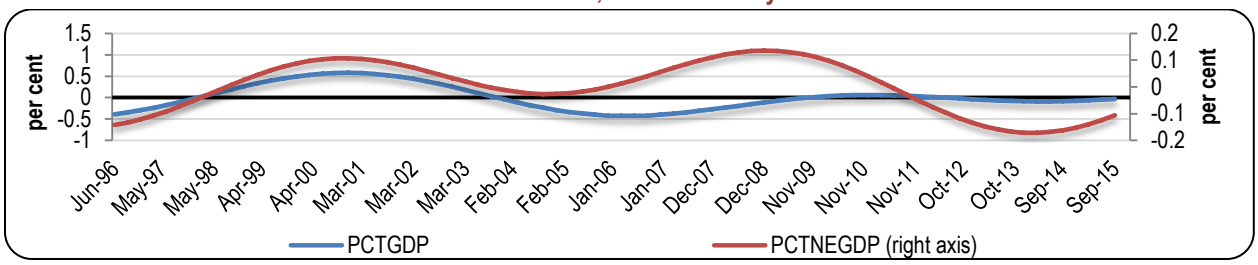
Figure 5 shows the super cycle for oil prices[23]. Figures 6, 7, 8, 9 and 10 show the medium-term cyclical components of credit measures; asset price measures, capital market development; bond market development and bank balance sheet data, respectively. Figure 11 shows the short-term cyclical component of real GDP.

Figure 5
Oil Prices, long-term cycle



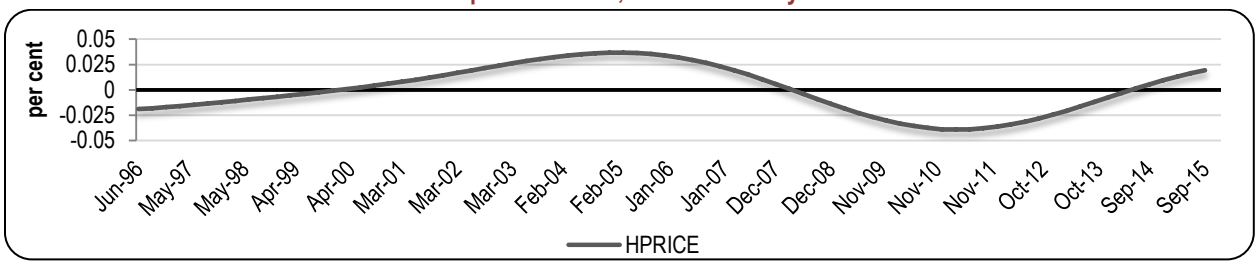
Source: Author.

Figure 6
Credit measures, medium-term cycle



Source: Author.

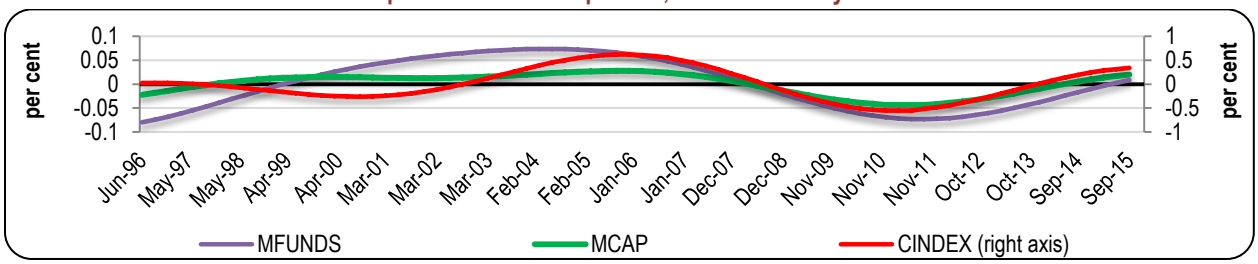
Figure 7
Asset price measure, medium-term cycle



Source: Author.

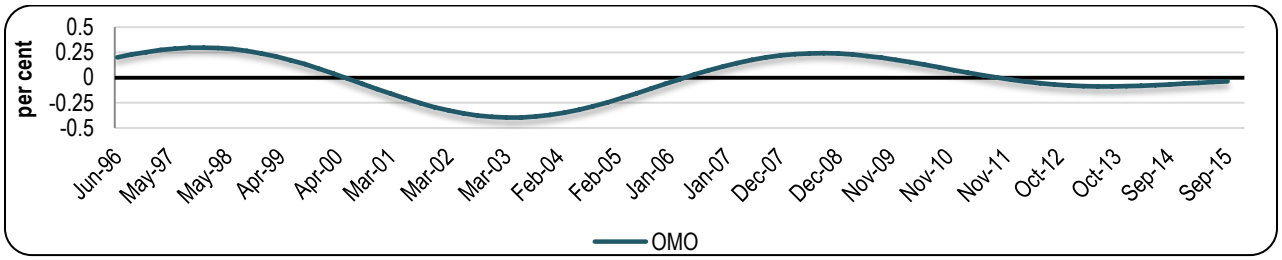
[23] To facilitate comparisons with short-term and medium-term FBF results, this section will only display the oil prices super cycle from June 1995 to September 2015.

Figure 8
Capital market developments, medium-term cycle



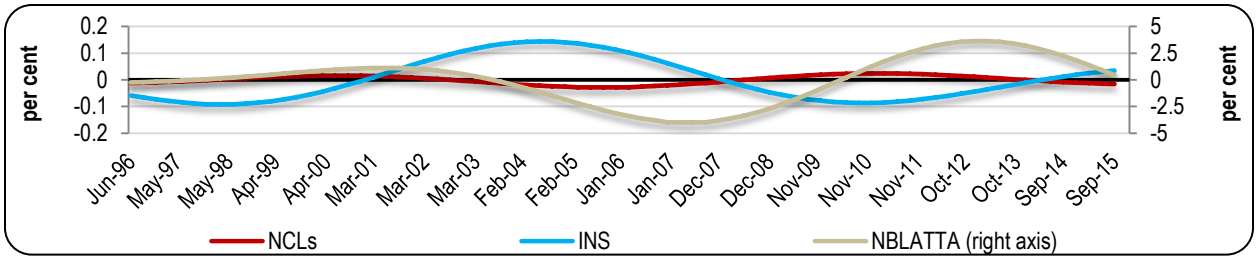
Source: Author.

Figure 9
Bond Market Developments, medium-term cycle



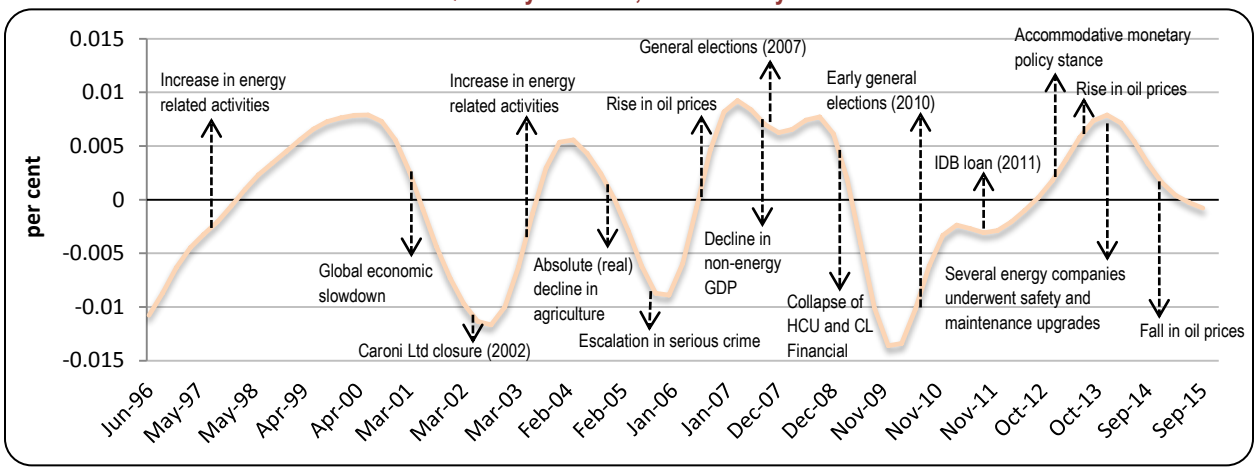
Source: Author.

Figure 10
Bank Balance Sheet Data, medium-term cycle



Source: Author.

Figure 11
Quarterly real GDP, short-term cycle



Source: Author.

Given that the units on the vertical axis represent percentage deviations from trend, the diagrams help to characterise the underlying indicators and to make general statements about their potential usefulness.

- From Figure 5, oil prices appeared weak with below trend growth rates (1996 - 2005) and a noticeable dip in above trend movement in the latter stages of the cycle (2012 - 2015).
- From Figure 6, private credit-to-non-energy GDP exhibited more above trend growth, whereas private credit-to-GDP more below trend growth.
- From Figure 7, residential property prices portrayed a noticeable period of prolonged above trend growth from 2000 - 2008.
- From Figure 8 the coincident indicators for capital market development for the most part followed the same pattern of behaviour. That is, these coincident indicators occurred concurrently.
- From Figure 9, open market operations displayed more periods of above trend growth than below trend growth.
- From Figure 10, insurance assets portrayed mainly below trend growth, non-bank liquid assets-to-total assets portrayed mainly above trend growth and non-core liabilities, low levels of above trend growth but high levels of below trend growth.

While TPA and FBF have provided insight on the behaviour of specific coincident indicators, the practicality of these stand-alone measures of cyclical activity is very limited given that they may miss certain developments in financial markets and in general do not give a conclusive picture of the financial sector. Instead, as in Drehmann et al (2012), these results suggest that it may be more feasible to combine the messages from the individual variables and establish an aggregate measure of financial market developments. Akin to the real business cycle literature (Growiec, McAdam and Mućk 2015) to find the best measures of this aggregate financial cycle, medium-term components were analysed according by: volatility (standard deviation), persistence (first-order autocorrelation) and co-movement (concordance index).

5.3 Volatility

Table 4 reports the ratio of the standard deviation of the medium-term components to the short-term components. A ratio higher than unity implies that the time horizon of the financial indicator is medium-term. In other words, the ratio of the standard deviations of the short-term and medium-term components indicates, on average, which of the cycle measures are more important in shaping the behaviour of the series (the short-term or the medium-term).

Table 4
Relative volatility of the short and medium-term cycles of the individual series

Variable	Medium-term Standard Deviation	Short-term Standard Deviation	Ratio
HPRICE	0.023	0.018	**1.288**
MCAP	0.022	0.026	0.85
CINDEX	0.336	0.328	**1.023**
NBLATTA	2.182	1.046	**2.086**
MFUNDS	0.052	0.049	**1.043**
INS	0.079	0.034	**2.286**
PCTGDP	0.287	0.275	**1.042**
PCTNEGDP	0.095	0.111	0.855
OMO	0.209	0.139	**1.498**
NCL	0.016	0.021	0.744

Source: Author
Note: Cells shown in bold denote cases where the ratio of medium-term to short-term component is greater than 1.

Financial components; HPRICE, CINDEX, NBLATTA, MFUNDS, INS, PCTGDP and OMO all have ratios of higher than unity. Given that the gradual build-up of macro-financial instability places more significance on lower frequency, medium-term components, for the rest of the paper focus is placed on these seven variables.

5.4 Persistence

The dynamic effect of any shocks depends on the persistence of the series. For highly persistent series, the shock has a long-lasting effect. For weakly persistent series the effect of the shock diminishes sooner (Darvas and Szapáry 2004). To derive an aggregate measure of the financial cycle, (from the perspective of synchronisation of series), similar persistence is important. Persistence may be measured through the first order autocorrelation coefficient of the medium-term components.

Table 5
The relative persistence of the medium- term components

Medium Term Component	First Order Autocorrelation Coefficient*
HPRICE	0.98
CINDEX	0.98
NBLTTA	0.97
MFUNDS	0.98
INS	0.98
PCTGDP	0.98
OMO	0.97

Source: Author
Note: * All First Order Autocorrelation Coefficients were statistically significant at p = .01

From Table 5, the seven synthetic measures of the financial cycle all have high levels of statistically significant persistence and as such must be further evaluated to determine which variables are indeed the true measures of the financial cycle of Trinidad and Tobago.

5.5 Co-Movement

To analyse co-movement, this paper employs the concordance index to the TPA results. The concordance index is a bivariate index of synchronisation developed by Harding and Pagan (2002) that expresses the time periods in which two time series are in the same phase in relation to all periods. The index has a range value of 0 per cent to 100 per cent with an increasing index indicating better co-movement between two variables. That is if both time series are expanding or contracting at the same time, the concordance index will be at 100 per cent. If both time series have fully independent cycles, the concordance index will be 50 per cent. The concordance index indicates which variables best capture the financial cycle given that variables that do not co-move with other potential financial cycle measures will cancel out the potential peaks and troughs of the financial cycle measure.

Table 6
The relative co-movement between the medium-term components

	PCTGDP	HPRICE	MFUNDS	INS	CINDEX	OMO	NBLATTA
PCTGDP	-	-	-	-	-	-	-
HPRICE	0.65	-	-	-	-	-	-
MFUNDS	0.54	0.60	-	-	-	-	-
INS	**0.71**	0.65	0.54	-	-	-	-
CINDEX	0.60	**0.78**	**0.48**	0.59	-	-	-
OMO	**0.50**	0.78	**0.79**	**0.45**	0.61	-	-
NBLATTA	0.50	0.54	0.45	**0.23**	0.51	0.63	-
QGDP	**0.44**	0.74	**0.63**	**0.44**	**0.84**	0.77	0.67

Source: Author.
Note: The lower diagonal consists of the concordance indices[24]. Bolded cells indicate statistical significance.

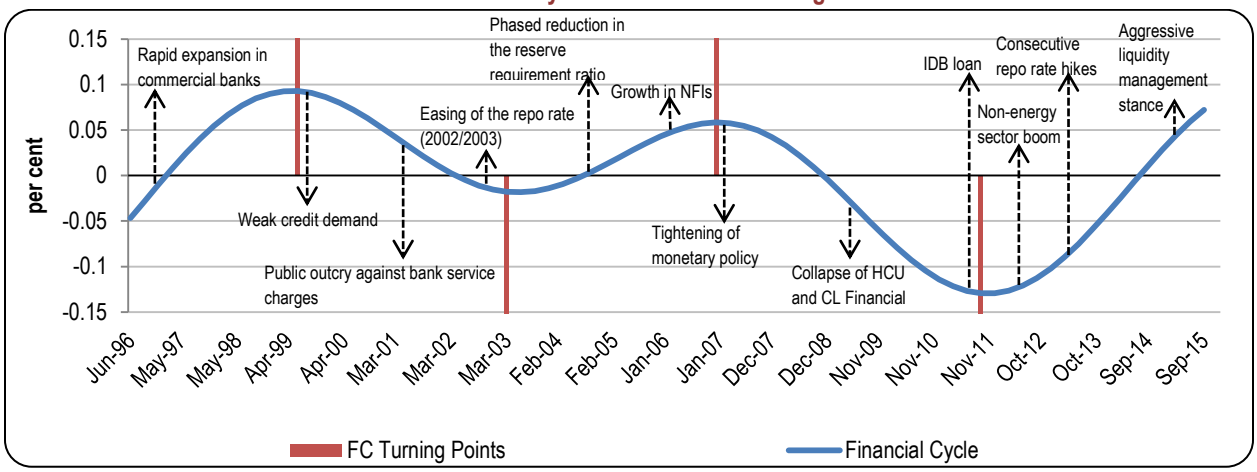
From the lower diagonal of Table 6, PCTGDP, HPRICE and CINDEX all have high levels of co-movement (HPRICE and CINDEX in particular possess statistically significant co-movement) and as such must be considered in the final aggregate measure of the financial cycle. The lack of statistically significant concordance indices for MFUNDS, INS, NBLATTA and OMO (50 percent concordance implies diverging series) however imply that these variables should not be considered in the final aggregate measure of the financial cycle.

[24] Please see Appendix 2 for further information.

6.0 The Financial Cycle

Ultimately, following various specification tests (measures of medium-term cycle volatility, persistence and co-movement), the Trinidad and Tobago Financial Cycle was set to be a combination of the medium-term cycles in: residential property prices, private credit-to-GDP and the TTSE composite index, indicators consistent with empirical literature. However, as other studies have complemented their financial cycles with country-specific bond market developments (ECB 2014), the Financial Cycle was also approximated with open market operations (despite the low concordance index with private credit-to-GDP). The importance of open market operations in sterilising and keeping banking system liquidity at appropriate levels in Trinidad and Tobago cannot be ignored and should be included in a comprehensive measure for financial sector distress. As such these four "dominant" indicators were used to estimate the Trinidad and Tobago financial cycle (Figure 12).

Figure 12
The financial cycle of Trinidad and Tobago



Source: Author.

Note: The blue line is the aggregate frequency based filter results. The red columns are the aggregate turning point analysis results.

Table 7
Properties of the Trinidad and Tobago financial cycle

Condition	Expansion	Contraction
Number of quarters	43	35
Average duration	14	17.5
Median duration	14	17.5
Max duration	16	19
Min duration	13	16
Proportion of time	55 %	44 %
Average amplitude	.139	.149
Slope	0.0099	-0.0079

Source: Author

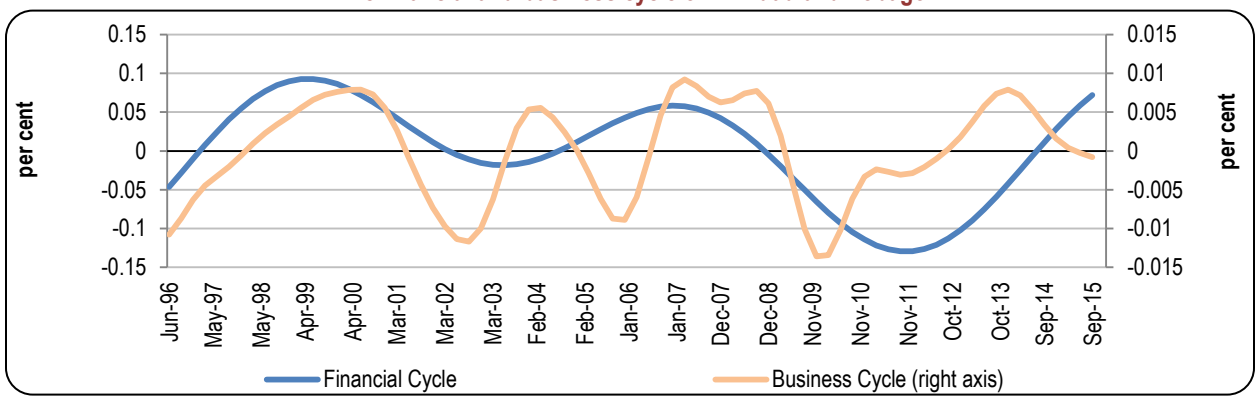
Note: Results produced from Excel coding by James Engel see http://www.ncer.edu.au/data/documents/BBQEXCELINSTRUCT.pdf

Figure 12 shows that the Financial Cycle exhibits a cyclical pattern (Table 7), consistent with macroeconomic and financial sector developments in Trinidad and Tobago:

- ❖ The mid-1995 to mid-1998 rise in the financial cycle corresponds to the rapid advancement of financial intermediation services in the late 1990s.
- ❖ The mid-1998 to mid-2004 sudden protracted decline in the financial cycle corresponded to signs of a credit crunch combined with weak loan demand.
- ❖ The rise in the financial cycle from mid-2004 to mid-2008 corresponds to the expansive period of development in the asset price and capital market measures (Figure 7 and Figure 8).
- ❖ The September-2006 to December-2011 sharp fall in the Financial Cycle effectively captures the impact of the 2008/2009 GFC and its effect on commodity markets as well as the fallout from the failure of a large, interconnected insurance company. In particular, the ability of the Financial Cycle to indicate well in advance the realisation of systemic risk in the financial sector (Section 7) highlights the Early Warning Indicator Properties of this macroprudential indicator.
- ❖ The December-2011 to September-2015, steady rise in the financial cycle hints at a recovering financial sector.

While for the 1996 (quarter 2) to 2015 (quarter 3) period there were more upturns than downturns[25], policymakers should aim to reduce the severity of financial cycle downturns given that financial imbalances can stay hidden and amplify the contraction phase of the business cycle (Drehmann, Borio and Tsatsaronis 2012). Therefore, although the drivers of the financial cycle are important, an appreciation of the interactions between the financial cycle and the business cycle is also essential. While preliminary observations (Figure 13) imply that the average financial cycle (30 quarters) is just about three times as long as the average business cycle (10.3 quarters[26]), of key interest here is the near symmetrical movement between the two measures. This finding hints that the close relationship between perceptions of "good times" and "bad times" and its effect on systemic risk build-up may exist within Trinidad and Tobago. In other words, medium-term expansions (contractions) in private credit-to-GDP, residential property prices, the TTSE composite index and open market treasury bill issuances mirror short-term expansions (contractions) in GDP.

Figure 13
The financial and business cycle of Trinidad and Tobago



Source: Author.
Note: * implies series plotted on the right axis.

[25] Turning points in filtered data are referred to as "downturns" and "upturns".
[26] Rand and Tarp (2002) note the average duration of business cycles for fifteen developing as 7.7 and 12 quarters. Male (2010) notes the average duration of the business cycle for Trinidad and Tobago (from 1978 q1 to 2003 q4) was 12 quarters.

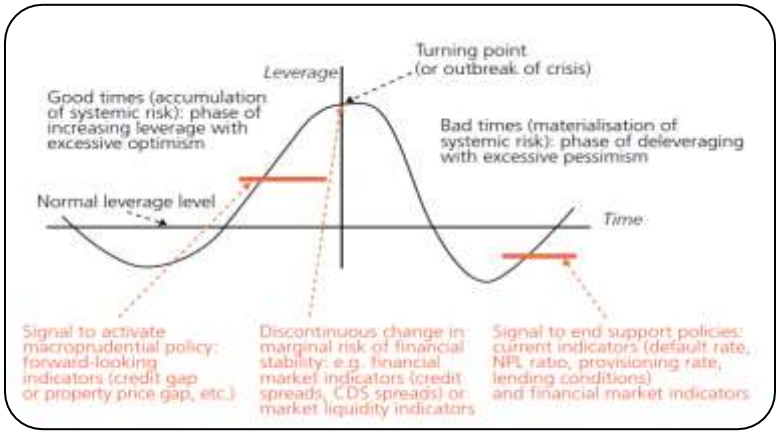
7.0 Conclusion and Recommendations

The financial cycle for Trinidad and Tobago was estimated to be comprised of the medium-term components of four separate financial indicators (private credit-to-GDP, residential property prices, the TTSE composite index and open market operation treasury bill issuances) on the basis of their statistical properties for: volatility; persistence; and co-movement. From Figure 12 and Table 7, it appears that Trinidad and Tobago has done well with regard to the two main tasks of macroprudential policy – prevention and mitigation– given that:

- The narrow range of deviations in trend (+ 9 per cent and –12 per cent) imply low leverage levels within the Trinidad and Tobago financial system.
- The Trinidad and Tobago financial cycle experienced more expansions than contractions (the financial cycle was in expansion 55 per cent of the time).
- Over the June 1996 to September 2015 time period, the speed of recovery of the Trinidad and Tobago financial cycle (as indicated by the slope of expansions) outperformed the violence of recessions (Table 7).

This study delivers the first systemic assessment of cyclical analysis in Trinidad and Tobago. However, across the globe, regulators have been dedicating more resources to understanding the relationships among the various segments of their financial sectors and investigating any inherent risk to the real sector. Therefore, it is recommended that we continue developing a suite of early warning indicators that can be used to refine the local financial cycle. The development of a financial cycle is important to any country as it can assist in forecasting the buildup of vulnerabilities that can destabilize the economy. Macroprudential policy has become quite popular post global financial crisis as it is seen to prevent systemic risk and (if prevention fails) to mitigate the impacts if it materialises. With respect to the prevention perspective, the financial cycle signals when to activate forward-looking macroprudential measures. These forward-looking indicators act as a measure of the degree of materialisation of systemic risk and act to abate its build-up (Figure 14). When the materialisation phase occurs, the impetus on macroprudential policy is to mitigate the impact of the crisis through support policies. By acting through the financial cycle, well-timed support policies should limit the degree of instability. Therefore, the development of our local financial cycle is seen as a stepping stone to improving the CBTT's overall macroprudential framework in assessing the latent balance sheet risks of financial institutions and their clients.

Figure 14
Systemic Risk and the Financial Cycle



Source: (Frait and Komárková 2011)

It should be noted that this study on the local financial cycle is preliminary and hence caution should be taken in interpreting the results due to a number of limitations. In particular, the period of estimation does not contain the minimum number of observations for suitable medium-term cyclical analysis (at least 80 observations for quarterly data are needed). Therefore, further research could deepen the understanding of the Trinidad and Tobago financial cycle as data availability improves. One such extension of the present analysis could relate to a detailed analysis of the drivers of the financial cycle such as, determining the particular developments that cause systemic risk to build up within the Trinidad and Tobago financial sector.

Bibliography

Anas, Jacques, and Ferrara Laurent. 2004. "Detecting Cyclical Turning Points: The ABCD Approach and Two Probablistic Indicators." *Journal of Business Cycle Measurement and Analysis – Vol. 1, No. 2 – ISSN 1729-3618.* http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.194.8542&rep=rep1&type=pdf (accessed 2015).

Artana, Daniel, Sebastián Auguste, Ramiro Moya, Sandra Sookram, and Patrick Watson. October 2007. "Trinidad & Tobago: Economic Growth in a Dual Economy." Inter-American Development Bank. https://sta.uwi.edu/salises/pubs/workingpapers/16.pdf (accessed 2015).

Avouyi-Dovi, Sanvi, and Julien Matheron. 2003. "Interactions between business cycles, financial cycles and monetary policy: stylised facts." *Bank for International Settlements.* http://www.bis.org/publ/bppdf/bispap22p.pdf (accessed 2015).

Borio, Claudio. December 2012. "The financial cycle and macroeconomics: What have we learnt?" *Bank for International Settlements, BIS Working Papers, No 395.* http://www.bis.org/publ/work395.pdf (accessed 2016).

CBTT. 2008. "Financial Stability Report." *Central Bank of Trinidad and Tobago.* http://www.central-bank.org.tt/pdf/Research%20and%20Publications/Financial%20Stability%20Report%202008.pdf (accessed 2016).

CBTT. September 2005. "The Implementation of Monetary Policy in Trinidad and Tobago." *Central Bank of Trinidad and Tobago.* http://www.central-bank.org.tt/pdf/Public%20Education%20Pamphlets/Public%20Education%20Pamplet%20%20The%20Implementation%20of%20Monetary%20Policy%20In%20Trinidad%20&%20Tobago.pdf (accessed 2015).

Claessens, Stijn, Ayhan M Kose, and Marco E Terrones. September 2011. "Financial Cycles: What? How? When?" *National Bureau of Economic Research, NBER International Seminar on Macroeconomics.* http://www.nber.org/chapters/c12210.pdf (accessed 2015).

Comin, Diego, and Mark Gertler. September 2003. "Medium Term Business Cycles." *National Bureau of Economic Research, NBER Working Paper Series.* http://www.nber.org/papers/w10003.pdf (accessed 2015).

Craigwell, Roland, and Alain Maurin. March 2007. "A sectoral anlysis of Barbados' GDP business cycle." *Munich Personal RePEc Archive, Central Bank of Barbados, Campus de Fouillole.* https://mpra.ub.uni-muenchen.de/33428/1/MPRA_paper_33428.pdf (accessed 2015).

Darvas, Zsolt, and György Szapáry. October 2004. "Business Cycle Synchronization in the Enlarged EU." *European Central Bank, Eurosystem.* https://www.ecb.europa.eu/events/pdf/conferences/ecbimf/paper.szapary.pdf (accessed 2016).

Doms, Mark. "The Boom and Bust in Information Technology Investment." *Federal Reserve Bank of San Francisco, FRBSF Economic Review.* 2004. http://www.frbsf.org/economic-research/files/er19-34bk.pdf (accessed 2016).

Drehmann, Mathias, Claudio Borio, and Kostas Tsatsaronis. June 2012. "Charachterising the financial cycle: don't lose sight of the medium term!" *Bank for International Settlements, BIS Working Papers, No. 380.* http://www.bis.org/publ/work380.pdf (accessed 2015).

ECB. November 2014. "Capturing the Financial Cycle in Euro Area Countries." *European Central Bank, Financial Stability Review.* https://www.ecb.europa.eu/pub/fsr/shared/pdf/sfbfinancialstabilityreview201411.en.pdf?dec8334a70c7081d9e0a5c38cd2eafed (accessed 2016).

English, William, Edda Soli and Kostas Tsatsaronis. 2005. "Assessing the predictive power of measures of financial conditions for macroeconomic variables." *Bank for International Settlements, BIS Papers No. 22.* http://www.bis.org/publ/bppdf/bispap22n.pdf (accessed 2015).

Forde, Penelope, Daryl Cheong, Carlene Coker, Kevin Finch, Garvin Gilbert, and Kester Guy. October 2009. "The Evolution of the Financial Sector in Trinidad and Tobago." *Caribbean Centre For Money & Finance.* http://www.ccmf-uwi.org/files/publications/monograph_book/TFEOTCC_Update/10trinidadandtobago.pdf (accessed 2016).

Frait, Jan, and Zlatuše Komárková. 2011. "Financial Stability, Systemic Risk and Macroprudential Policy." *Czech National Bank / Financial Stability Report 2010/2011.* http://www.cnb.cz/en/financial_stability/fs_reports/fsr_2010-2011/fsr_2010-2011_article_1.pdf (accessed 2015).

Gómez-González, José E, Jair N Ojeda-Joya, Fernando Tenjo-Galarza, and Héctor Manuel Zárate. 2013. "The Interdependence between Credit and Real Business Cycles in Latin American Economies." *Borradores de Economica, Central Bank of Colombia, Num 768, 2013.* http://www.banrep.gov.co/sites/default/files/publicaciones/archivos/be_768.pdf (accessed 2015).

Grossman, Valerie, and Adrienne Mack . April 2014. "Database of Global Economic Indicators (DGEI): A Methodological Note." *Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute, Working Paper No. 166*. https://www.dallasfed.org/assets/documents/institute/wpapers/2013/0166.pdf (accessed 2015).

Growiec, Jakub, Peter McAdam, and Jakub Mućk. 2015. "Endogenous labor share cycles: theory and evidence." *European Central Bank, Working Paper Series, No 1765.* https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1765.en.pdf (accessed 2015).

Harding, Don. September 2008. "Detecting and forecasting business cycle turning points." *Munich Personal RePEc Archive.* https://mpra.ub.uni-muenchen.de/33583/2/MPRA_paper_33583.pdf (accessed 2015).

Harding, Don, and Adrian Pagan. May 1999. "Dissecting the Cycle." *Melbourne Institute Working Paper, No. 13/99, ISSN 1328-4991.* https://www.melbourneinstitute.com/downloads/working_paper_series/wp1999n13.pdf (accessed 2016).

Harun, Cicilia A, R Renanda Nattan, Ndari Surjaningsih and Aditya Anta Taruna. 2014. "Financial Cycle of Indonesia- Potential Foward looking analysis." *Bank Indonesia, Working Paper, WP/9/2014.* http://webcache.googleusercontent.com/search?q=cache:kx0mfP8afjwJ:www.bi.go.id/id/publikasi/wp/Documents/Financial%2520Cycle%2520Paper-revisi-final%2520Juni-9-2014.pdf+&cd=3&hl=en&ct=clnk (accessed 2015).

Hiebert, Paul P, Tuomas A Peltonen and Yves S Schüler. September 2015. "Charaterising the finanical cycle: a multivariate and time-varying approach." *European Central Bank, EuroSystem, Working Paper Series, No. 1846.* https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1846.en.pdf (accessed 2016).

IADB. 2013. "Private Sector Assessment of Trinidad and Tobago." *Inter-American Development Bank.* https://competecaribbean.org/wp-content/uploads/2015/02/2014-Trinidad-and-Tobago-Private-Sector-Assessment-Report.pdf (accessed 2016).

—. 2011. "Strengthening of the Financial Sector Supervisory and Regulatory Framework." *Inter-American Development Bank, Project Profile (PP), Trinidad and Tobago, Project Number TT-L1024.* http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=36334514 (accessed 2016).

IMF. January 2007. "Trinidad and Tobago: Selected Issues." *IMF, Country Report No. 07/8.* https://www.imf.org/external/pubs/ft/scr/2007/cr0708.pdf (accessed 2015).

—. March 2011. "Trinidad and Tobago: 2010 Article IV Consultation." *International Monetary Fund, IMF Country Report No. 11/73.* https://www.imf.org/external/pubs/ft/scr/2011/cr1173.pdf (accessed 2016).

Kristjánsdóttir, Eva M. 2010. "Japan's Lost Decade, Lessons for Iceland." *Háskóli Íslands, Hugvísindasvið, Japanskt mál og menning.* http://skemman.is/stream/get/1946/5076/15206/1/ritger%C3%B0.pdf (accessed 2016).

Mishkin, Frederic S. December 2010. "Over the Cliff: From the Subprime to the Global Finacnial Crisis." *National Bureau of Economic Research, NBER Working Paper Series.* https://www0.gsb.columbia.edu/faculty/fmishkin/papers/nberwp.w16609.pdf (accessed 2016).

Ng, Tim. June 2011. "The predictive content of financial cycle measures for output fluctuations." *Bank for International Settlements, Quarterly Review.* http://www.bis.org/publ/qtrpdf/r_qt1106g.pdf (accessed 2015).

Quadrini, Vincenzo. "Financial Frictions in Macroeconomic Fluctuations." April, 1998.*Economic Quaterly-Volume 97, Number 3-Third Quarter*. 2011. http://www-bcf.usc.edu/~quadrini/papers/FFpap.pdf (accessed 2015).

Radelet, Steven, and Jeffrey Sachs. 1998. "The East Asian Financial Crisis: Diagnosis, Remedies, Prospects." *Harvard Institute for International Development.* http://www.cid.harvard.edu/archive/hiid/papers/bpeasia.pdf (accessed 2016).

Reid, Jim, Nick Burns, and Stephen Stakhiv. September 2012. "LT Asset Return Study, A Journey into the Unkown." Deutsche Bank. *Global Markets Research*. http://www.johnbudden.com/wp-content/uploads/2012/09/ltassetreturnstudy2.pdf (accessed 2015).

Stremmel, Hanno. June 2015. "Capturing the financial cycle in Europe." *European Central Bank, Working Paper Series No. 1811.* https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1811.en.pdf (accessed 2015).

Stremmel, Hanno, and Balázs Zsámboki. June 2015. "The relationship between structural and cyclical features of the EU financial sector." *European Central Bank, Working Paper Series, No. 1812.* https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1812.en.pdf (accessed 2015).

Strohsal, Till, Christian R Proaño, and Jürgen Wolters. 2015. "Characterizing the financial cycle: evidence from a frequency domain analysis." *Deutsche Bundesbank, No 22/2015.* https://www.bundesbank.de/Redaktion/EN/Downloads/Publications/Discussion_Paper_1/2015/2015_07_28_dkp_22.pdf?__blob=publicationFile (accessed 2015).

World Bank. October 2000. "Payments and Securities Clearance and Settlement Systems in Trinidad and Tobago." *World Bank, Centre for Latin American Monetary Studies, Western Hemisphere Payments and Securities Clearance and Settlement Initiative.* http://www.forodepagos.org/pdf/report_tt.pdf (accessed 2016).

Zelllou, Abdel M, and John T Cuddington. 2012. "Is There Evidence of Super Cycles in Oil Prices?" *Colorado School of Mines, Golden, CO.* http://inside.mines.edu/~jcudding/papers/Super_Cycles/Zellou-Cuddington-Super%20Cycles%20in%20Crude%20Oil%20Prices(3-22-2012).pdf (accessed 2015).

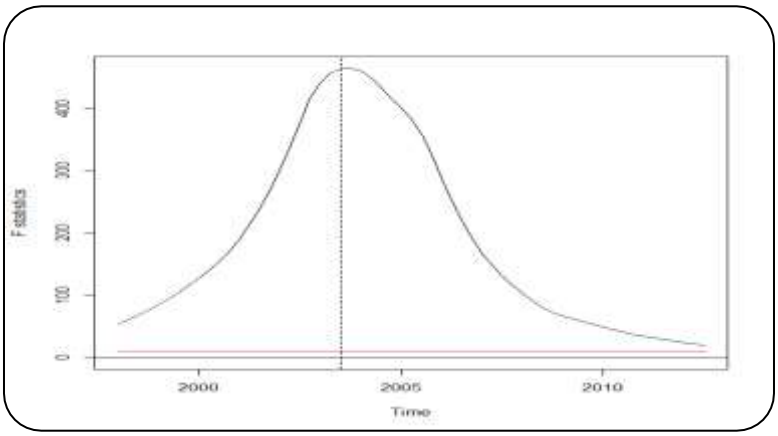
APPENDIX

Appendix 1

Breakpoint for Business Cycle

Data: Real GDP
Breakdate: 2003 q4
F-Statistic = 464.24, p-value < 2.2e-16

Figure 15
Real GDP, structural break point

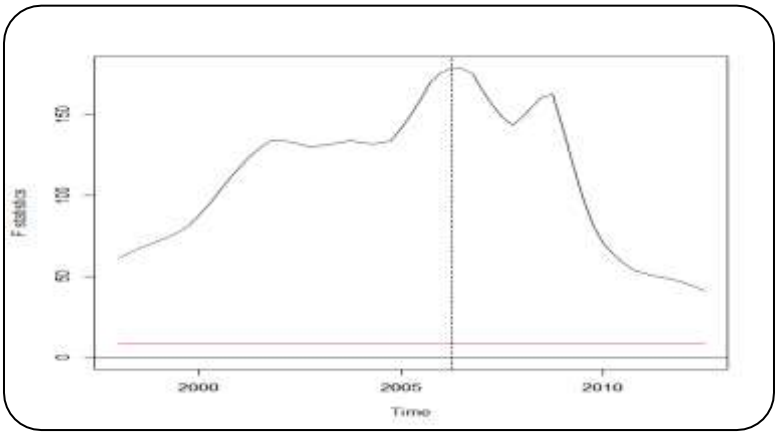


Source: Author.

Breakpoint for Financial Indicators

Data: Real Non-Energy GDP
Breakdate: 2006 q3
F-Statistic = 180.52, p-value < 2.2e-16

Figure 16
Non-energy GDP, structural break point

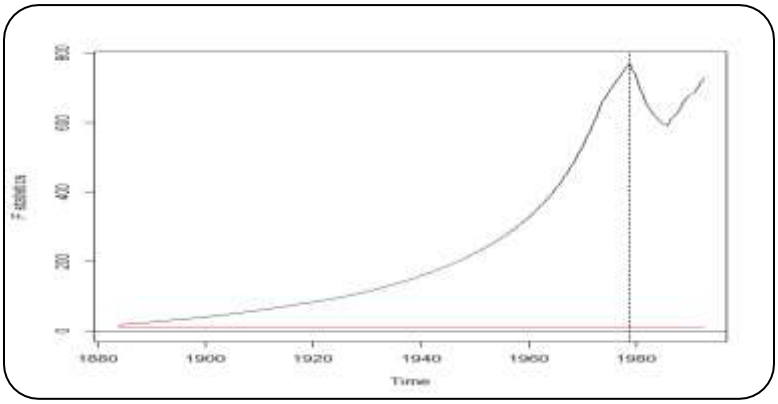


Source: Author.

Breakpoint for Oil Prices

Data: WTI Crude Oil Prices
Breakdate: 1978 q4
F-Statistic = 772.07, p-value < 2.2e-16

Figure 17
Oil prices, structural break point



Source: Author.

Appendix 2

Table 8
Concordance Index

	PCTGDP	HPRICE	MFUNDS	INS	CINDEX	OMO	NBLATTA	PCTNEGDP	QGDP
PCTGDP	-	0.14	0.90	0.03**	0.51	0.00*	0.78	0.03**	0.00*
HPRICE	0.65	-	0.03**	0.11	0.04**	0.86	0.30	0.3009	0.95
MFUNDS	0.54	0.60	-	0.87	0.05***	0.02	0.08**	0.6219	0.43
INS	0.71	0.65	0.54	-	0.37	0.00*	0.00*	0.3941	0.03
CINDEX	0.60	0.78	0.48	0.59	-	0.68	0.8197	0.00*	0.12
OMO	0.50	0.78	0.79	0.45	0.61	-	0.53	0.4837	0.75
NBLATTA	0.50	0.54	0.45	0.23	0.51	0.63	-	0.2264	0.2553
QGDP	0.44	0.74	0.63	0.44	0.84	0.77	0.67	0.32	-

Source: Author.
Note: To test the significance of the Concordance index the standard t-statistics of an OLS Regression based on the Newey-West heteroscedasticity and autocorrelation consistent (HAC) standard errors was adopted to account for possible serial correlation and heteroscedasticity that arises from binary regression. In other words, the null hypothesis $\rho_{CI} = 0$ of the equation: $\frac{C_t^y}{\sigma C^y} = const + \rho_{CI}\left(\frac{C_t^x}{\sigma C^x}\right) + \epsilon_t$ was evaluated using OLS with Newey-West HAC standard errors. These errors are illustrated in the upper diagonal, where asterisks *, ** and *** denote significance at the 1%, 5% and 10% level, respectively.