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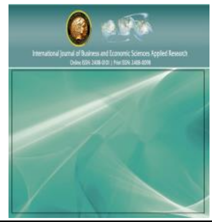

The Effects of Oil Price Shocks on Turkish Business Cycle: A Markov Switching Approach

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Abstract

Purpose - *The purpose of this study is to investigate the relationship between oil price changes and the output growth in Turkey.*

Design/methodology/approach - *The data were taken from International Financial Statistics databases, consisting of monthly data for the period 1986:01-2014:09. Different univariate Markov-switching regime autoregressive models are specified and estimated. Among them we selected univariate MSIH(3)-AR(2) model for output and extended it to verify if the inclusion of various asymmetric oil price shocks as an exogenous variable improves the ability of the Markov switching model. Four different oil price shocks are considered.*

Findings - *We find that amongvarious oil price shocks, onlynet oil price increases have negative effects on output growth and mitigate the magnitude of thesome recessionary periods in Turkey. However, it doesn't strongly explain the behavior of business cycle in Turkey.*

Research limitations/implications - *Our results suggest that the inclusion of other fundamental financial factors in the bivariate Markov switching modelof aggregate economic activity and oil price changes becomes important to explicitly detect the negative impact of oil price shocks on output in Turkey.*

Originality/value - *Our results support the existence of a negative relationship between oil price increases and output growth mentioned in the literature and empirical studies on Turkey.*

Keywords: *business cycle, output, Markov switching regime, oil shocks*

JEL Classification: *E32, E44, Q41*

1. Introduction

There is a wide belief that oil price shocks have important effects on both economic activity and economic policy of all countries. These effects emerge from huge and sudden changes in oil prices. In an early seminal study, Hamilton (1983) finds a strong negative correlation between oil price changes and GNP growth using a multivariate vector autoregression (VAR) system. Further, he provides evidence that oil prices were both significant determinants of U.S. economic activity and exogenous to it throughout the post-war.

Mork (1989) investigates asymmetric response of output to oil price changes by specifying real oil price increases and decreases and concludes that real oil price increases generates large negative effect on output while decrease in oil prices would not confer a positive effect on output. Hence, Mork (1989) proposes an asymmetric relation in which oil variable is given by the oil price change when oil prices go up but equal to zero when oil prices decline.

Hamilton (1996) argues that oil shocks affect the macroeconomy primarily by depressing demand for consumption and investment goods. Therefore, in order to measure the effect of oil price change on spending decisions of consumers and firms, it is appropriate to compare the current price of oil with where it has been over the previous year rather than during the previous quarter alone. Thus, Hamilton (1996) states that Mork (1989)'s proposal is not satisfactory and proposes a net real oil price increase variable that is defined as the percentage change in the current price of oil from the maximum value at some point during the previous year.

On the other hand, Lee, Ni and Ratti (1995) argue that an oil shock is likely to have greater impact on economic activity in an environment where oil prices have been stable than in an environment where oil price movements have been frequent and erratic because price changes in a volatile environment are likely to be soon reversed. A significant relationship between oil and economic activity implies that a certain oil price increase will cause a decrease in economic activity, while a price increase in a period of high volatility is less likely to cause it.

In order to investigate an empirical relationship between business cycle dynamics and oil price changes, one must address movements in business cycle. Hamilton (1989) has proposed a Markov switching (MS) model to investigate asymmetries in business cycle dynamics. Following Hamilton (1989), a number of studies have employed MS autoregressive models to investigate non-linearities and asymmetries in business cycle for various countries (among them see, Engel and Hamilton, 1990; Filardo, 1994; Boldin, 1996; Raymond and Rich, 1997; Krolzig, 1997; Krolzig and Toro, 2000; Clements and Krolzig, 2002; Holmes and Wang, 2003; Cologni and Manera, 2006; 2009).

In recent years, the literature on Turkish business cycle dynamics has been growing. Yilmazkuday and Akay (2008) investigate business cycles of the Turkish economy for the period 1987-2002. Using a three-state univariate MS model (MSMH(3)-AR(2)) they decompose business cycle into recessionary, high-growth and low-growth regimes. They find important asymmetries in the business cycle. Their model captures all the recessionary periods the Turkish economy went through in the sample period. According to their results, the recessionary regime lasts more than the sum of the low- and high-growth regime durations.

Yılmazkuday (2009) investigates productivity cycles of public and private manufacturing sectors in Turkey by using two-state MS model applied through the Bayesian multimove Gibbs-sampling approach over the period 1988-2006. He finds that the productivity in public sector is procyclical in periods of real shocks, such as stagnation or earthquakes, while the productivity in private sector is procyclical in periods of financial crises.

Çatık and Önder (2011) investigate inflationary effects of oil prices in Turkey for the period 1996-2007. Using MSIAH-ARX model among various specifications, they find evidence for the increasing effect of oil on inflation in high inflation regime. Their result stresses that the low-inflation environment plays an important role in the absorption of oil shocks to some extent.

Oil is one of the most important import items for Turkey. Approximately 90 percent of Turkey's crude oil is imported. The oil dependent structure of Turkey makes oil prices a significant variable for Turkish economy. There are some studies on the oil price-macroeconomy relationship for Turkey. Alper and Torul (2008) investigate the response of output growth to oil price increases for Turkey using bivariate VAR and SVAR model separately. They find that when the global liquidity conditions are included, the response of real output to oil price innovations is statistically significant especially for the post-2000 period. Özlale and Pekkurnaz (2010), analyzes the impact of oil prices on the current account balances for the Turkish economy using a structural vector autoregression model where other determinants of current account is considered as well. The results indicate a significant effect of oil price shocks in the short-run. Aydın and Acar (2011) analyze long-term effects of oil price shocks on macroeconomic variables, including GDP, CPI, indirect tax revenues, trade balance, and carbon emissions by a dynamic multi-sectoral general equilibrium model (TurGEM-D) for Turkey. Their simulation results show that oil prices have significant effects on macro indicators and carbon emissions in the Turkish economy. Kapoor (2011) investigates effects of oil price shocks on economic activity of emerging economies. Using the F-test, He finds significant relationship between net oil price increases and the real GDP growth at 10% significance level for Turkey for the period 2000-2009. Finally, Güney and Hasanov (2013) investigate the effects of oil price changes on output and inflation in Turkey for the period 1990-2012. Using ARDL model and Granger causality tests they find that while oil price increases have clear negative effects on output growth, the impact of oil price decline is insignificant.

In this paper we analyze the relationship between oil price shocks and business cycle fluctuations in Turkey by incorporating various oil price increases in a univariate MS model of output and examine the capabilities of these variables to generate shifts in the growth rate of GDP. We use the criteria suggested by Cologni and Manera (2009) to select the optimal MS model among various univariate MS models and then we extend the selected model to investigate asymmetric effects of oil price shocks on business cycle fluctuations. We conclude that although net oil price increases have negative effect on output growth and mitigate the magnitude of the some recessionary periods, it doesn't strongly explain the behavior of Turkish business cycle.

The paper is structured as follows. Section 2 discusses MS model specifications for business cycle, section 3 presents data and various modeling techniques for the effects of oil price changes. Section 4 discusses the empirical results and Section 5 concludes the study.

2. **MS model Specifications for Business Cycle**

According to the Hamilton (1989), the MS model of real GDP can be described as follows:

$$\Delta y_t - \mu(s_t) = \sum_{i=1}^{p} \alpha_i (\Delta y_{t-i} - \mu(s_{t-i})) + \varepsilon_t ,$$

ε_t~N(0, σ^2) (1)

Where Δy_t is the growth rate of the real GDP, μ is the mean of the process and depends on the discrete random variable s_t that reflects unobserved state of the economy. This dependence implies that different regimes are associated with different conditional distributions of the growth rate of the GDP. In case of two regimes, the unobserved state represents "rising" and "falling" states in the GDP. If s_t takes on M different values, model (1) represents a mixture of M different autoregressive models. The autoregressive parameters of model (1) can be functions of the unobserved state s_t. In this case, MS model of real GDP can be described as follows:

$$\Delta y_t = c(s_t) + \sum_{i=1}^{p} a_i (s_t) \Delta y_{t-i} + \varepsilon_t \qquad (2)$$

Where, the parameters of the autoregressive model depend on a regime or unobserved state. The unobserved state itself is described as the outcome of the unobserved Markov chain. Transitions between states are defined by transition probabilities which follow first-order Markov process:

$$p_{ij} = P[s_t = i \mid s_{t-1} = j] , \qquad \sum_{i=1}^{M} p_{ij} = 1$$

More generally, it is assumed that s_t follows an ergodic M-state Markov process with an irreducible transition matrix:

$$P = \begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1M} \\ p_{21} & p_{22} & \cdots & p_{2M} \\ \vdots & \vdots & \ddots & \vdots \\ p_{M1} & p_{M2} & \cdots & p_{MM} \end{bmatrix}$$

where $p_{1i} + p_{2i} + ... + p_{Mi} = 1$ for $i = 1,2,...,M$ and the probability of a regime switching is assumed to be constant.

There can be asymmetry in the persistence of regimes. For example, in case of two-regime GDP growth model (1), if μ_1 is negative and large in absolute value and p_{11} is small, downward movements in the GDP are short but sharp. On the other hand, if μ_2 is positive and small and p_{22} is large, upward movements in the GDP are gradual and weak. Another possibility is the long swings hypothesis as described by Engel and Hamilton (1990): if μ_1 and μ_2 are opposite in sign and that the values of both p_{11} and p_{22} are large, there are long swings in the business cycle.

Following Psaradakis and Spagnolo (2003), we use the Akaike Information Criterion (AIC) to determine the correct number of regimes in models (1) and (2). They suggest AIC test to select the number of regimes, provided that the sample size and parameter changes are not too small. Further, we use both AIC and likelihood ratio(LR) tests to determine the number of autoregressive terms in models (1) and (2). Following Cologni and Manera (2009), in the final stage, we compare the different types of selected models. The comparison is based on the following criteria: i) model fit, as summarized by the standard error of the residuals; ii) value of the log-likelihood function; iii) values of means and/or intercepts estimated in the different economic regimes; iv) relation between the probability of regime switching and the macroeconomic fundamentals. This last criterion emphasizes that the probability of a low growth state should be smaller than the probability of high growth, since recessions are recognized to be more short-lived than expansions[1].From the estimated transition probabilities we measure the persistence of the different economic phases.

[1] With this criterion we differ from Yilmazkuday and Akay (2008) analysis. Their result indicates that the recessionary regime lasts even more than the sum of the low- and high-growth regime durations.

3. Data and Model Specifications for the Effects of Oil Price Shocks

In this study, we use monthly data of seasonally adjusted total industrial production index (IP) for Turkey and real oil price for the period 1986:1-2014:9. Both data are taken from the International Financial Statistics databases (IFS). The real oil price is obtained by multiplying the nominal oil price expressed in U.S. Dollars by the nominal exchange rate and deflating it by consumer price index (CPI). Thus, the real oil price reflects exchange rate fluctuations and inflation variations as well. The data for IP and oil price are obtained from the IFS. The logarithmic first difference of IP is referred to as the output growth rate.

In order to account for the asymmetric effects of oil shocks, we introduce four different definitions of oil shocks. The first is the logarithmic first differences of the real oil price, i.e. $\Delta roil_t$, t=1,…,T.

$$\Delta roil_t = \ln roil_t - \ln roil_{t-1}$$

The second variable is defined as the positive change in the logarithm of the real oil price suggested by Mork 1989.

$$\Delta roil_t^{+} = \begin{cases} \Delta roil_t, & if \quad \Delta roil_t > 0 \\ 0, & if \quad \Delta roil_t \le 0 \end{cases}$$

The third definition is the net oil price increases ($NOPI_t$) suggested by Hamilton (1996). The $NOPI_t$ is defined as the positive percentage change in the current price of oil from the maximum value at some point during the previous year:

$$NOPI_t = \begin{cases} \ln roil_t - \max(\ln roil_{t-1}, ..., \ln roil_{t-12}), & if \ \ln roil_t > \max(\ln roil_{t-1}, ..., \ln roil_{t-12}) \\ 0 & otherwise \end{cases}$$

Following Lee, Ni and Ratti (1995), the fourth oil shock variable is aimed at capturing the volatility in the oil price market. Lee, Ni and Ratti (1995) normalize the oil price changes with their GARCH volatility. Following them, the resulting normalized or standardized oil price increases ($SOPI_t$) are calculated according to the following model[2]:

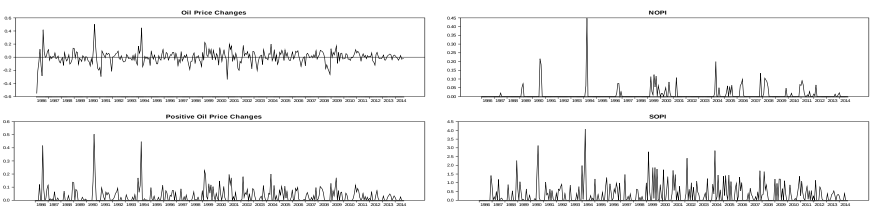
$$\Delta roil_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta roil_{t-i} + \varepsilon_t , \quad \varepsilon_t \sim N(0, h_t)$$

$$h_t = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 h_{t-1}$$

$$SOPI_t = \begin{cases} \dfrac{\hat{\varepsilon}_t}{\sqrt{h_t}}, & if \quad \dfrac{\hat{\varepsilon}_t}{\sqrt{h_t}} > 0 \\ 0, & if \quad \dfrac{\hat{\varepsilon}_t}{\sqrt{h_t}} \le 0 \end{cases}$$

Figure 1 presents alternative measures of oil price shocks discussed so far in this section.

Figure 1. Alternative Measures of Oil Price Shocks



Using the data described above, we explore whether realization of oil price shocks alone generates cyclical asymmetries in output principally in the MS framework. By incorporating real oil price shocks in a MS model of output we investigate whether real oil price shocks generate shifts in the growth rate of output in Turkey.

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[2] We estimated AR(8)-GARCH(1,1) model with t-distributed innovations. AIC and SBC are used to determine the optimal number of lags for oil price change ($p = 8$).

The first model to investigate the relationship between real oil price shocks and business cycle fluctuation sis the extension of (1), known as the MS-mean (MSM) model[3]:

$$\Delta y_t - \mu(s_t) = \sum_{i=1}^{p} \alpha_i (\Delta y_{t-i} - \mu(s_{t-i})) + \sum_{i=1}^{q} \beta_i oil_{t-i} + \varepsilon_t \quad (3)$$

$$\varepsilon_t \sim N(0, \sigma^2) \quad (4)$$

where oil_t represents one of four alternative specifications of oil price shocks (namely, $\Delta roil_t$, $\Delta roil_t^+$, $NOPI_t$, $SOPI_t$) described in Section 2.

If we consider a once-and-for-all jump in the real GDP series, the MSM model (3)-(4) turns tothe MS-intercept (MSI) model:

$$\Delta y_t = c(s_t) + \sum_{i=1}^{p} \alpha_i \Delta y_{t-1} + \sum_{j=1}^{q} \beta_j oil_{t-j} + \varepsilon_t \quad (5)$$

Equations (3)-(4) and (5)-(4) can be generalized in two directions. Since output volatility in recessions is generally different from the volatility in expansions, equation (3) can incorporate a regime-varying variance of the disturbance terms:

$$\varepsilon_t \sim N(0, \sigma^2(s_t)) \quad (6)$$

Equations (3) and (6) define MSM – heteroskedastic (MSMH) model, while equations (5) and (6) define MSI – heteroskedastic (MSIH) model. On the other hand, if the parameters of the autoregressive part of the MSI model are allowed to become functions of the state variable s_t, resulting MSI-autoregressive (MSIA) model is written as:

$$\Delta y_t = c(s_t) + \sum_{i=1}^{p} \alpha_i (s_t) \Delta y_{t-i} + \sum_{j=1}^{q} \beta_j (s_t) oil_{t-j} + \varepsilon_t \quad (7)$$

Combining model (7) with (6) obtains MSI-autoregressive-heteroskedastic (MSIAH) model[4].

4. Empirical Results

The Expectation-Maximization (EM) algorithm is used to estimate univariate and bivariate models. The analysis is started by examining various univariate MS(m)-AR(p) models for monthly IP growth rate over the period 1986:01-2014:09.Then, we compare m-state univariate MSM, MSMH, MSI, MSIH, MSIA and MSIAH models with each other in order to select the optimal model by using the criteria suggested by Cologni and Manera (2009) described in section 2. AIC and LR tests are used to determine optimal lag length of autoregressive terms in MS models. As a result, the univariate MSIH(3)-AR(2) model, namely a MSIH model with three regimes and a two-lag autoregressive component is selected as most appropriate model to detect the business cycle feature of Turkey.

The estimation results of MSIH(3)-AR(2) model are reported in Table 1. All coefficients are statistically significant. Estimated regime dependent intercept terms point out that in regime 1 the economy experiences a moderate growth, in regime 2 the economy experiences high economic growth and in regime 3 the economy experiences recession. Regime 1 and regime 2 each tend to last approximately 4 months, while regime 3 is less persistent which tends to lasts 2 months. According to the regime 3, the periods 1990:07, 1990:12-1991:01, 1991:06, 1994:02-1994:06, 1995:03-1995:04, 1996:02, 1998:04, 1999:08, 2000:03, 2000:12, 2001:02-2001:04, 2003:02, 2006:01, 2007:12, 2008:09-2009:01, 2013:08 are characterized as recessionary[5]. Figure 2 reveals smoothed probability of the recession periods in univariate model. As seen from the

[3] In the empirical section, a univariate MS model is denoted by MS(m)-AR(p), while a bivariate MS model with exogenous oil variable is denoted by MS(m)-ARX(p).

[4]In equations (3) and (4) we assume that oil price shocks are independent of the unobserved state variable for output, while in equation (7) the effect of oil price shocks on economic growth is regime dependent.

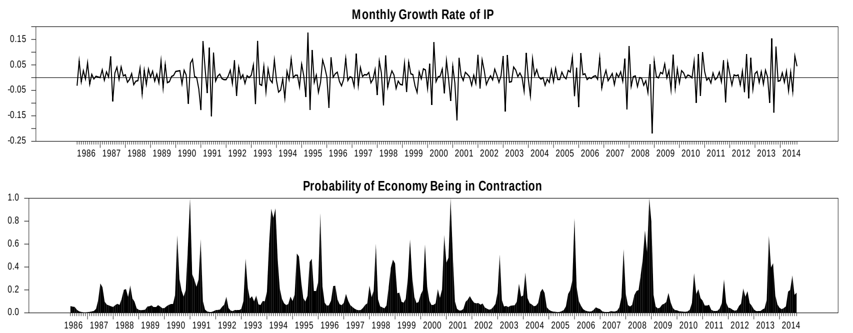
[5] We assign the t-th observation of the IP to the third regime if $\Pr(s_t = 3 \mid \Delta y_t > 0.50)$.

Table 1. Selected Univariate MSIH(3)-AR(2) Model and Bivariate MSIH(3)-ARX(2) model with various exogenous oil prices

Parameter	Univariate Model	Bivariate Models			
	MSIH(3)-AR(2)	$\Delta roil_t$	$\Delta roil_t^+$	$NOPI_t$	$SOPI_t$
c_1	0.00852***	0.00830***	0.00741***	0.01025***	0.00653***
	(0.0022)	(0.0021)	(0.0022)	(0.0020)	(0.0020)
c_2	0.01495***	0.01492***	0.01407***	0.01253***	0.01087***
	(0.0035)	(0.0034)	(0.0034)	(0.0035)	(0.0032)
c_3	-0.02630**	-0.03006***	-0.03193**	-0.01842	-0.04853***
	(0.0123)	(0.0139)	(0.0136)	(0.0164)	(0.0179)
α_1	-0.67036***	-0.68519***	-0.68060***	-0.66171***	-0.71306***
	(0.0392)	(0.0382)	(0.0386)	(0.0390)	(0.0369)
α_2	-0.19636***	-0.20994***	-0.20338***	-0.18929***	-0.23217***
	(0.0376)	(0.0367)	(0.0373)	(0.0349)	(0.0348)
β_1		0.02225	0.02165	-0.06201	0.00271
		(0.0176)	(0.0252)	(0.0457)	(0.0026)
β_2		0.01344	0.01182	-0.07159	0.00587**
		(0.0177)	(0.0257)	(0.0470)	(0.0026)
$\sigma_{\varepsilon 1}$	0.00021***	0.00020***	0.00021***	0.00021***	0.00018***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$\sigma_{\varepsilon 2}$	0.00157***	0.00158***	0.00156***	0.00180***	0.00166***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0002)
$\sigma_{\varepsilon 3}$	0.00418***	0.00419***	0.00418***	0.00520***	0.00417***
	(0.0010)	(0.0011)	(0.0011)	(0.0017)	(0.0015)
Transition Matrix					
	regime1 regime2 regime3	*regime1 regime2 regime3*	*regime1 regime2 regime3*	*regime1 regime2 regime3*	*regime1 regime2 regime3*
Regime 1	0.73 0.13 0.07	0.73 0.11 0.12	0.73 0.12 0.08	0.73 0.11 0.19	0.73 0.09 0.16
Regime 2	0.27 0.73 0.48	0.27 0.76 0.44	0.27 0.75 0.48	0.27 0.82 0.17	0.27 0.83 0.36
Regime 3	0.00 0.14 0.45	0.00 0.13 0.44	0.00 0.13 0.44	0.00 0.07 0.64	0.00 0.08 0.48
Duration					
Regime 1	3.69	3.74	3.68	3.75	3.75
Regime 2	3.73	4.23	3.98	5.53	5.79
Regime 3	1.83	1.79	1.78	2.77	1.90
Log-L	627.9323	628.8452	628.3739	629.0239	629.86494
AIC	-3.60078	-3.59440	-3.59164	-3.59545	-3.60038
LR test	-	1.8259	0.8832	2.1834	3.8654

Figure 2, the regime 3 shows the recessionary effects of crises occurred in Turkish economy in past years, namely 1990-1991 oil crisis due to Iraq's invasion of Kuwait, 1994 financial crisis, destructive effects of August 1999 earthquake on the economy, 2000-2001 financial sector crisis and 2008-2009 global financial crisis on output. However, the recessionary effect of 1998 Russian stock market crisis on the economy remains a bit less than 50%. Regime 3 well approximates the dates of recessionary periods reported by the OECD (see Table 2).

Figure 2. Smoothed Probability of Recession Periods in Univariate MSIH(3)-AR(2) Model



The transition probabilities in the univariate model (p_{11}=0.73, p_{22}=0.73 and p_{11}=0.45) describe the presence of asymmetries in the business cycle. Moderate growth and high growth regimes both are found to be the more persistent, while recessionary regime is less persistent, which are also confirmed by the average duration of each regime. According to the calculated transition probabilities, while the moderate growth regime has no probability to be followed by the recessionary regime, it has high probability to be followed by a high growth regime ($p_{21} = 0.27$). Further, the recessionary regime has high probability to be followed by high growth regime, while it has low probability (0.07) to be followed by moderate growth regime. Recessionary regime shows the highest variability of standard errors, which reflects the view that recessions are less stable than expansions. On the other hand, high growth regime is characterized by relatively smaller residual standard errors and moderate growth regime is characterized by the smallest residual standard errors.

Table 2. Business Cycle Dates For Turkey[6]

Peak	1987M11	1993M8	1998M1	2000M8	2006M7	2011M5
Trough	1989M5	1994M7	1999M8	2001M10	2009M3	2012M11

[6] The dates are obtained from the webpage of the OECD that publishes the OECD Composite Leading Indicators: Turning Points of Reference Series and Component Series, http://www.oecd.org/std/leading-indicators/oecdcompositeleadingindicatorsreferenceturningpointsandcomponentseries.htm

In order to investigate whether oil price shocks are able to increase the accuracy of MS regression models, we have estimated various MSIH models with three regimes. The optimal lag length of the autoregressive terms and the exogenous oil shocks are determined by using AIC, BIC and LR test. According to the test results, MSIH(3)-ARX(2,2) specification for various exogenous oil shocks is preferred to be the best specification. Our aim is to verify if the introduction of oil shock variables can improve the identification of the different business cycle phases.

For various oil price changes, we are able to describe the first regime as a moderate growth regime, second regime as a high growth regime and third regime as the recessionary regime as in the case of the univariate MS model. As seen from the Table 1, all coefficients of oil shock variables in various bivariate models are statistically insignificant, except for the second coefficient of the $SOPI_t$ which is significant and positive near zero value. The coefficients of $\Delta roil_t$ and $\Delta roil_t^+$ variables are positive and insignificant. On the other hand, both coefficients on the $NOPI_t$ are negative but statistically insignificant at 10% significance level[7]. These results indicate that, when compared with the $NOPI_t$, $\Delta roil_t$, $\Delta roil_t^+$ and $SOPI_t$ are not good regressors to measure the negative effect of oil shocks on output. Further, all the bivariate models don't lead to any significant increase in the likelihood function when compared with the univariate model. Therefore, the LR test, which is distributed as χ^2 with 2 degrees of freedom, doesn't reject the univariate model against all other bivariate models. These findings suggest that oil prices don't significantly affect the Turkish business cycle.

Figure 3 presents smoothed probabilities of recession, moderate growth and high growth periods in univariate model and bivariate model with exogenous $NOPI_t$[8]. As seen from the figure, although addition of the $NOPI_t$ to the univariate model mitigated the magnitude of the some recessionary periods, namely 1994:02-1994:06, 1998:04, 1999:08, 2000:03, 2003:02, 2006:01, 2007:12 and 2013:08 periods, net oil price increases don't have a strong direct effect on the behavior of business cycle in Turkey. However, oil price shocks can also affect an economy indirectly. As mentioned by Aydın and Acar (2011), rising oil prices increases import costs for non-energy products globally which causes unsustainable current account deficits, exchange rate depreciations and high inflation rate in emerging economies like Turkey. Further, rising oil prices can affect global financial conditions by influencing oil importing large emerging economies and developed countries which have high debt burdens. Rising oil prices will make it difficult for these countries to pay-off their deficits which cause disturbances in international financial markets. These disturbances in turn affect small emerging economies like Turkey by causing large capital outflows, exchange rate depreciations, interest rate increases on loans and large current account deficits. Alper and Torul (2008) find that when financial and global liquidity conditions are not considered, the response of real output to oil price increases is found to be insignificant. However, when these conditions are considered, real economic activity in Turkey is negatively affected by oil price increases. Hence, the inclusion of other fundamental

[7] The probability values of the null hypothesis for the coefficients of $NOPI_t$ are 0.17 and 0.13 respectively.

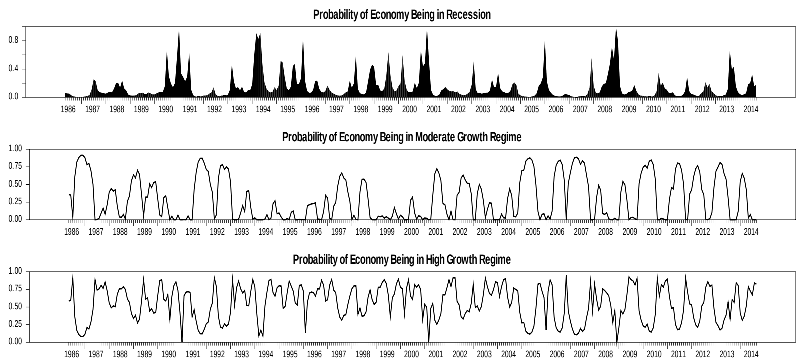
[8] Since the behavior of Turkish business cycle is not significantly affected by other real oil price shocks, business cycle features of bivariate models with other real oil price shocks are very similar to that of the univariate model. To save space, we don't report the graphs of these bivariate models, which are available upon request.

financial conditions in the relation between aggregate economic activity and oil price changes is important to explicitly detect the negative impact of oil price shocks on output for Turkey.

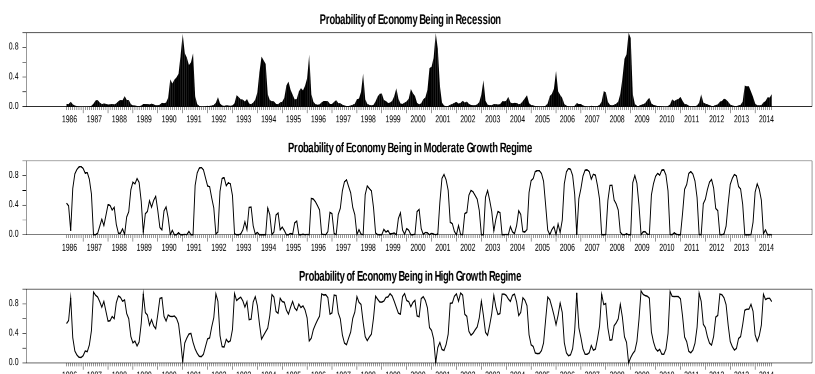
Another result from our analysis is that the regime transitions are not strongly affected by extending the model to include various exogenous oil price variables. According to the univariate and bivariate models, a moderate growth regime tends to be followed by a high growth regime while moderate growth regime has no probability to be followed by recessionary regime in the economy. Further, recessionary phase tends to be followed by high growth phase more often rather than a phase of moderate growth except for the bivariate model with the $NOPI_t$.

Figure 3.Smoothed Probabilities of Recession, Moderate Growth and High Growth Periods in Univariate and Bivariate Models

a) MSIH(3)-AR(2) model



b) MSIH(3)-ARX(2) Model with exogenous $NOPI_t$ variable



5. Conclusions

This paper investigates business cycle dynamics in Turkey by incorporating real oil price changes in a MS model of output and examining the capabilities of this variable to generate shifts in the business cycles. The main consideration is that if real oil price increases have explanatory content for the recessionary phases of output, then the addition of this variable to a univariate MS model for output can mitigate the magnitude of the shifts in these phases. Evaluation of the contribution of oil prices hocks to the recessionary phases of output permits an identification of those periods that can be principally explained by real oil price increases.

First of all, according to the estimation results of various univariate MS models, the three-regime MS models typically outperform the corresponding two-regime specifications in describing the business cycle features for Turkey. In particular, univariate MSIH(3)-AR(2) model well approximates the dates of recessionary periods reported by the OECD. Then, we have considered four different definitions of oil shocks. In particular, oil price changes, positive oil price changes, net oil price increases and standardized oil price increases are used in order to proxy oil shocks.

According to our model selection strategy, among different types of oil shocks, only net oil price increases have negative effect on output growth and mitigates the magnitude of the some recessionary periods. However it doesn't strongly influence the behavior of Turkish business cycle. Oil price shocks can also affect the economy through other variables. In this respect, we recommend that future studies tend to investigate a detailed analysis of Turkish business cycle by incorporating other fundamental financial factors such as exchange rate, unit cost of import, budget deficits, current account, capital inflow, international reserves etc., in the bivariate MS model so as to measure indirect effects of oil price shocks.

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