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Dating Business Cycle in Oil Exporting Countries

EmanueleBacchiocchi
Department of Economics, University of Milan, Milan, Italy
Ali Sarzaeem*
Faculty of Economics, Allameh Tabatabaei University, Tehran, Iran

Abstract
In this paper, we empirically investigate the relationship between oil price changes and output in a group of oil exporting countries. The dynamics of business cycles in Libya, Saudi Arabia, Nigeria, Kuwait, Venezuela and Qatar are modeled by alternative regime switching models. We show that the extension of uni-variate Markov Switching model in order to include oil revenue improves dating business cycles in these economies. For all countries, the optimal specification suggested by the data is to consider three cycles or regimes, namely, high growth, mild growth, and recession. These three regimes can be associated to high positive oil shock, mild positive oil shock and negative oil price shock. An interesting finding of the paper is that there is a variety of relationships between oil price shocks and business cycles. Thus, in order to see the effects of an oil price shock one should take into consideration the economic regime when the oil price shock hits the economy. Therefore, it is not possible to talk about a general relationship between oil price shocks and macroeconomic variables for all the main oil exporting countries.

Keywords: Business Cycle, Oil Exporting Countries, Markov Switching Model, Oil Price Shock

JEL Classification: E31, E32, E52, Q41

* Correspondent Author, ali.sarzaeem@css.ir

1. Introduction

It is widely believed that oil price shocks have major effects on economic activities and macroeconomic variables in both oil importing and oil exporting countries. It is assumed that an increase in oil price precedes economic booms in oil exporting countries, since it enables governments to increase their expenditure and aggregate demand accordingly. Conversely, negative oil price shocks predict arrival of periods of recession due to reduction in aggregate demand. An opposite direction of changes is expected for oil importing countries, based on several researches done about the nature of relationship between oil price shocks and macroeconomics of developed countries (see Hamilton (1983,1996 and 2003),Burbidge and Harrison (1984), Hooker (1996, 1996b), Mork (1989) and Cunado and Perez de Gracia (2003) among all).

Although there is a wide range of literature on this issue for oil importing countries, there are very few studies about oil exporting countries (Eltony and Al-Awadi, 2001, on Kuwait, Olomola and Adejumo, 2006, on Nigeria, Berument and Ceylan, 2005, on samples of countries in MENA, and Esfahani, Mohaddes and Pesaran, 2009, on Iran).

The traditional methodology used in these studies is based on vector autoregressions (VAR). In particular, many of them concentrate on the issue of asymmetric response of GDP to oil shocks (for instance Farzanegan and Markwardt (2009), Mehrara and Oskoui (2007), and Mendoza and Vera (2010)). Recent research on this topic for developed countries has moved to model business cycles and to investigate the role of different shocks including oil price shock in transition between cycles. However, research for oil exporting countries is still behind this frontier. The aim of this paper is to study the nature of business cycles in oil exporting countries and the role of oil price shocks in dating business cycles.

Our review of literature shows that Markov-Regime Switching is a common technique for dating business cycle and calculating the probability of transition between regimes.To the best of our knowledge, there is no paper that applies this method to oil exporting countries. This paper fills such a gap.

The rest of the paper is organized as follows. In Section 2, we introduce the econometric framework for doing empirical investigation. Specifically, we describe Markov switching model as a workhorse model for our paper. In the following section (Section 3), data that have been used are presented. In Section 4, empirical findings are discussed. Concluding remarks are offered at the ends.

2. The Econometric Framework

The traditional approach for studying the relationship between oil price shocks and macroeconomic variables is VAR, see among many others Hamilton (1983), Burbidge and Harrison (1984), Bernanke, Gertler and Watson (1997) and Cunado and Perez de Gracia (2003). Negative oil price shocks during 80's confirm the failure of the most predictions in the past and led Lee, Ni and Ratti (1995) to distinguish between periods in which oil price was stable and periods in which oil price was volatile.

Recently Kilian (2009) distinguished between oil demand shock and oil supply shock and showed that each has its own effect. Peersman and Robays (2012) applied distinction of oil supply shock and oil demand shock to investigate the effect of oil shock on major industrial economies. They have found that oil increase leads to the decline of economic activity regardless of the source of oil shock whereas oil negative shock has no significant effect on GDP if it is oil supply shock.

This paper satisfies the necessity of addressing different regimes in the economy and the necessity of investigating the effect of oil shocks in each regime. For this purpose, Markov-Switching (MS) models are used as econometric framework. This approach is a common method of studying business cycles in different countries and regions. Hamilton (1989) and Chauvet and Hamilton (2006) applied this method for dating business cycles in US while Raymond and Rich (1997), Clements and Krolzig (2002) and finally Holmes and Wang (2003) used the same approach for studying the impact of oil price shocks on the business cycles in UK and US.. Stanca (1999) applied MS method to the case of Italy and Saltoğlu et al (2003) applied MS framework to study business cycle in Turkey. Cologni and Manera (2009) studied business cycles of a sample of developed countries through MS models while Ginters (2010) employed the same approach to study aggregate variation in Latvia. Finally, Krolzig (2013) explained in detail superiority of Markov Switching Model for studying business cycles.

We begin our analysis by introducing Markov-Switching models as a framework for analyzing business cycles based on the seminal paper by Hamilton (1989). In fact, MS-VAR model is a modern parametric alternative to the more traditional non-parametric approach to business cycle measurements in the Burns-

Mitchell tradition. This method assumes that the parameters of a time series model of some macroeconomic variables depend upon an unobservable regime variable $S_t \in \{1, \dots, M\}$ which represents the state of the business cycle. It is assumed that regime S_t is generated by a Markov chain.

In a general form, one can specify the Markov-Switching models in the following statement:

$$y_t - \mu(s_t) = \vartheta(s_t) + A_1(s_t)[y_{t-1} - \mu(s_t)] + \cdots + A_P(s_t)[y_{t-P} - \mu(s_{t-P})] + \varepsilon_t \quad (1)$$

where $y_t = (y_1, y_2, \dots, y_t)$ is a n dimensional time series vector, ϑ is the vector of intercept, A_1,..., A_P are the matrices of auto-regressive parameters and ε_t is a white noise vector process such that $(\varepsilon_t|s_t) \sim NID(0, \Sigma(s_t))$.

Krolzig (1998) introduced a notation which is widely used as a common specification of switching models. Based on variation of mean and intercept, Krolzig call them Markov-Switching in mean (MSM) and Markov-Switching in intercept (MSI) as shown below:

$$y_t - \mu(s_t) = A_1(s_t)[y_{t-1} - \mu(s_t)] + \cdots + A_P(s_t)[y_{t-P} - \mu(s_{t-P})] + \varepsilon_t \quad (2)$$

$$y_t - \mu(s_t) = \vartheta(s_t) + A_1[y_{t-1} - \mu] + \cdots + A_P[y_{t-P} - \mu] + \varepsilon_t \quad (3)$$

If the variance of error terms are not constant and also depend on a latent variable s_t, these models are called MSMH and MSIH respectively. If auto-regressive parameters depend on latent variable s_t, then it is called MSIAH. The following Table 1 summarizes the different typologies of Markov-Switching models.

Table 1: Typology of Markov Switching Models

	Mean	Intercept	Variance	Matrix of Autoregressive Parameters
MSM-AR	Varying	-	Invariant	Invariant
MSMH-AR	Varying	-	Varying	Invariant
MSI-AR	-	Varying	Invariant	Invariant
MSIH-AR	-	Varying	Varying	Invariant
MSIAH-AR	-	Varying	Varying	Varying

Source: Krolzig (1998)

It is worth mentioning that Hamilton (1989) used MSM(2)-AR(4) as follows:

$$y_t - \mu(s_t) = A_1[y_{t-1} - \mu(s_t)] + \cdots + A_P[y_{t-P} - \mu(s_{t-P})] + \varepsilon_t \quad (4)$$

where $(\varepsilon_t|s_t) \sim NID(0, \Sigma(s_t))$, with two different regimes $s_t = 1,2$. One basic assumption is that an unobserved state follows a first order Markov process, meaning that each regime depends on the previous regime only, but not any further in the past.

$$P\{s_t = j | s_{t-1} = i, s_{t-2} = k, \dots\} = P\{s_t = j | s_{t-1} = i\} = P_{ij} \quad (5)$$

. P_{ij} shows the probability that state j follows state i. Given the fact that there are N states, one can define a transition matrix as follows:

$$P = \begin{bmatrix} P_{11} & \dots & P_{N1} \\ \vdots & \ddots & \vdots \\ P_{1N} & \dots & P_{NN} \end{bmatrix}$$

It is clear that the sum of probabilities of transition to different states should be one $(\sum_{j=1}^{N} P_{ij} = 1, i = 1 \dots N, 0 \le P_{ij} \le 1)$.

In this paper, we will follow the specifications used by Hamilton (1989) by assuming that deviation of output growth from its mean follows a p-th order auto-regressive process as shown below:

$$\Delta gdp_t - \mu(s_t) = \vartheta(s_t) + A_1(s_t)[\Delta gdp_{t-1} - \mu(s_t)] + A_1(s_t)[\Delta gdp_{t-2} - \mu(s_t)] + \cdots + A_P(s_t)[\Delta gdp_{t-P} - \mu(s_{t-P})] + \varepsilon_t \quad (6)$$

If we assume a three state model (for example recession, low growth and high growth), then the above specifications will be as follows:

$$\begin{aligned} \Delta gdp_t &= (W_1) + A_{11}\Delta gdp_{t-1} + \cdots + A_{P1}\Delta gdp_{t-P} + \varepsilon_t \\ \Delta gdp_t &= (W_2) + A_{12}\Delta gdp_{t-1} + \cdots + A_{P2}\Delta gdp_{t-P} + \varepsilon_t \\ \Delta gdp_t &= (W_3) + A_{13}\Delta gdp_{t-1} + \cdots + A_{P3}\Delta gdp_{t-P} + \varepsilon_t \end{aligned} \quad (7)$$

Following Cologni and Manera (2009), the test for the existence of non-linearity (i.e. regime shift) is done based on statistics with asymptotic $\chi^2(q)$ distribution where q represents the number of restrictions. Cologni and Manera (2009) used Akaike Information Criterion (AIC) as suggested by Psaradakis and Spagnolo (2003) in order to determine the optimal number of regimes. As is common, the optimal number of lags is tested based on a Likelihood Ratio Test (LR). Besides taking into account these criterions, my key criteria for selection of models are goodness of fit, value of log-likelihood function and reasonable probability of regime switching. Moreover, as reported below, normality, Arch and Portmanteau tests were calculated for all estimated models.

3. Data

In this paper, we focus on six major oil exporting countries: Libya, Saudi Arabia, Kuwait, Nigeria, Venezuela and Qatar. All data are annual. The GDP data of all these countries have been extracted from IFS database. We intentionally use oil revenue from export as a proxy for oil price. The data is collected from IFS dataset or from the OPEC website.we have used OxMetrics6 for all econometric analysis.

Regarding the sample sizes and specific country information, data of Libya are from 1960 to 2009 and data for oil revenue was obtained from OPEC website. Data of Kuwait are from 1962 to 2008 and was obtained from IFS database. Data of Saudi Arabia are from 1968 to 2008 and was obtained from IFS database. Data of Qatar come from IFS dataset and range from 1980 to 2008. Data of Nigeria cover the period 1973-2003 and was obtained from IFS database

Figures 1-6 show the trend of oil revenue changes and GDP growth. The first general comment refers to the evidence of co-movements between the two variables, clearly highlighted in all graphs. As it is shown in Figure 1, Saudi Arabia has benefited from oil price increase during 70's especially at the time of second oil price shock (due to the Iranian revolution) and its economic growth was negligible or even negative during 80's when negative oil price shocks hit the oil market. Moreover, it is worth mentioning that Saudi Arabia also benefited from the recent positive oil price shocks (after 2004).

Libya is an interesting case in the sense that co-movement of oil revenue and economic growth is clearer than any other countries which confirm high dependency of this economy on revenue from oil export. In Figure 2, recession of Libyan economy during 80's is concurrent with recession in global oil market and low price for petroleum while economy was in the boom during 70's and the first years of the third millennium.

Co-movement of oil price and economic growth in Venezuela is also confirmed in Figure 3 but this correlation is weaker than any other countries in the sample. Mild growth during 70's and mild recession are the main features of this economy.

The pattern of macroeconomic trend in a small oil exporting country, like Kuwait, is not different from its neighbors (like Saudi Arabia) because these countries implemented similar economic policies in the past. The only exceptional policy measure Kuwait took was to create a fund for saving oil revenue for the next generations. Figure 4 indicates that Kuwait experienced boom at the time of positive oil shock and bust at the time of negative oil price shock.

Economic performance of Qatar is more successful since this economy has experienced less volatility and managed the risk of oil price shocks as shown in Figure 5. This became possible due to long-term oil and gas contracts between Qatar and major oil companies.

Nigerian economy follows the same pattern of performance but Figure 6 shows much less variations in aggregate output. Too much volatility in oil revenue of this country is the result of political and armed conflicts in the region over the oil fields. These conflicts sometimes prevent operation of oil extraction, transportation and exportation. To summarize, all countries in the sample of our study show the same pattern of co-movements of oil revenue and aggregate output.

4. Empirical Results

In this section, we perform an econometric analysis to better understand the stylized facts observed in the previous section. As already mentioned, the econometric analysis is based on the specifications and estimations of Markov Switching bivariate models for each of the mentioned countries. For each country, the dependent variable is represented by the first differences of log GDP (i.e. the growth rate of the economy) which is supposed to be a function of some of its lagged values, as well as of contemporaneous and lagged values of the growth rate of oil revenue. This simple econometric specification allows us to understand the dynamic effects that oil shocks exert on the pattern of the economy of this group of oil exporting countries.In what follows, we discuss, in detail, the specification of the model and the main findings for each of these countries. Tables for estimated results and graphs for the regimes are reported in Appendix 2 and Appendix 3, respectively.

For the case of Libya, the specification analysis suggests a model with three regime switching in mean and one auto-regressive component. The results are reported in Table 2 and Figure 7. The first regime (regime 0) covers periods of recessions which account for 17.3% of all samples and lasts on average one year. Concerning the other two regimes, regime 1, which accounts for 58.7% of all periods and lasts on average 4.5 years, depicts low growth periods, and regime 2 which accounts for 24% of all cases and lasts 1.1 years shows high growth periods. Transition probabilities show that recessions are temporary and the economy will move rather fast from recession into high growth phase. If the economy is trapped into low growth rate, with a probability of 75%, it will remain there and will transit into either recession or high growth rate with a probability of 14% and 10%, respectively. Periods of high growth rate will not last for a long time and with high probability (50%) will transit into low growth periods and with a probability of 36% will transit into recession and with probability of 11% will remain in that regime. Concerning the estimated coefficients, Table 2 shows that oil shocks have a greater effect during recessions (regime 0) and high growth periods (regime 2). It is worth noting that the sign of the coefficients of most variables are different in regime 0 and regime 2 which implies the existence of different relationships in each regime.

Figure 8 shows that a model with three regime switching in intercept and one lag fits data of Saudi Arabia well. The first regime (regime 0) indicates periods of mild growth which accounts for two thirds of the whole sample with an average duration of 5.2 years. Regime 1, indicating low or negative growth rate, represents 15% of all periods with an average duration of 1 year. Regime 2, instead, indicates high growth periods and lasts on average 1.75 years. The probabilities of transition from mild growth to either recession or high growth is rather low (less than 10%) whereas the probability of transition from recession (or low growth) to mild growth is very high (around 80%) and to high growth regime is around 20%. Based on these findings, when economy is in high growth periods, it will remain there with a probability of 47% or will transit into low growth or recession with a probability of 52%. The results of this regression show different and significant values for intercept in different regimes. Based on Table 3, we find that the impact of oil shocks on the economy does not depend on the cycle of the economy.

For Venezuela, econometric results reported in Table 4 and Figure 9 suggests a three regime switching in mean with three lags. Regime 0 indicates periods of low or negative growth rate which comprises 25% of the whole sample period with duration of 1.2 years. Regime 1 indicates periods of mild growth rate which amounts to 43% of the whole period with a duration of 2.1 years. Regime 2 shows periods of high growth rate which constitutes 31% of the whole sample periods with average duration of 2.14 years. Probability of remaining in recession or low growth period is low (18%) but the probabilities of transition to mild growth and high growth are 53% and 27%, respectively. The probability of remaining in mild growth regime is quite high (55%) with equal probabilities (22%) of transition to either high or low growth phase. The coefficients of oil price variables indicate different effects of oil price on output in each regime which confirms the claim that the impact of oil price depends on the regime of the economy. Thus, it is not possible to have a general judgment about the impact of oil shocks on Venezuela. Instead, one should see in which context (economic cycle) an oil shock hit the economy.

For Kuwait, a three regime switching in mean (with heteroskedasticity) with two lags fits the data well as pointed out in Table 5 and Figure 10. These results, however, highlight that the three regimes do not have clear economic interpretation. Regime 0 represents 20% of the whole period with average duration of 1 year while regime 1 forms 50% of the whole period with average duration of 1.5 years and regime 2 makes up 30% with average duration of 1 year. If the economy is in regime 0, it will move out of it for sure and probably to enter into regime 1 (83%) and regime 2 (17%). If it is in regime 1, it will not move into regime 0 but will move either into regime 2 with the probability of 54% or remain there with probability of 45%. If it is in regime 2, it won't remain there and will move to regime 1 with probability of 54% or, will transit into regime 1 with probability of 45%. An interesting result in Table 4 is the difference between coefficients of the same variables in different regimes which indicates that in each regime there is a specific relationship between macro variables.

For Nigeria, Table 5 and Figure 12 display a three regime switching in intercept. Regime 0 shows periods of recession while regime 1 shows periods of high growth rate and regime 2 indicates periods with mild growth. 27% of the whole period is in regime 0 with an average duration of 2 years and 27% of the whole period is in regime 1 with an average duration of 2 years while regime 2 indicates whole period from 1991 up to 2003 (13 years). If Nigerian economy is in regime 0 then, it will remain there with probability of 53% and will transit to regime 1 with probability of 46%. Conversely if it is in regime 1 then, it will move to regime 0 with probability of 39% and will remain in regime 1 with probability of 48% and will remain in regime 2 with probability of 11%. If Nigerian economy is in regime 1, then it will remain there, forever. An interesting result is the significant difference between coefficients of intercept in different regimes. In this economy, oil revenue plays a negligible role and its impact decreases significantly after one period.

For the case of Qatar, the specification analysis suggests an optimal model with three regime switching in intercept (with heteroscasticity) as described in Table 7 and Figure 11. Regime 0 indicates periods of recession or low growth while regime 1 indicates periods of mild growth and regime 2 indicates periods of high growth. Regime 0 comprises 53% of the whole observations and regime 1 makes up 28.5% and regime 2 forms 17.8% of the whole period. If this economy is trapped in regime 0, it will remain there with probability of 46% and will move into regime 1 with probability of 42% and into regime 2 with probability of 11%. If it is in regime 1, it will not remain there and will move into regime 0 with a probably of 84% and will transit into regime 2 with a probability of 15%. If it is in regime 2, it will remain in that period with probability of 43% or alternatively, it will move into regime 1 with probability of 56%. The intercept in these regimes are significantly different while the impact of oil shock on the economy does not depends on whether the economy is in boom or in recession .

5. Conclusion

This paper reports empirical results that may be of interest in dating business cycles in oil exporting countries. For this purpose, different specifications of Markov Switching models are proposed and estimated for each country included in the analysis.

The common finding is that, given the volatility of oil market, it is possible to discern three cycles or regimes in these economies, namely, high growth, mild growth, and recession. These three regimes can be associated to high positive oil shock (like the one in the 70's), mild positive oil shock and negative oil price shock. As a by-product of the performed econometric analysis, it is possible to estimate duration of each cycle and the probability of transition from one cycle to another in each economy.

An interesting finding of the paper is that there is a variety of relationships between oil price shocks and business cycles. In Saudi Arabia and Qatar, the impact of oil price shocks does not depend on the business cycle of the economy while in Kuwait, Venezuela and Libya, the effects of oil price shocks are different in each regime. Thus, one should take into consideration the business cycles (economic regimes) when an oil price shock hits the economy. In Nigeria oil price shocks have negligible influence on the economy. Therefore, it is not possible to talk about a general relationship between oil price shocks and macroeconomic variables for all the main oil exporting countries. Instead, one should consider the dependence of these relationships on business cycle in each country.

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Appendix1: Co-Movement of Oil Revenue Changes and GDP Growth

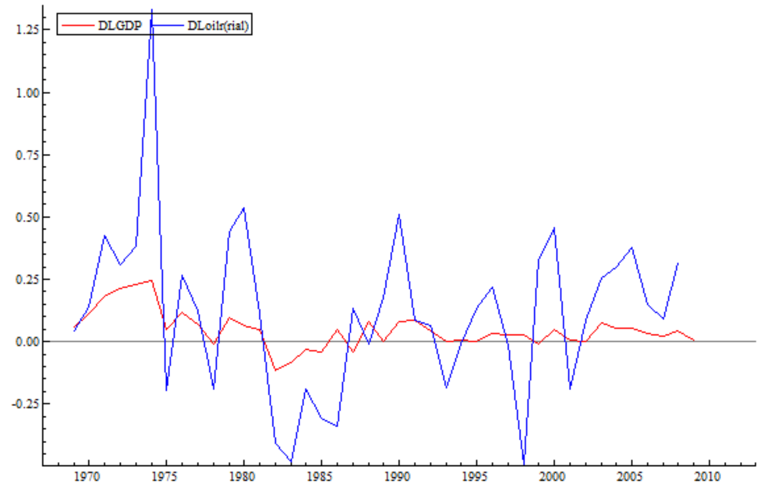

Figure1: Saudi Arabia: Trend of Oil Revenue Changes and GDP Growth

Source: Authors

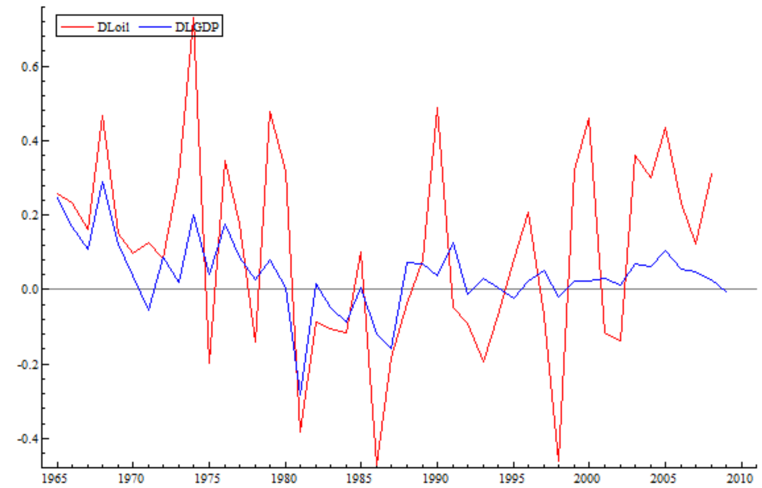

Figure2: Libya: Trend of Oil Revenue Changes and GDP Growth

Source: Authors

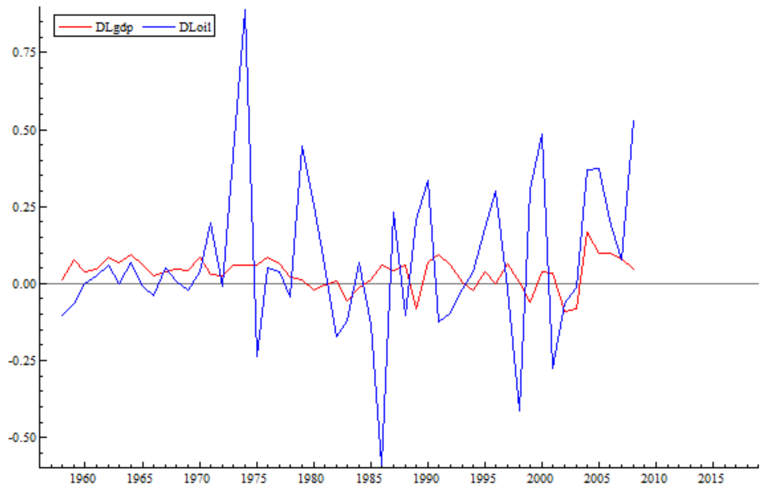

Figure 3: Venezuela: Trend of Oil Revenue Changes and GDP Growth
Source: Authors

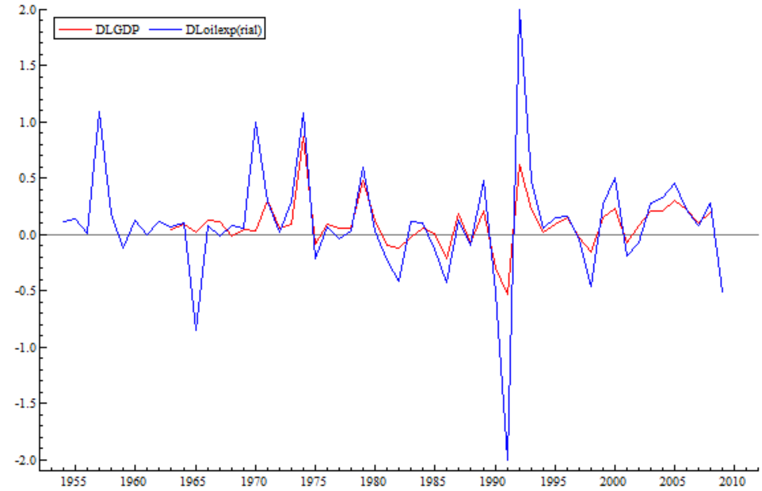

Figure 4: Kuwait: Trend of Oil Revenue Changes and GDP Growth
Source: Authors

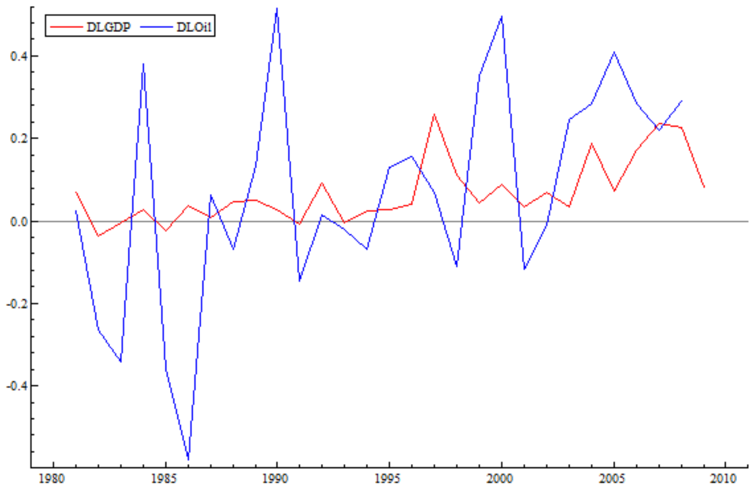

Figure 5: Qatar: Trend of Oil Revenue Changes and GDP Growth

Source: Authors

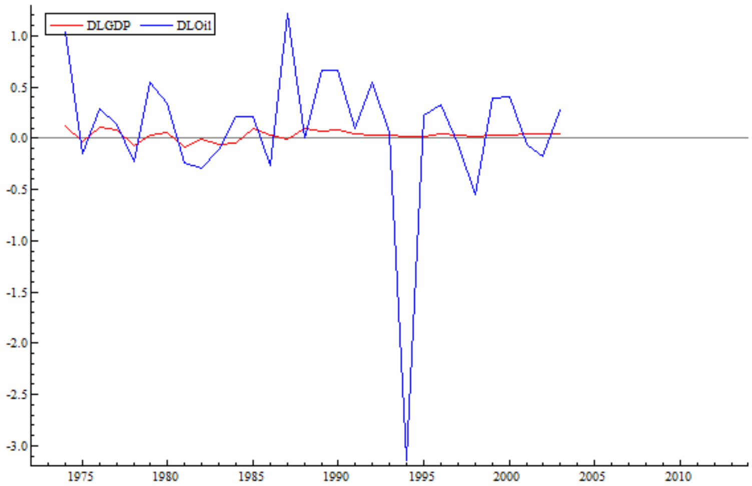

Figure6: Nigeria: Trend of Oil Revenue Changes and GDP Growth

Source: Authors

Appendix2: Tables of estimated results

Table 2: Libya: Estimation result of MS regression

Variable			Coefficients
Constant (0)			-0.077***
Constant (1)			-0.0015
Constant (2)			0.073***
Doil(0)			0.416***
Doil(1)			0.09***
Doil (2)			0.384***
Doil-1(0)			-0.089***
Doil-1(1)			0.002
Doil-1(2)			0.07732*
Dlgdp-1(0)			0.7532***
Dlgdp-1(1)			0.3446***
Dlgdp-1(2)			-0.06297
Sigma			0.0276***
Log-Likelihood			74.48
AIC			-2.499
LR Linearity Test			35.17**
Normality Test=Chi2(2)			1.8089
Arch 1-1 test=F(1, 27)			0.07634
Portmonteau(6)=Chi2 (6)			7.7396
Transition Probabilities			
Variable	Regime 0	Regime 1	Regime 2
Regime 0	0	0.1434	0.3665
Regime 1	0	0.7505	0.5191
Regime 2	1	0.1	0.11
Significant at *** at 1 percent-** at 10 percent-* at 1 percent			

Source: Authors

Table 3:Saudi Arabia: Estimation result of MS regression

Variable			Coefficients
Constant (0)			0.0079*
Constant (1)			-0.0567***
Constant (2)			0.0947***
Doil(0)			0.15***
Dlgdp-1			0.3263***
Sigma			0.019*
Log-Likelihood			77.16
AIC			-3.44
LR Linearity Test			26.82***
Normality Test=Chi2(2)			4.4
Arch 1-1 test=F(1, 27)			0.9051
Portmonteau(6)=Chi2 (5)			2.73
Transition Probabilities			
Variable	Regime 0	Regime 1	Regime 2
Regime 0	0.8369	0.7971	0
Regime 1	0.0787	0	0.5254
Regime 2	0.08437	0.2028	0.4745
Significant at *** at 1 percent-** at 10 percent-* at 1 percent			

Source: Authors

Table 4: Venezuela: Estimation result of MS regression

Variable	Coefficients
Constant (0)	-0.0632***
Constant (1)	0.01825***
Constant (2)	0.08224***
Doil(0)	0.004
Doil(1)	0.0167*
Doil (2)	0.08636***
Doil-1(0)	0.0138
Doil-1(1)	0.01198
Doil-1(2)	-0.0371***
Doil-2(0)	-0.106***
Doil-2(1)	-0.0441
Doil-2(2)	0.07558***
Doil-3(0)	0.0984***
Doil-3(1)	-0.0023
Doil-3(2)	-0.177***
Dlgdp-1(0)	1.0285***
Dlgdp-1(1)	0.4297***
Dlgdp-1(2)	-0.0859*
Dlgdp-2(0)	-0.0395*
Dlgdp-2(1)	-0.1878**
Dlgdp-2(2)	-0.0313
Dlgdp-3(0)	-0.4889***
Dlgdp-3(1)	0.1882**
Dlgdp-3(2)	0.0277
Sigma	0.0094***
Log-Likelihood	111.35
AIC	-3.34
LR Linearity Test	64.17***
Normality Test=Chi2(2)	1.9883
Arch 1-1 test=F(1, 15)	0.7373
Portmonteau(6)=Chi2 (6)	4.39*

Transition Probabilities

Variable	Regime 0	Regime 1	Regime 2
Regime 0	0.186	0.22	0.32
Regime 1	0.539	0.55	0.1925
Regime 2	0.2741	0.225	0.478

Significant at *** at 1 percent-** at 10 percent-* at 1 percent

Source: Authors

Table 5: Kuwait: Estimation result of MS regression

Variable	Coefficients
Constant (0)	-0.042***
Constant (1)	0.0279**
Constant (2)	0.0614***
Doil(0)	0.0347***
Doil(1)	0.4279***
Doil (2)	0.7339***
Doil-1(0)	0.354***
Doil-1(1)	0.1692***
Doil-1(2)	0.0079
Doil-2(0)	-0.0757***
Doil-2(1)	0.0482
Doil-2(2)	0.1475***
Dlgdp-1(0)	0.603***
Dlgdp-1(1)	-0.2216***
Dlgdp-1(2)	-0.0422
Dlgdp-2(0)	-0.1316**
Dlgdp-2(1)	0.0243
Dlgdp-2(2)	-0.1974**
Sigma (0)	0.00767**
Sigma (1)	0.04242***
Sigma (2)	0.02717***
Log-Likelihood	72.23
AIC	-2.19
LR Linearity Test	80.44**
Normality Test=Chi2(2)	1.1734
Arch 1-1 test=F(1, 18)	0.0033
Portmonteau(6)=Chi2 (6)	3.29

Transition Probabilities

Variable	Regime 0	Regime 1	Regime 2
Regime 0	0	0	0.5414
Regime 1	0.8306	0.4531	0.4585
Regime 2	0.1693	0.5468	0

Significant at *** at 1 percent-** at 10 percent-* at 1 percent

Source: Authors

Table 6: Nigeria: Estimation result of MS regression

Variable	Coefficients
Constant (0)	-0.035***
Constant (1)	0.0779***
Constant (2)	0.0428***
Doil	0.0129**
Doil-1	0.0071
Dlgdp-1	-0.258***
Sigma	0.0183***
Log-Likelihood	61.03
AIC	-3.51
LR Linearity Test	25.91*
Normality Test=Chi2(2)	0.117
Arch 1-1 test=F(1, 17)	1.73
Portmonteau(6)=Chi2 (5)	2.47

Transition Probabilities

Variable	Regime 0	Regime 1	Regime 2
Regime 0	0.5335	0.3956	0
Regime 1	0.4664	0.4888	0
Regime 2	0	0.1154	1

Significant at *** at 1 percent-** at 10 percent-* at 1 percent

Source: Authors

Table 7: Qatar: Estimation result of MS regression

Variable			Coefficients
Constant (0)			0.0136**
Constant (1)			0.0667***
Constant (2)			0.2033***
Doil			0.0554***
Sigma (0)			0.0187***
Sigma (1)			0.025**
Sigma (2)			0.0353***
Log-Likelihood			47.94
AIC			-2.63
LR Linearity Test			27.6***
Normality Test=Chi2(2)			0.62
Arch 1-1 test=F(1, 17)			0.0629
Portmonteau(6)=Chi2 (5)			2.63
Transition Probabilities			
Variable	Regime 0	Regime 1	Regime 2
Regime 0	0.46	0.84	0
Regime 1	0.42	0	0.5612
Regime 2	0.112	0.153	0.437
Significant at *** at 1 percent-** at 10 percent-* at 1 percent			

Source: Authors

Appendix 3: Figures of Fitted Values

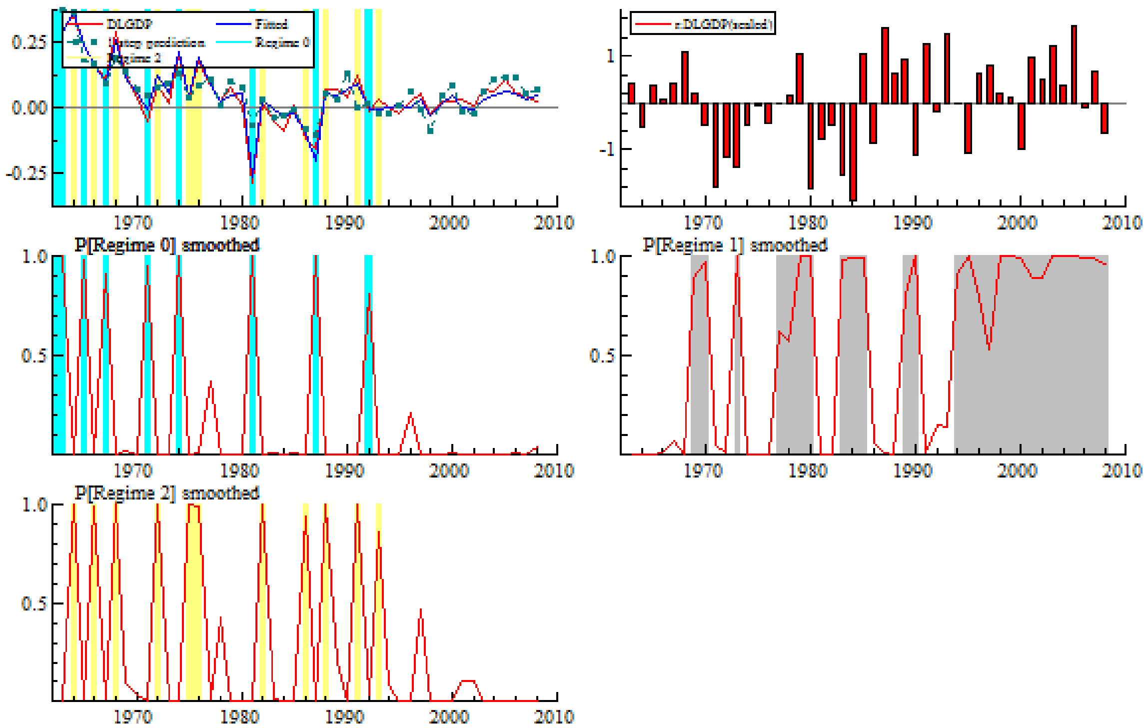

Figure 7: Libya: Fitted Value and Smoothed Probabilities

Source: Authors

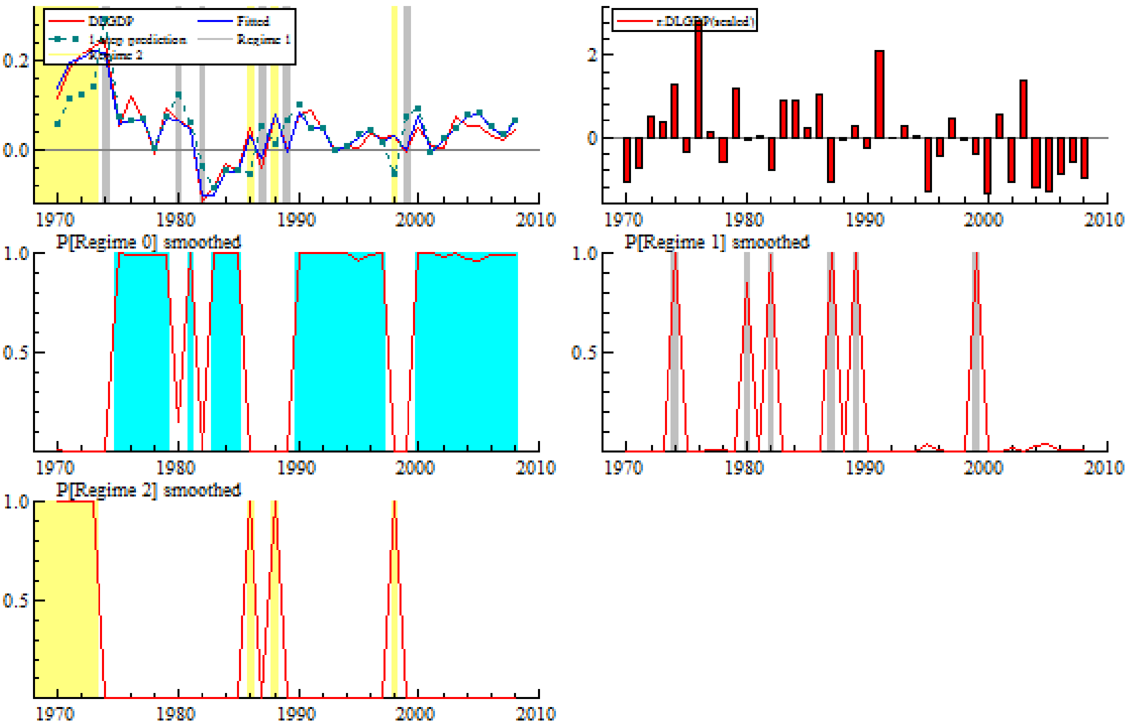

Figure 8: Saudi Arabia: Fitted Value and Smoothed Probabilities

Source: Authors

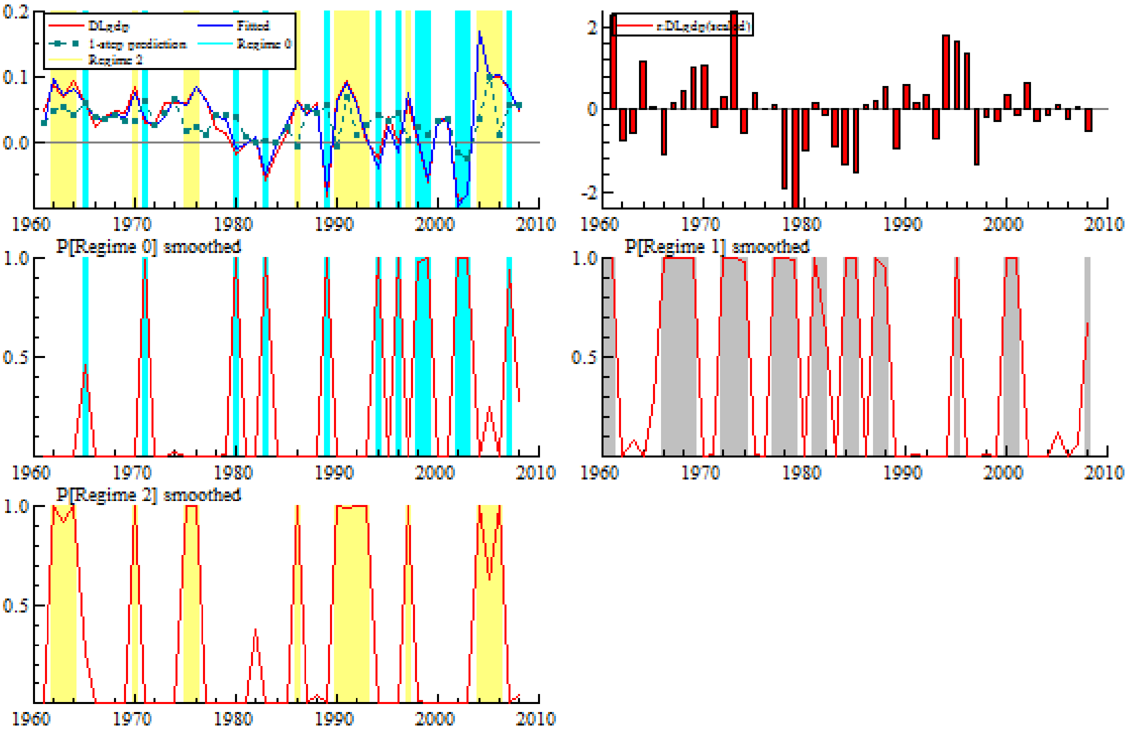

Figure 9: Venezuela: Fitted Value and Smoothed Probabilities

Source: Authors

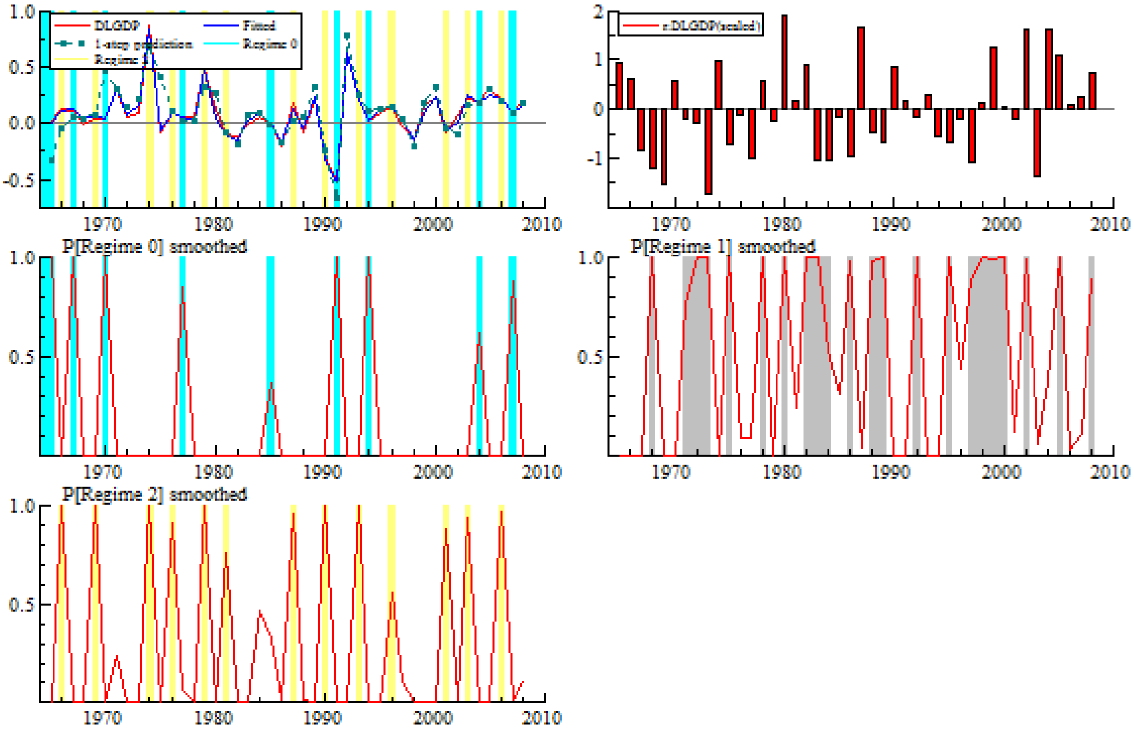

Figure 10: Kuwait: Fitted Value and Smoothed Probabilities

Source: Authors

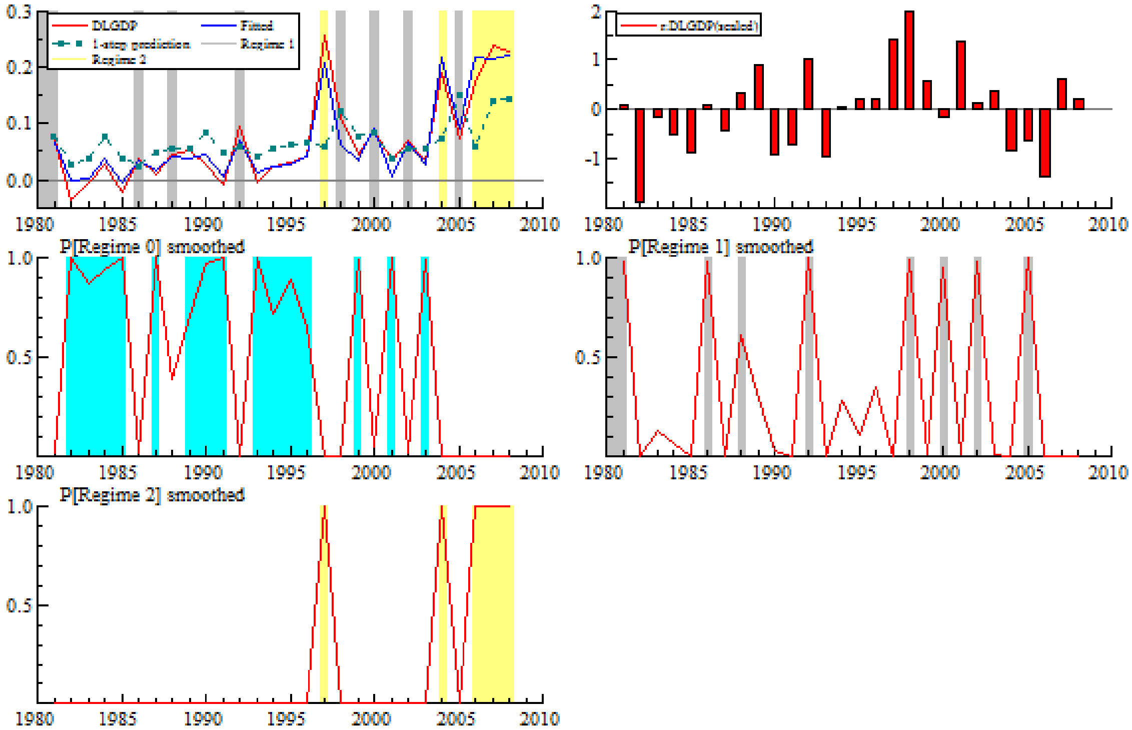

Figure 11: Qatar: Fitted Value and Smoothed Probabilities

Source: Authors

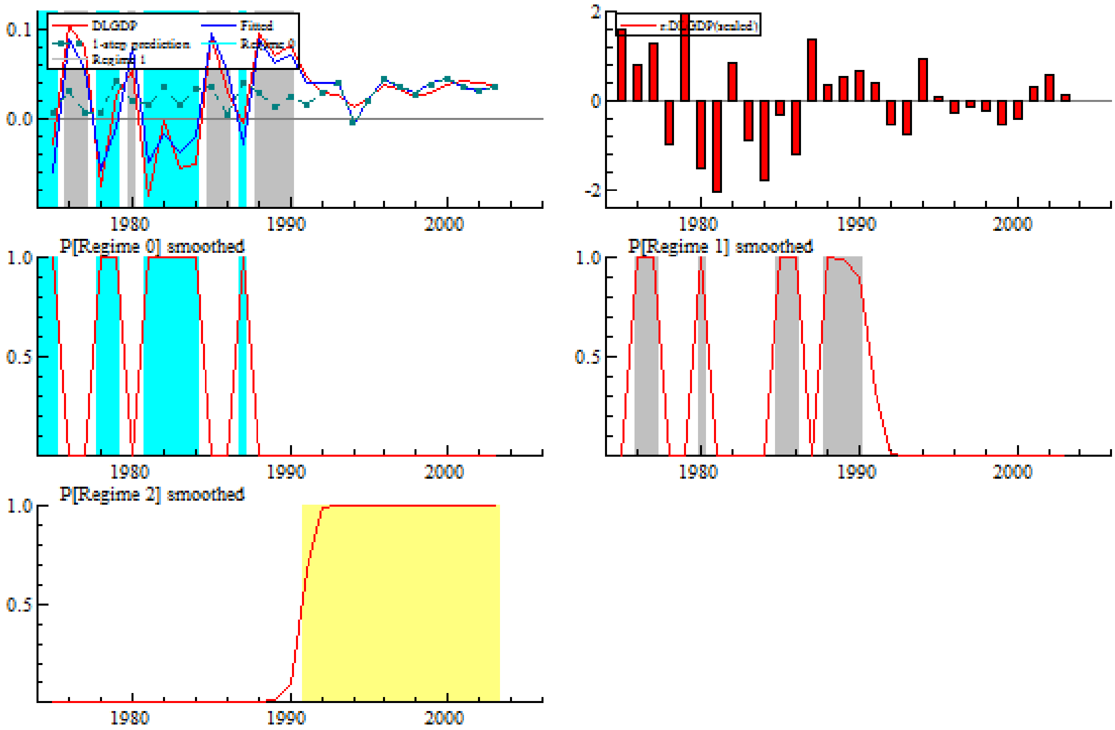

Figure 12: Nigeria: Fitted Value and Smoothed Probabilities

Source: Authors