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Business Cycles Fluctuations in Moroccan Macroeconomic Times Series

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Abstract: This paper tries to describe the Moroccan business cycles in both terms: classical and growth cycles, and to characterize its main regularities. The purpose of this study is to analyse the importance of the magnitude of the observed macroeconomic times series changes in predicting fluctuations in the real GDP. The key findings are the low performance of the Moroccan economy has not explained by the private consumption and the investment as components of the domestic demand, but, namely, by the impacts of the public expenditure, the external demand shocks on exports, the external supply shocks on imports and the money supply.

Key words: Growth cycle, GDP component, Employment, monetary aggregates, GNDI, Saving, Morocco

Jel Codes: E01, E32, E52

1. INTRODUCTION

Business cycles are more or less regular patterns in the fluctuations of macroeconomic variables, such as output, unemployment, consumption, investment, prices or interest rates. **National Bureau of Economic Research (NBER)** gives a more sophisticated definition as "Business cycles are a type of fluctuations found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or to twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own" (**Burns and Mitchell** 1946: 3).

Lucas (1977) was the first to introduce the definition of growth cycles. He defined the business cycle as the recurrent fluctuation of output about the trend and the co-movement among other aggregate time series. Thus, the fluctuations are, by definition, deviations from the slowly varying path (**Lucas** 1977: 9). He added that the business cycle as repeated fluctuations in the employment, the output and the output composition associated with a certain typical pattern of co-movements in prices and other variables (**Lucas** 1977:17). In this approach, the time series of output growth are generally detrended to obtain the "growth cycles", which can be defined as the deviation of the output from its long-term trend. Obviously, business cycles are variations around the trend, although these variations are probably not permanent. These variations have also characterized by their periodicity, where the period is the approximate time interval between two peaks or two troughs in the GDP growth and in other aggregate time series.

Measuring the business cycle, characterizing its regularities and anticipating its turning points are the fascinating area of studies. The reason is to understand the economic behind events originally in the cyclical movements in order to better formulate the government policies and strategies, especially in the areas of employment, the monetary policy and the trade.

In the developing economies, this area of study is highly limited. They are further influenced like to develop economies by different changes in the world such as the proliferation of the free-trade agreements, the creation of regional economic groupings and the integration in the global financial market. Consequently, this context has led to an increase of the sensibility of the national economies' cycles and the fluctuations of the international markets.

The Moroccan economy cannot be excluded from these world economic changes. It depends on:

- The external factors are mainly the unfavourable climatic condition[1], the political shocks (the social and political crisis caused by "Daech"/terrorism, the political crisis between Morocco and some countries of the EU[2], among others), the competitors from foreign products and the interaction between trade openness and the financial integration, and
- The interior factors depend directly on the structural economy of Morocco, which essentially characterizes by the dominance of the informal sectors, the non-diversification of foreign exchange, and the lack of infrastructure[3] especially in small towns and rural areas where more than 42% of the population lives.

In addition, the financing of the balance of payments greatly depends especially on the transfers of Moroccans living abroad and on tourism revenues. The monetary policy is an important interior factor that can also influence the performance of the Moroccan economy.

According to the monetarist theory, the changes in the money supply are the most significant determinants of the rate of the economic growth and the behaviour of the business cycle, i.e. monetary policy's short-run effect on interest rates, its impact lag, and its longer-run effect on the inflation. Thus, monetary growth rates were crucial for changing the aggregate demand and the unemployment rate in the short-run. Therefore, interior and exterior factors could combine alternate movements of the expansion and the recession with recurring variations of the GDP during the last thirty years. In this paper, we try to determine which interior or domestic factor has more influence on the Moroccan business cycle, especially in the contraction phases.

These considerations justify the interest taken from this work in the questions of the relative irregularity at the time of the business cycle of the Moroccan economy. While, there is a little work, which deals with the business cycle fluctuations that the Moroccan economy has confronted during the past years. This is regrettable since the business cycle fluctuations are one of the central concepts in the macroeconomics.

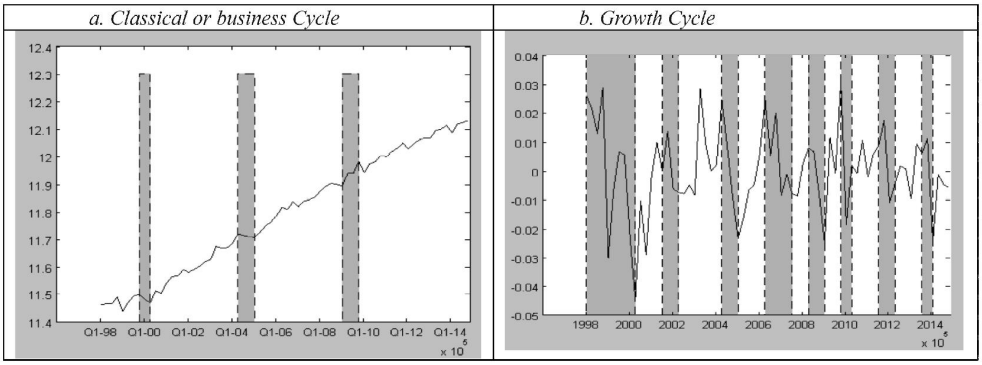
The plan of this paper is as follows. The next section describes the sequence of the economic fluctuations using the algorithm of Bry-Boschan. The third section evaluates the degree of synchronization of the economic cycle with some macroeconomic variables to determine its co-movements: is it procyclical, acyclical or countercyclical co-movement? Thus, the aim of this section is to determine what macroeconomic variables can predict the fluctuations of the real GDP in Morocco. The last section provides concluding remarks.

2. DESCRIPTION OF MOROCCAN CLASSICAL AND GROWTH CYCLES

The data used in this study are the real quarterly GDP of the Moroccan economy, noted *Mor_RGDP*. Then, the algorithm of **Bry-Boschan** modified by **Harding and Pagan** (2003) denoted BBQ was used[4]. This algorithm was utilized, especially for its advantage such as their simplicity, transparency and robustness of their results. This algorithm is nonparametric and it is not necessary to change of regime points compared with other methods (**El Alaoui**, 2015). These methods are parametric and are based essentially on the Markov regime switching model (**Hamilton,** 1989) which is unobserved, i.e. changes in the state of the business cycle.

The series of *Mor_RGDP* is decomposed in cyclical and irregular components using the HP filter, during the period 1998:q1-2014:q4[5]. This filter is a more robust estimate compared to other filters, particularly Baxter-King filter and Christiano-Fitzgerald filter, and it is used by many economists. The popularity of the HP filter among applied macroeconomic results from its flexibility to accommodate these needs since the implied trend line resembles what an analyst would draw by hand through the plot of the data (**Canova,** 1998; **Chateau and Henin,** 1994). **Figure 1** shows the dating of turning points in the classical and growth cycles of *Mor_RGDP* (in log) during the period 1998:q1-2014:q1.

Figure 1: Dating business and growth cycles of *MOR_RGDP*, 1998: q1-2014: q4



Results of the growth cycle show that the duration of growth cycles is more different from that of business cycles. If we focus only over the period 1998:q1-2014:q4, we found the length of the minimum and maximum cycles are five and eleven quarters, respectively. Duration of the contraction (peak-to-trough) fluctuates between two quarters to five quarters. However, the duration of the expansion (trough-to-peak) fluctuates between three quarters to eight quarters. The average of the contraction phases (4.86 quarters) is superior to the expansion phases (3.17 quarters). Firstly, there are six full cycles of Peak-to-Peak and seventh cycle is not achieved. Secondly, there are seven full cycles of trough-to-trough. **Table 1** indicates in detail these results.

3. METHODOLOGY AND RESULTS

The real GDP has decreased with different rates during the contraction phases (Peak to Trough): 2001:q3-2002:q2; 2004:q2-2005:q1, 2006:q2-2007:q3, 2008:q2-2009:q1,

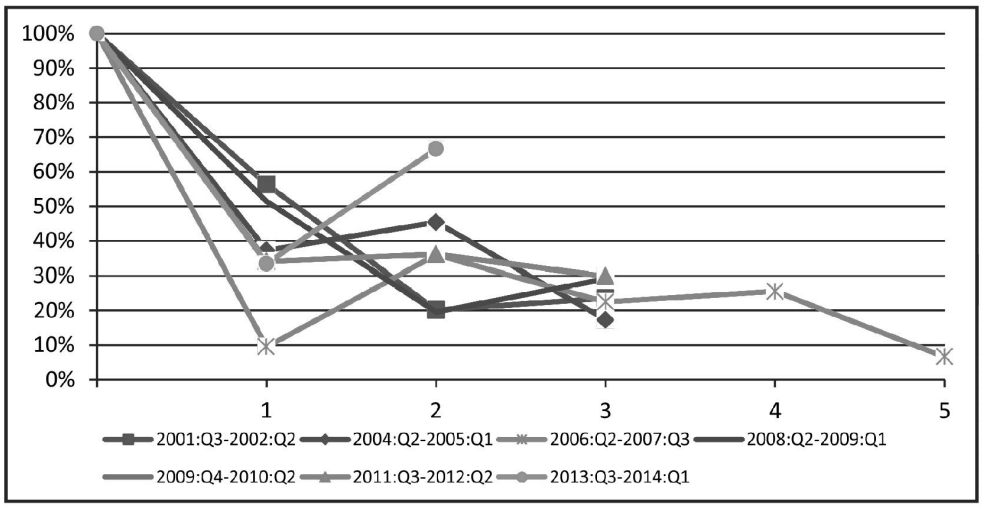
Table 1: Duration of growth cycle of *MOR_RGDP*, 1998:q1-2014:q4

Reference dates		*Contraction*	*Expansion*	*Cycle*	
Trough (T)	*Peak (P)*	*P to T*	*T to P*	*P to P*	*T to T*
2000:Q2	**2001:Q3**		5	—-	—-
2002:Q2	**2004:Q2**	3	8	11	8
2005:Q1	**2006:Q2**	3	5	8	11
2007:Q3	**2008:Q2**	5	3	8	10
2009:Q1	**2009:Q4**	3	3	6	6
2010:Q2	**2011:Q3**	2	5	7	5
2012:Q2	**2013:Q3**	3	5	8	8
2014:Q1	—	2		CU*	7
Mean		3.17	4.86	8.00	7.86
Median		3	5	8	8
Standard Deviation		1.00	1.68	1.67	2.12

Source: My estimation. * Cycle unachieved

2009:q4-2010:q2, 2011:q3-2012:q2, and 2013:q3-2014:q1. Therefore, there is no-homogeneity in the amplitude of the contraction in the evolution of the real GDP, **Figure 2**. The reason behind this is that the contraction can be the results of the interior and/or exterior shocks explained above (introduction).

Figure 2: Mor_RGDP in contraction phases normalized at 100%



To make this analysis, we follow two steps. In the first step, we decompose each macroeconomics series in irregular and cyclical components using the HP filter, during the period 1998:q1-2012:q4[6]. These series, noted Y_t, are the components of the GDP (final consumption of households (*FCH*) or private consumption, government expenditure (*G*), investment[7] (*Inv*), export (*X*) and import (*M*)), monetary aggregates (*M2* and *M3*), gross national disposable income[8] (GNDI), Saving (S) and employment[9] (*Emp*)). In the second step, we use several classic statistics such as the standard deviation and the cross-correlation of the cyclical component of each series Y_t with the cyclical component of the real GDP Mor_RGDP using k=6 quarters of lead and of lag.

Table 2 shows the cross-correlation between Y_t and *Mor_RGDP*, which it was analysed using 6 quarters of leads and of lags. The degree of contemporaneous co-movement with the real GDP is indicated in the Y(t) line. The statistics in that line are the correlation coefficients of the cyclical deviations of each series with the cyclical deviations of the real GDP, noted ρ. The variable Y_t is procyclical if ρ close

Table 2: Cross correlation of Mor_RGDP with variables Y_t

		Mor_RGDP	*Component of RGDP*						*Labour Supply*	*Money supply*	
			G	*FCH*	*Inv*	*X*	*M*	*Saving*	*GNDI*	*Emp*	*M2*	*M3*
Volatility (% Std Dev.)		*0.217*	*0.199*	*0.212*	*0.317*	*0.284*	*0.308*	*0.328*	*0.300*	*0.077*	*0.502*	*0.501*
Lags	**y(t-6)**	*-0.14*	-0.01	-0.06	-0.22	0.26	0.13	-0.09	-0.09	-0.02	0.10	0.16
	y(t-5)	*-0.09*	-0.01	-0.15	0.00	0.11	0.04	0.08	0.04	0.04	-0.09	-0.02
	y(t-4)	*-0.05*	-0.21	-0.26	0.01	0.00	-0.06	-0.03	-0.22	-0.02	0.01	0.03
	y(t-3)	*-0.16*	-0.03	0.11	-0.20	-0.07	-0.15	-0.07	-0.08	-0.23	-0.04	0.01
	y(t-2)	*0.09*	-0.03	0.09	-0.10	-0.02	-0.11	-0.01	0.04	0.26	0.04	0.07
	y(t-1)	*0.18*	0.05	0.25	-0.19	0.14	-0.09	0.06	0.17	0.30	-0.01	0.00
	y(t)	*1.00*	-0.22	0.21	0.54	0.01	-0.09	0.66	0.62	0.24	0.25	0.12
lead	**y(t+1)**	*0.18*	-0.14	0.11	0.07	0.02	-0.07	0.24	0.24	-0.06	0.21	0.06
	y(t+2)	*0.09*	-0.04	0.12	0.09	-0.06	0.05	0.05	0.14	0.22	0.30	0.10
	y(t+3)	*-0.16*	0.03	-0.01	0.20	-0.20	0.12	-0.11	-0.08	0.16	0.13	0.01
	y(t+4)	*-0.05*	-0.12	0.10	0.08	-0.12	0.07	-0.26	-0.27	-0.05	0.21	0.09
	y(t+5)	*-0.09*	0.10	0.07	-0.04	-0.04	0.06	-0.08	-0.09	-0.20	0.11	-0.02
	y(t+6)	*-0.14*	0.06	0.01	-0.08	-0.03	0.05	-0.20	-0.17	0.02	-0.02	-0.08

Source: Our calculation

to one, i.e. the variable, usually increases in the expansion or decreases in the recession. The variable Y_t is acyclical if ρ close or equal to zero, i.e. the variable shows no systematic relationship to the business cycles. The variable Y_t is countercyclical if ñ close to one, but in the opposite sign, i.e. the variable, usually decreases in the expansion and increases in the recession.

Standard deviation of each series shows that the government expenditure (G), the final consumption of households (FCH) and the employment (Emp) are less volatile. Nevertheless, the saving, the GNDI, the investment (Inv), the exports (X), the imports (M) and the monetary aggregates (M2 and M3) are more volatile. All of the series are procyclical, while the import (M), the final consumption of households (FCH) and the government expenditure (G) are not.

The final consumption of households (FCH) is countercyclical and lags of four quarters, implying that the private consumption might follow the fluctuations of the real GDP. However, the correlation between the FCH and the real GDP is not strong, implying that the business cycle has a moderate impact on the private consumption. Similarly, the government expenditure (G) is countercyclical and coincides, suggesting the role of the regulator (the government) in the Moroccan economy during both periods/phases (the contraction and the expansion). Then this role is limited since the correlation between the G and the real GDP is not strong.

In addition, the investment is procyclical and coincident, which means that it is positively correlated with the real GDP and has the same timing, i.e. it has an intimate relationship with the GDP in each period of the expansion and the recession. Similarly, both saving and GNDI are strongly procyclical and coincide.

The imports are countercyclical and lag with three quarters, meaning that the fluctuations in the business cycle can have an impact on the magnitude of changes in import. This impact is limited because the correlation between them is not strong. However, the exports are procyclical and lag of six quarters. The correlation between the real GDP and the export is stronger and more important than that between the real GDP and the import. So, the external demand shocks on exports played an important role in strengthening the performance of the Moroccan economy. In other words, the magnitudes of its change could predict the movement of the GDP. The correlation is 0.26 at lags=6 which means that an increase in exports in the past lags behind an increase in the real GDP for at least two years.

Employment is procyclical and lags of one quarter. In Morocco, it is relatively stable even in both the phases of expansion and the phases of recession. The correlation between employment and the real GDP is not strong. Therefore, the

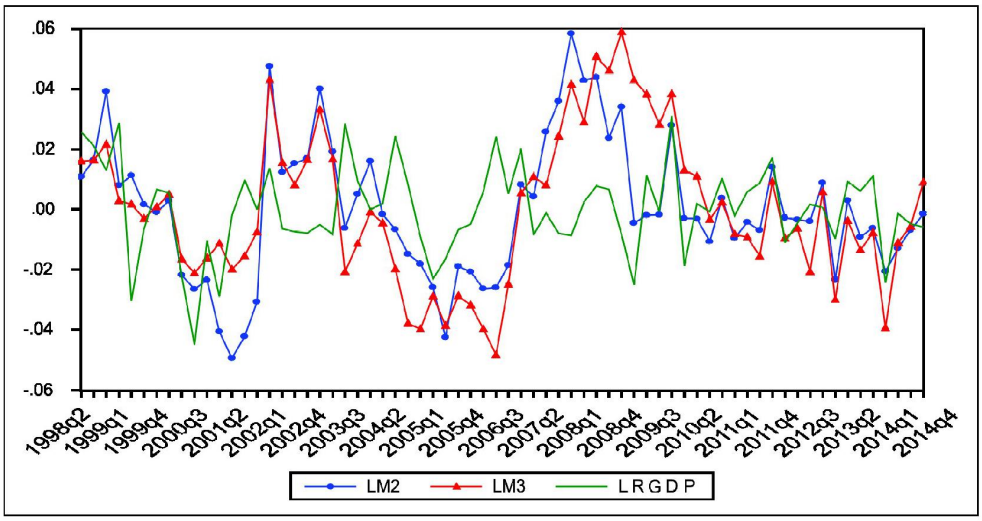
magnitudes of its change are moderately important in predicting upcoming movements in the real GDP.

Monetary aggregate M2 is procyclical and leads of two quarters, but the M3 is less procyclical and lags with six quarters[10]. The relationship between them and the real GDP is positive. On the other hand, the correlation between the M2 and the real GDP is strong. Conversely, the M3 has a weak correlation with the real GDP. This relationship remains an important area of investigation in macroeconomics studies, which is not the focus of this study, but it is useful to ask how changes over this period have affected the character of fluctuations in the business cycle, particularly the relationship between the monetary aggregates and the real GDP in Morocco.

Figure 3 shows that the evolution of real GDP, M2 and M3 is roughly similar, keeping in our mind that the Bank Al Maghreb controls the growth rate of the monetary aggregates as one of the means for monetary policy. The results display that the correlation is 0.30 at lead=2 meaning that an increase in the money supply today leads to an increase in the real GDP for at least than one year. We can therefore conclude that monetary policy affects the real economy.

Figure 3 (see appendix) shows the dating of turning points in macroeconomics series, during the period 1998:q1-2014:q4. The results indicate that all series have

Figure 3: Evolution of cyclical components of Mor_RGDP and monetary aggregates, 1998: q1-2014: q4



recognized many full cycles (trough-to-trough) as the growth cycle of the real GDP, excluding households final consumption (FCH) and employment (Emp). We highlight that the series do not have a similar duration of cycles between them. So, the evolution of all variables reveals that exports, imports, investment and government spending have similarities behaviours during the contraction phase, and final consumption of households and investment have followed the similar path. However, the low performance of the Moroccan economy has not explained by the private consumption and the investment as components of the domestic demand, but, namely, by the impacts of the public expenditure, the external demand shocks on exports, the external supply shocks on imports and the money supply. These variables are among the best aggregates to explain the low performance of the Moroccan economy.

4. CONCLUSION

Our empirical findings indicate that the Moroccan economy has recognized six growth cycles (P-P) and that the seventh cycle has not been reached since 2014:q1, or, in another way of analysis, the Moroccan economy has known seven growth cycles (T-T). We can conclude that the Moroccan economy has been modestly dominated by the expansion phases.

The results for the individual series are presented as follows:

i. the government expenditures (G), the final consumption of households and the employment are less volatile;

ii. the investment, the export, the import, the saving GNDI, and the monetary aggregates are most volatile, and

iii. All series are procyclical, while the interior (private and public demand) and foreign demands are not.

The performance of the Moroccan economy depends in particular on foreign trade policy and monetary policy, which play an important role in the recession phases as well as in the expansion phases.

Notes

1. Morocco has recognized a long period of dryness in the beginning 80s: 1980-1984; 1993-1995; 1999-2000 and 2005-2008.
2. The Moroccan government decided on February 25, 2016, to freeze contact with European institutions, except for exchanges on the appeal related to the EU-Morocco agriculture agreement, knowing that EU-Moroccan farm trade in 2015 amounted to 43 billion dirhams ($4.6 bn).

3. The lack of investment and the no-access to social services, such as education and health, are the bigger problems in Morocco. For example, the maternal death rate in 2010 is the highest in rural areas (148 maternal mortality per 100,000 live births) than that in urban areas (73 maternal mortality per 100,000 live births) and the literacy rate is more than 44% in rural areas; see HCP Report (2010), Morocco.
4. For more explication see **El Alaoui** (2015).
5. Data of the macroeconomic series are only available over the period 1998:q1-2014:q4. So, it is preferable to detect and identify the business and growth cycles for Mor_RGDP, also, over this period to make a concordance between all dating of cycles. For this reason, there is 'light' difference between dating found in this work and in previous work (**El Alaoui**, 2015).
6. Quarterly data is only available for those variables over this period.
7. Investment is referred to the gross capital formation.
8. Gross national disposable income = gross national income + current transfer receivable by resident units - current transfers payable by resident units.
9. Employment is referred to the occupied active person.
10. M2=M1+saving deposits, where M1=currency in circulation + demand deposits ; and M3= M2+other monetary assets

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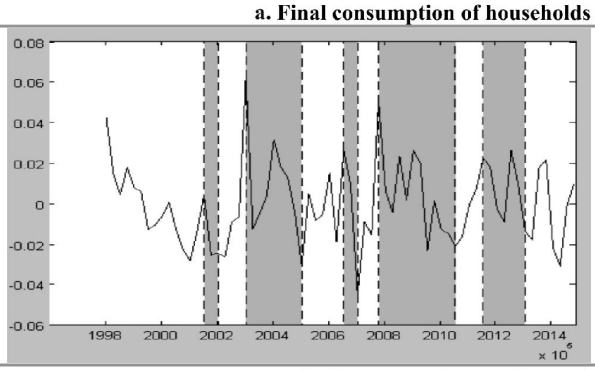
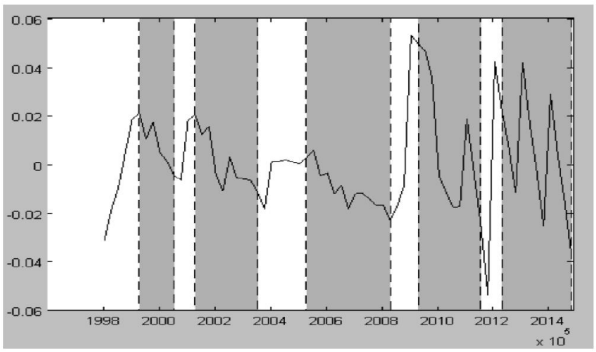
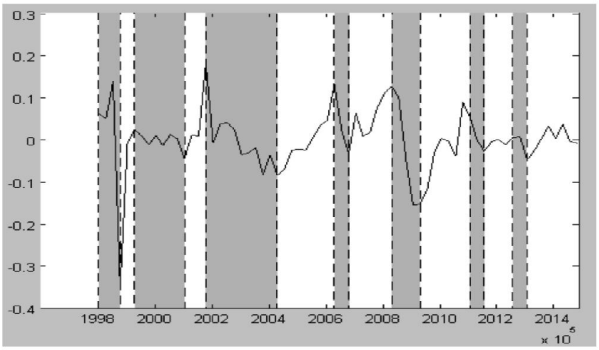
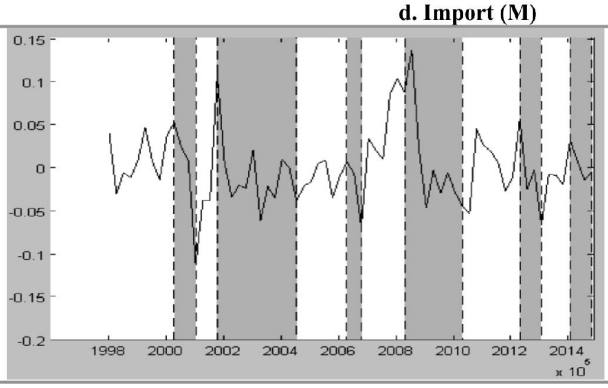
APPENDIX

Figure 3: Dating and statistics of GDP components, monetary aggregates, GNDI, saving, and employmentover the period 1998: q1-2014: q4

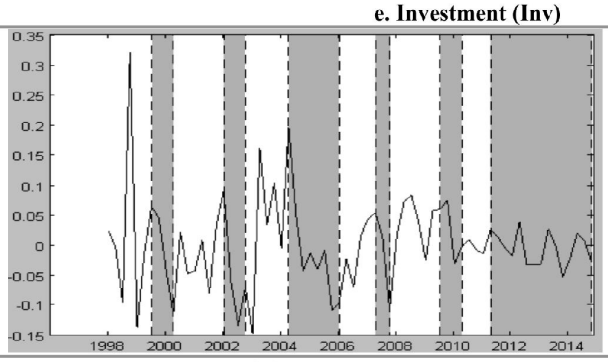
Macroeconomic series	Statistics
a. Final consumption of households (*FCH*)	
	1.P-P cycles: 4 2.T to T cycles: 3 3.Min: 8 4.Max: 19 5.Mean: 13.71 6.Stand. Dev: 3.59 7.Min P to T: 5 8.Max P to T: 12 9.Mean P to T: 8.75 10. Stand. Dev P to T: 2.87 11. MinT to P: 3 12.Max T to P: 7 13. Mean T to P: 4.67 14.Stand. Dev T to P: 2.08
b. Government expenditures (G)	
	1.P-P cycles: 4 2.T to T cycles: 4 3.Min: 5 4.Max: 15 5.Mean: 10.50 6.Stand. Dev: 3.85 7.Min P to T: 2 8.Max P to T: 11 9.Mean P to T: 5.80 10. Stand. Dev P to T: 3.90 11. MinT to P: 3 12.Max T to P: 6 13. Mean T to P: 4.25 14.Stand. Dev T to P: 1.26
c. Export (X)	
	1.P-P cycles: 5 2.T to T cycles: 6 3.Min: 6 4.Max: 18 5.Mean: 10.00 6.Stand. Dev: 3.35 7.Min P to T: 2 8.Max P to T: 10 9.Mean P to T: 5.00 10. Stand. Dev P to T: 3.46 11. MinT to P: 2 12.Max T to P: 8 13. Mean T to P: 5.00 14.Stand. Dev T to P: 2.37

d. Import (M)



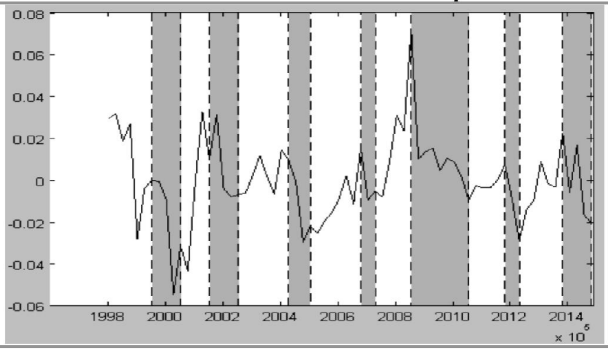
1.P-P cycles	5
2.T to T cycles	4
3.Min	6
4.Max	18
5.Mean	11.44
6.Stand. Dev	4.25
7.Min P to T	2
8.Max P to T	11
9.Mean P to T	5.40
10. Stand. Dev P to T	3.91
11. MinT to P	3
12.Max T to P	8
13. Mean T to P	6.00
14.Stand. Dev T to P	2.16

e. Investment (Inv)



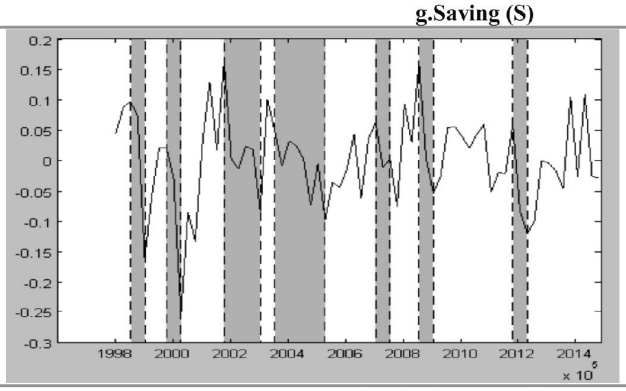
1. P-P cycles	5
2. T to T cycles	4
3. Min	7
4. Max	13
5. Mean	9.67
6. Stand. Dev	2.00
7. Min P to T	2
8. Max P to T	7
9. Mean P to T	3.60
10. Stand. Dev P to T	1.95
11. Min T to P	5
12. Max T to P	7
13. Mean T to P	6.25
14. Stand. Dev T to P	0.96

f. Gross National Disposable Income (GNDI)



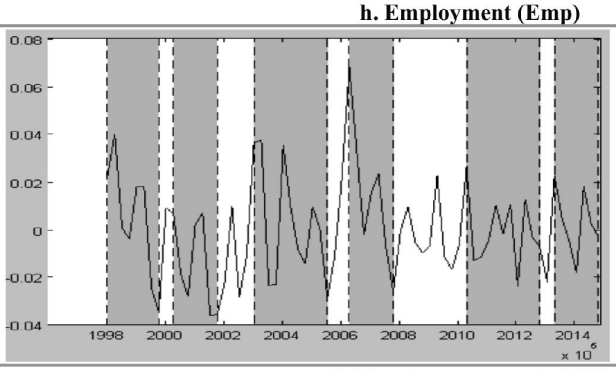
1.P-P cycles	6
2.T to T cycles	5
3.Min	7
4.Max	13
5.Mean	9.45
6.Stand. Dev	2.16
7.Min P to T	2
8.Max P to T	8
9.Mean P to T	3.83
10. Stand. Dev P to T	2.23
11. MinT to P	4
12.Max T to P	7
13. Mean T to P	5.60
14.Stand. Dev T to P	1.34

g.Saving (S)



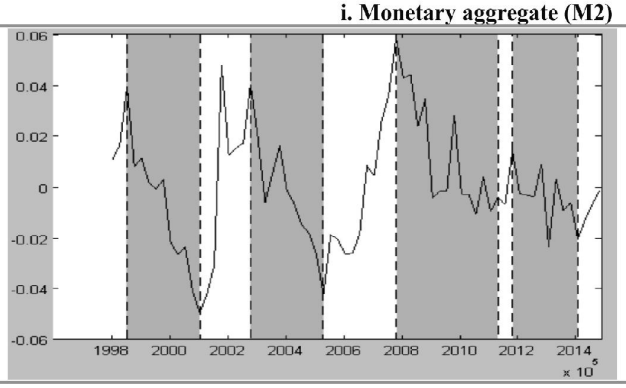
1.P-P cycles	6
2.T to T cycles	6
3.Min	5
4.Max	14
5.Mean	8.83
6.Stand. Dev	3.24
7.Min P to T	2
8.Max P to T	7
9.Mean P to T	3.14
10. Stand. Dev P to T	2.04
11. MinT to P	2
12.Max T to P	11
13. Mean T to P	5.50
14.Stand. Dev T to P	3.27

h. Employment (Emp)



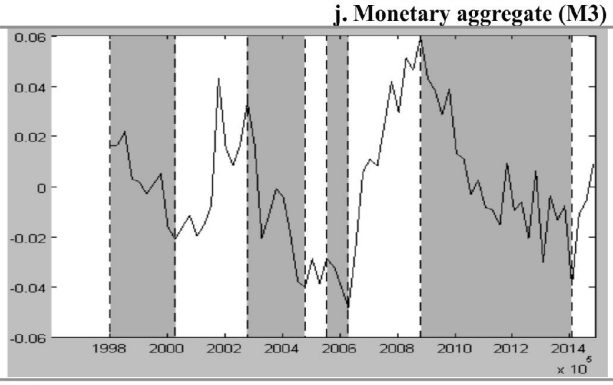
1. P-P cycles	4
2. T to T cycles	4
3. Min	8
4. Max	20
5. Mean	13.00
6. Stand. Dev	3.93
7. Min P to T	6
8. Max P to T	10
9. Mean P to T	8.00
10. Stand. Dev P to T	2.31
11. Min T to P	2
12. Max T to P	10
13. Mean T to P	4.40
14. Stand. Dev T to P	3.36

i. Monetary aggregate (M2)



1.P-P cycles	3
2.T to T cycles	3
3.Min	11
4.Max	24
5.Mean	17.50
6.Stand. Dev	4.32
7.Min P to T	9
8.Max P to T	14
9.Mean P to T	10.75
10. Stand. Dev P to T	2.22
11. MinT to P	2
12.Max T to P	10
13. Mean T to P	6.33
14.Stand. Dev T to P	4.04

j. Monetary aggregate (M3)



1.P-P cycles	2
2.T to T cycles	3
3.Min	6
4.Max	31
5.Mean	15.80
6.Stand. Dev	9.52
7.Min P to T	3
8.Max P to T	8
9.Mean P to T	5.50
10. Stand. Dev P to T	3.54
11. MinT to P	3
12.Max T to P	10
13. Mean T to P	7.67
14.Stand. Dev T to P	4.04

Note:

1.	Number of peak-to-peak cycles	8.	Maximum peak-to-trough phase
2.	Number of trough-to-trough cycles	9.	Mean peak-to-trough phases
3.	Minimum cycle length	10.	Standard deviation peak-to-trough phases
4.	Maximum cycle length	11.	Minimum trough-to-peak phase
5.	Mean cycle lengths	12.	Maximum trough-to-peak phase
6.	Standard deviation of cycle lengths	13.	Mean trough-to-peak phases
7.	Minimum peak-to-trough phase	14.	Standard deviation trough-to-peak phases