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THE ROLE OF SUBSIDY POLICY IN OIL PRICE SHOCKS: THE MOROCCAN CASE

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ABSTRACT

This paper studies the impact of oil prices fluctuations on key macroeconomics variables of Morocco. We will focus on the role of subsidy policy in the oil price-macro-economy relationship. The vector auto regression (VAR) model was used to analyze the data over the period 1993 to 2007. The results of the linear and non-linear models show that the oil prices shock can indirectly affect the economic activity. The oil price shock can hit economic activity through subsidy policy measured by cash payment for operating activities.

Key words:

Oil price shock, Subsidy policy, VAR model, Morocco.

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INTRODUCTION

Since World War II, the oil price shocks in 1973 were among the greatest shocks which have affected the world economy. Since this date, the oil price-macro-economy relationship has become a fruitful field of research. The existence of a negative relationship between oil prices and macroeconomic activity has become widely accepted since Hamilton's results in 1983. These results have been confirmed by a number of other studies (Burbidge and Harrison (1984), (Hamilton (1985, 1996), Gisser and Goodwin (1986) and Mork (1989)).

Several transmission channels[1] by which oil price shock affects economic activity were identified. Some studies (Rasch and Tatom (1981), Brumo and Sachs (1982) and Darby (1982)) explained the negative impact of oil price on economic activity by the supply side. In this case, the oil price increase directly affects the production costs. Pierce and Enzler (1974), Hamilton (1988, 2003), Ferderer (1996), Brown and Yucel (2002) and Cologni and Manera (2005) explained it by the demand side and the real balance. For Bohi (1989) and Bernanke and al (1997) it is the response of the monetary policy to the oil price shock that directly reduces the economic activity and not the rise in the oil price. For these authors, oil price shock counts only slightly for the economic activity recession[2]. Recently, Jbir and Zouari-Ghorbel (2009) showed that oil price can affect economic activity through subsidy policy. This paper is somewhat related to the study of Jbir and Zouari-Ghorbel (2009).

Furthermore, the empirical research has tried to show the existence of an asymmetrical relationship. The rise of the oil price leads to a decline of GDP, but the fall does not stimulate the economic activity. Some studies have suggested non-linear specifications (Mork (1989), Lee et al. (1995) and Hamilton, 1996).

The impact of oil price shocks on the economic activity was for a long time, a controversial subject. Recently, because of the rise of oil prices since 2003, several studies showed that for the importing industrialized countries this relationship is limited since the end of the eighties and the developing countries seem to be more affected. In order to protect their economies, the majority of developing countries apply a subsidy policy[3]. This policy makes the domestic oil price lower than the international oil price. But given the strong increase of oil prices, this policy can affect the economic development of these countries and lead to the slowdown of the economic activity (Jbir and Zouari-Ghorbel (2009)).

The remaining part of this paper is organized as follows: section one summarizes the Moroccan oil situation, the second section presents the model and empirical results, and the last section presents the summary and the conclusion.

1. MOROCCO AND OIL

Morocco suffers from lack of oil resources. Its energy balance was always overdrawn. In order to ensure their development, Morocco needs to import oil from the exporting countries.

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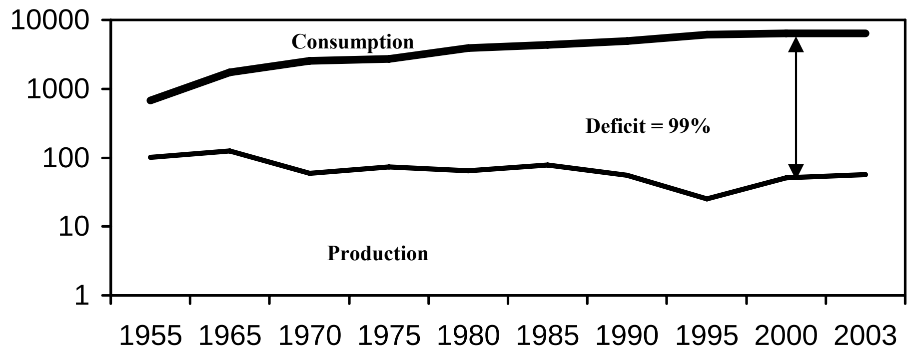
[1] For more discussion on transmission channels, see Brown and Yucel (2002).
[2] These studies were criticized by Hamilton and Herrera (2004).
[3] For more details see Jbir and zouari-Ghorbel (2009)

1.1 Oil production and consumption in Morocco

Since 1928, oil research in Morocco failed to discover important quantities. Until today the maximum produced quantity was about 126000 TOE (ton oil equivalent) in 1965, which remains insufficient compared to consumption in strong progression, which reached 1723000 TOE. This situation involved a deficit in the order of 93% (Debbarh, 2006). Figure 1 illustrates the oil situation of Morocco.

Figure 1: Oil production and consumption in Morocco (thousand TOE)

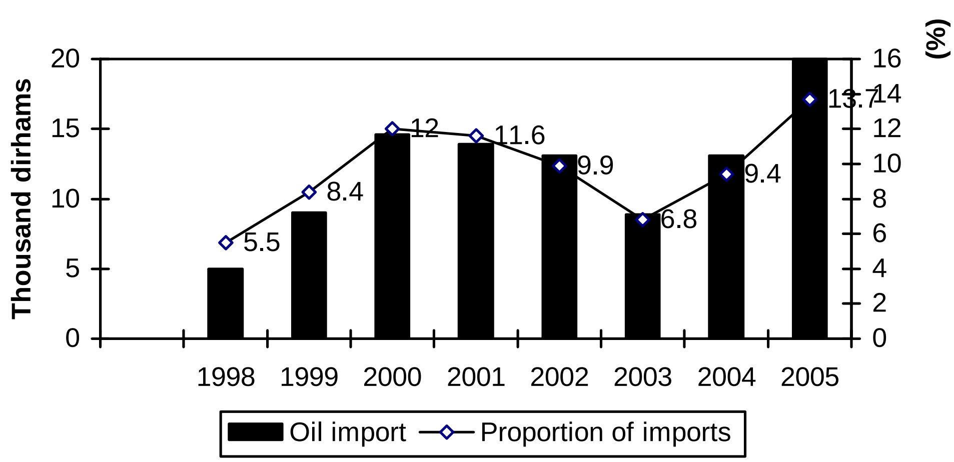


Source of data: Debbarh, A.M. (2006)

1.2 Oil import in Morocco

According to the Moroccan Minister of Finance and the National Office of Hydrocarbons and Mines (ONHYM), in 2004 oil imports reached 3.3% of GDP against an average of 3.4% of GDP in the period 1999-2002. This percentage represents about 17% of export revenue (the equivalent of 62 days of exports) against 11% and 14% respectively in 2003 and 2002. The relative proportion of oil imports to overall imports has increased since 1998. It reached 13.7% in November 2005 against 9.4% in 2004. The rise of oil imports accounted for a 47% overall increase of imports in 2005. Indeed after a decline in 2003 and since the beginning of 2004, Moroccan crude oil needs have grown rapidly as shown in the figure2.

Figure 2: Oil import in Morocco



Source: Office des changes

In November 2005 the crude oil imports of Morocco amounted to 6.6 million tonnes, registering a growth rate of about 16.9% over the same period of the previous year, and 14.1% compared to the average (January-November) of the five previous years. This increase of oil imports is the result of high energy consumption in Morocco due to the increase of the Moroccan population. According to Debbarh (2006) energy consumption in Morocco has increased by 2.34% between 1980 and 2003. Between 1993 and 2003, the population increased from 25.6 to 29.5 million. The energy consumption is mainly used as a factor of production of goods and services (industry).

In spite of this situation, Morocco applies a subsidy policy. The aim of this policy is the disconnection between international oil price and domestic oil price. Due to the inability to index domestic prices on international oil prices, the subsidies have almost doubled between January and October 2006 compared to the same period of the previous year. The part of subsidy payment in 2006 was about 2.3% of GDP (11 billion dirham) (ADB / OECD, 2007).

2. MODEL AND EMPIRICAL RESULTS

2.1 The model

We measure the economic activity (Y) by Moroccan GDP, the role of the subsidy policy by Cash payments for operating activities (C), the inflation rate (p) by the variation of the consumer price index, the ability to compete with countries by the real effective exchange rate (REER) and oil price by the real oil price expressed in American dollars.

We use a Vector Auto regression (VAR) model to analyze the impact of oil prices fluctuations on Morocco. The VAR (P) model is expressed by:

$$Y_t = c + \sum_{i=1}^{P} \phi_i Y_{t-i} + \mu_t \tag{1}$$

where $c\ (n \times 1)$ is the intercept vector of the VAR, Y_t is a $(n \times 1)$ vector of endogenous variables, ϕ is the i^{th} $(n \times n)$ matrix of the autoregressive coefficients for $i = 1, 2, \ldots, p,$ and u_t is the $(n \times 1)$ generalization of a white noise process.

The VAR system can be transformed into its moving average representation in order to analyze the system's response to a real oil price shock, that is:

$$Y_t = \varepsilon + \sum_{i=0}^{\infty} \gamma_i \mu_{t-i} \tag{2}$$

where γ_0 is the identity matrix, ε is the mean of the process. The MA representation is used to obtain the forecast error variance decomposition and the impulse-response function.

The empirical literature identified three transformations of oil price variables for asymmetrical response of the macroeconomics variables to an oil price shock: Mork (1989), Lee, et al, (1995) and Hamilton (1996).

Mork (1989) distinguished between the rises and falls of oil price (asymmetric specification). According to him, the variable which defines the oil price change is showed through the following expression:

$$\Delta oil_t^+ = \max(0, \Delta oil_t),\ \Delta oil_t^+ : \text{Real oil price increases;}$$
$$\Delta oil_t^- = \min(0, \Delta oil_t),\ \Delta oil_t^- : \text{Real oil price decreases.} \tag{3}$$

$\Delta oil_t = \ln oil_t - \ln oil_{t-1}$, Δoil : Quarterly changes of real oil price in logarithm and,

oil_t is the real oil price.

Lee, et. Al., (1995) defended the idea that an oil price change is likely to have greater impact on real GNP in an environment where oil prices are stable, than in an environment where oil price movements are frequent and erratic. These authors used Generalised Autoregressive Conditional Heteroscedasticity (GARCH) model (Bollerslev, 1986). Lee, et al, (1995) proposed the following GARCH (1, 1) representation of oil prices:

$$o_t = \beta_0 + \beta_1 o_{t-1} + \beta_2 o_{t-2} + \beta_3 o_{t-3} + \beta_4 o_{t-4} + e_t$$
$$e_t / \mathrm{I}_{t-1} \approx N(0, h_t)$$
$$h_t = \gamma_0 + \gamma_1 e_{t-1}^2 + \gamma_2 h_{t-1}$$

$$SOPI = \max\left(0, \frac{\hat{e}_t}{\sqrt{\hat{h}_t}}\right)$$
$$SOPD = \min\left(0, \frac{\hat{e}_t}{\sqrt{\hat{h}_t}}\right) \tag{4}$$

Where $SOPI$: Scaled Oil Price Increases, and

$SOPD$: Scaled Oil Price Decreases.

Hamilton (1996) defined the "Net Oil Price Increase" (NOPI). The NOPI is the percentage of the rise in oil price if the price of the current quarter (at the date t) exceeds the four previous quarter maximum (twelve quarters) and zero if not. Thus, the NOPI is presented as follows:

$$NOPI_t = \max\{0, (\ln(oil_t) - \ln(\max(oil_{t-1}, \ldots, oil_{t-4})))\}$$
$$NOPI_{12} = \max\{0, (\ln(oil_t) - \ln(\max(oil_{t-1}, \ldots, oil_{t-12})))\} \tag{5}$$

2.2 Empirical Results

2.2.1 Unit Root Test

The results of unit root tests are displayed in Table 1. We use the Augmented Dickey Fuller (ADF) and Phillips-Perrons (PP) tests to check the stationary status of the variables. This table shows that all variables are stationary in the first difference and are integrated with order one.

Table1: Unit root tests (ADF and PP)

ADF						
Variables	**level**			**1^{er} Difference**		
	(i)	(ii)	(iii)	(i)	(ii)	(iii)
P	4.07	-1.85	-3.42**	-6.37*	-8.48*	-8.59*
C	2.40	3.42	2.18	-3.08**	-3.72**	-4.24*
Y	5.33	1.71	-2.22	-5.39*	-8.18*	-8.62*
REER	0.24	-2.70	-2.86	-5.47*	-5.69*	-5.68*
Oil	1.78	0.66	-1.48	-5.93*	-6.14*	-6.40*
Phillips-Perron (PP)						
P	4.97	-2.16	-3.50**	-6.42*	-8.63*	-8.83*
C	0.65	-3.08**	-6.62*	-15.56*	-18.87*	-24.15*
Y	2.93	-0.11	-5.95*	-11.97*	-13.05*	-12.93*
REER	0.60	-2.62	-2.78**	-5.28*	-5.24*	-5.62*
Oil	1.71	0.59	-1.61	-5.87*	-6.04*	-6.29*

P: inflation rate, C: cash payments, Y: economic activity, REER: real effective exchange rate and Oil: oil price.
(i) : Without intercept, (ii) : with an intercept, and (iii) : with an intercept and trend.
*, **and***: asterisks mean a p-value less than 1%, 5% and 10%.
Critical levels in the model (i): -2.60 (1%), -1.95 (5%) and -1.61 (10%).
Critical levels in model (ii): -3.51, -2.89 and -2.58.
Critical levels in (iii): -4.04, -3.40 and -3.15.

2.2.2 Significance test

The significance test aims to determine whether the impact of oil price shock on economic activity is direct or indirect. The null hypothesis is that all oil price coefficients are jointly zero in the Y equation of the VAR model. We test these restrictions based on statistics of chi-square (Wald). The results of the significance test displayed in Table 2 show that there is not a direct impact.

Table 2: Significance test (Wald test)

Models		**Real oil price**
Linear	Δoil_t	0.039 (0.842)
Asymmetric	Δoil_t^+	0.965 (0.325)
	Δoil_t^-	0.019 (0.889)
NOPI	NOPI4	0.028 (0.866)
	NOPI12	0.011 (0.915)
Scaled	SOPI	0.076 (0.782)
	SOPD	0.0177 (0.894)

Δoil_t : real oil price changes, Δoil_t^+ : increase in real oil price, Δoil_t^- :decrease in real oil price, NOPI4 : Net Oil Price Increase over previous four quarters, NOPI12 : Net Oil Price Increase over previous twelve quarters, SOPID: Scaled Oil Price Increases and SOPD : Scaled Oil Price Decreases.

(.) : P-values of the asymptotic distribution of Chi-squared.

The null hypothesis: The oil price coefficients are jointly equal to zero in Y equation of the VAR model.

*: asterisk means a p-value less than 5%.

2.2.3 Granger causality tests

Granger causality tests can be examined using block exogeneity tests. This test is also used to check whether an endogenous variable can be treated as an exogenous variable. The results of Granger causality tests are presented in Tables 3.1 until 3.7. These tables indicate that there is causality from real oil price to cash payments (C) in the asymmetrical model (Δoil_t^+) and from inflation (P) to cash payments (C) in all models. In addition, the real effective exchange rate causes the cash payments (C) and inflation rate (P).

Table 3.1: Granger causality test / bloc exogeneity test (Linear model: ΔOil_t)

	Excluded variables					Block Exogeneity
Dependent Variable	**Y**	**TCER**	**P**	**C**	**ΔOil**	**All variables together**
Y		0.009 [0.92]	0.017 [0.89]	0.00069 [0.97]	0.039 [0.84]	0.1222 [0.998]
TCER	2.392 [0.12]		1.90 [0.16]	0.075 [0.78]	0.018 [0.89]	4.51 [0.34]
P	1.33 [0.24]	4.482* [0.034]		0.013 [0.905]	0.377 [0.53]	6.097 [0.191]
C	0.121 [0.72]	4.95* [0.026]	9.61 * [0.0019]		0.968 [0.325]	10.50* [0.032]
ΔOil	0.16 [0.68]	0.464 [0.495]	0.739 [0.38]	0.011 [0.91]		0.914 [0.922]

P: inflation rate, C: cash payments, Y: economic activity, REER: real effective exchange rate and ΔOil: oil price. The values in each box represent chi-square (Wald) statistics for the joint significance of each other lagged endogenous variable in that equation. The statistics in the last column are the chi-square statistics for joint significance of all other lagged endogenous variables in the equation. *,** significant at 5% et 10%.

Table 3.2: Granger causality test / bloc exogeneity test (asymmetric model: ΔOilt+)

	Excluded variables					Block Exogeneity
Dependent Variable	**Y**	**TCER**	**P**	**C**	**ΔOil**	**All variables together**
Y		0.043 [0.83]	5.12 E-05[0.99]	0.0011 [0.97]	0.965 [0.32]	1.05 [0.90]
TCER	2.40 [0.12]		1.90 [0.16]	0.092 [0.76]	0.0039 [0.94]	4.494 [0.34]
P	1.38 [0.23]	4.80* [0.028]		0.059 [0.80]	0.317 [0.57]	6.031 [0.19]
C	0.11 [0.73]	6.40* [0.011]	11.99* [0.0005]		4.99* [0.025]	15.28* [0.0042]
ΔOil	0.007 [0.93]	0.796 [0.37]	0.132 [0.71]	2.87** [0.089]		5.30 [0.25]

Table 3.3: Granger causality test / bloc exogeneity test (asymmetric model: ΔOil_t^-)

	Excluded variables					Block Exogeneity
Dependent Variable	**Y**	**TCER**	**P**	**C**	**ΔOil**	**All variables together**
Y		0.01 [0.91]	0.015 [0.90]	0.0021 [0.96]	0.019 [0.88]	0.1026 [0.998]
TCER	2.40 [0.12]		1.867 [0.17]	0.082 [0.0.77]	0.014 [0.90]	4.505 [0.34]
P	1.387 [0.23]	4.40* [0.035]		0.041 [0.83]	0.041 [0.83]	5.723 [0.22]
C	0.336 [0.56]	5.76* [0.016]	10.68* [0.0011]		2.733 ** [0.098]	12.597* [0.013]
ΔOil	0.773 [0.37]	0.024 [0.87]	0.16 [0.68]	0.228 [0.63]		1.299 [0.86]

Table 3.4: Granger causality test / bloc exogeneity test (NOPI4 model)

	Excluded variables					Block Exogeneity
Dependent Variable	**Y**	**TCER**	**P**	**C**	**ΔOil**	**All variables together**
Y		0.0054 [0.94]	0.025 [0.87]	0.0024 [0.96]	0.028 [0.86]	0.111 [0.99]
TCER	2.60* [0.10]		1.661 [0.19]	0.116 [0.73]	0.336 [0.56]	4.856 [0.30]
P	1.285 [0.25]	4.580* [0.032]		0.046 [0.83]	0.026 [0.87]	5.707 [0.22]
C	0.074 [0.78]	4.465* [0.034]	8.534* [0.0035]		0.563 [0.452]	10.022* [0.040]
ΔOil	1.263 [0.26]	0.234 [0.62]	0.44 [0.50]	0.084 [0.77]		1.0809 [0.77]

Table 3.5: Granger causality test / bloc exogeneity test (NOPI12 model)

	Excluded variables					Block Exogeneity
Dependent Variable	**Y**	**TCER**	**P**	**C**	**ΔOil**	**All variables together**
Y		0.0085 [0.92]	0.021 [0.88]	0.0021 [0.96]	0.0111 [0.91]	0.0944 [0.99]
TCER	2.205 [0.13]		1.981 [0.15]	0.067 [0.79]	0.087 [0.76]	4.584 [0.33]
P	1.073 [0.30]	4.451* [0.034]		0.015 [0.89]	0.557 [0.45]	6.298 [0.17]
C	0.144 [0.70]	4.674* [0.030]	9.267* [0.0023]		0.018 [0.89]	9.374** [0.052]
ΔOil	0.398 [0.52]	0.062 [0.80]	0.333 [0.56]	2.205 [0.13]		2.704 [0.60]

Table 3.6: Granger causality test / block exogeneity test (SOPI model)

	Excluded variables					Block Exogeneity
Dependent Variable	**Y**	**TCER**	**P**	**C**	**ΔOil**	**All variables together**
Y		0.0068 [0.93]	0.021 [0.88]	8.4E-05 [0.99]	0.076 [0.78]	0.159 [0.99]
TCER	2.517 [0.11]		1.888 [0.16]	0.141 [0.70]	0.112 [0.73]	4.612 [0.32]
P	1.299 [0.25]	4.549* [0.032]		0.048 [0.82]	7.6E-05 [0.99]	5.678 [0.22]
C	0.117 [0.73]	4.702* [0.03]	9.257* [0.0023]		0.0053 [0.94]	9.359** [0.052]
ΔOil	0.313 [0.57]	0.323 [0.56]	0.576 [0.44]	0.634 [0.42]		1.311 [0.85]

Table 3.7: Granger causality test /bloc exogeneity test (SOPD model)

	Excluded variables					Block Exogeneity
Dependent Variable	**Y**	**TCER**	**P**	**C**	**ΔOil**	**All variables together**
Y		0.0045 [0.94]	0.021 [0.88]	0.005 [0.94]	0.017 [0.89]	0.101 [0.99]
TCER	2.233 [0.13]		2.125 [0.14]	0.132 [0.71]	0.675 [0.41]	5.226 [0.26]
P	1.257 [0.26]	4.82* [0.02]		0.07 [0.78]	0.295 [0.58]	6.00 [0.19]
C	0.221 [0.63]	5.694* [0.0.017]	10.29* [0.0013]		1.875 [0.17]	11.579* [0.02]
ΔOil	0.412 [0.52]	0.465 [0.49]	0.634 [0.42]	0.003 [0.95]		1.134 [0.88]

2.2.4 Impact of oil price in Morocco

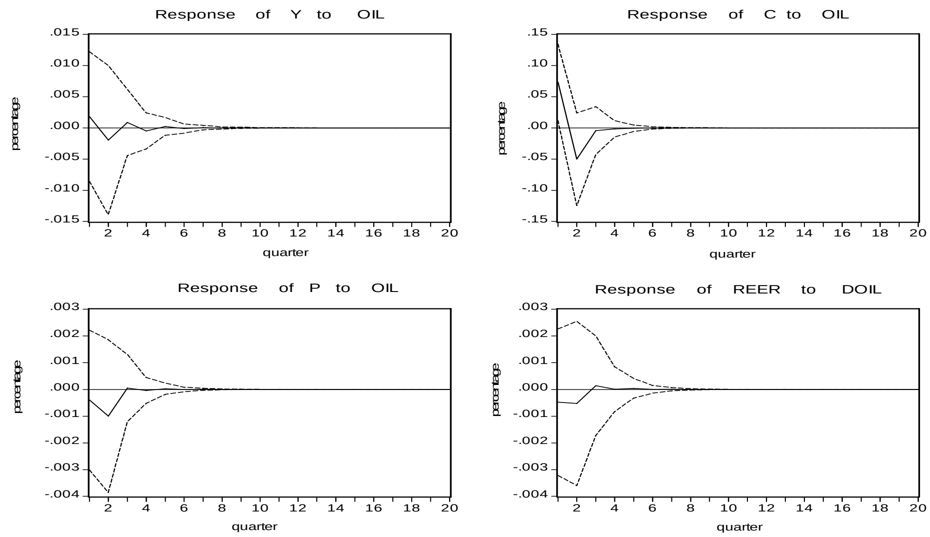
2.2.3.1 Orthogonalised impulse response function

In this section, we study the impact of oil price on the macro-economic variables by analyzing the orthogonalised impulse response functions and variance decomposition. The identification is made by using the decomposition of Cholesky. This requires the choice of the order of the variables in the system. We classify the variables of the model as follows: real oil price (Δoil), Cash payments (C), inflation (P), real effective exchange rate (REER) and economic activity (Y).

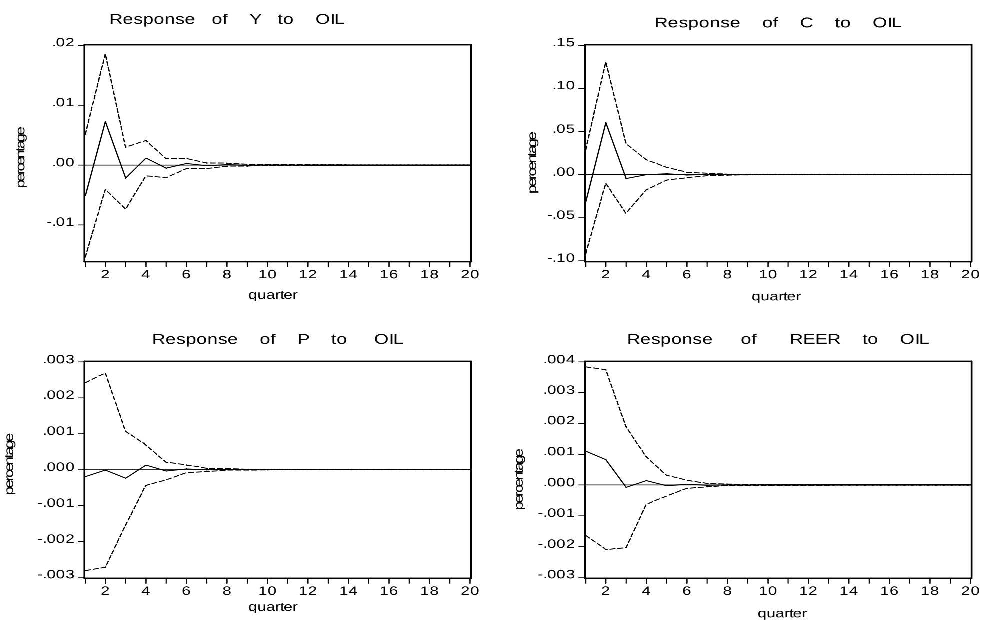
The results of the orthogonalised impulse response functions are presented in Figure 3 below.

Figure 3: Impulse response functions of macroeconomics variables

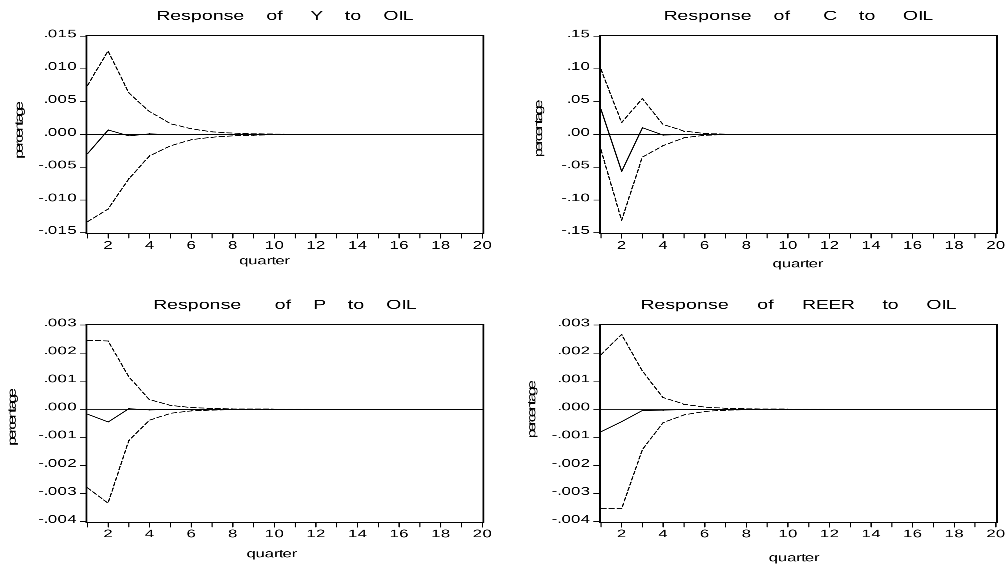
Impulse response functions of macroeconomics variables: (Linear model: ΔOil_t)



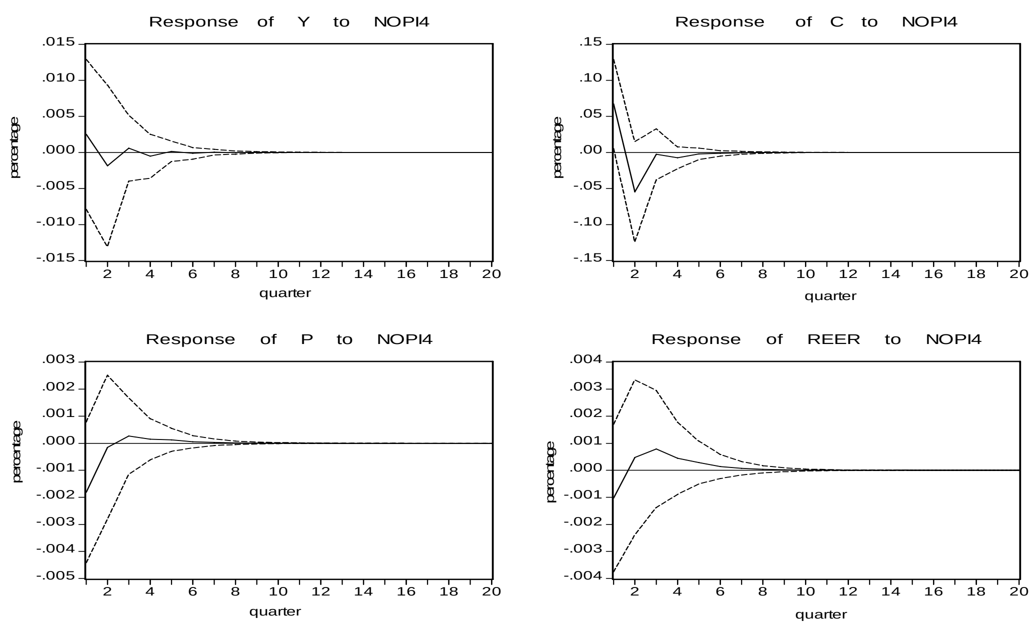
Impulse response functions of macro-economics variables: (Asymmetric model: Δoil_t^+)



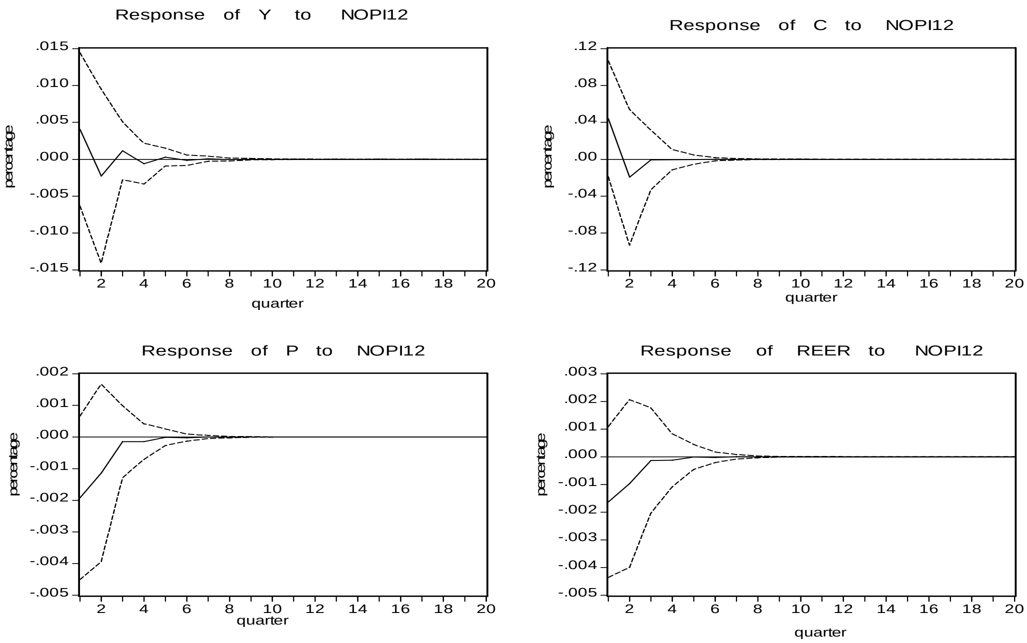
Impulse response functions of macroeconomics variables: (Asymmetric model: Δoil_t^-)



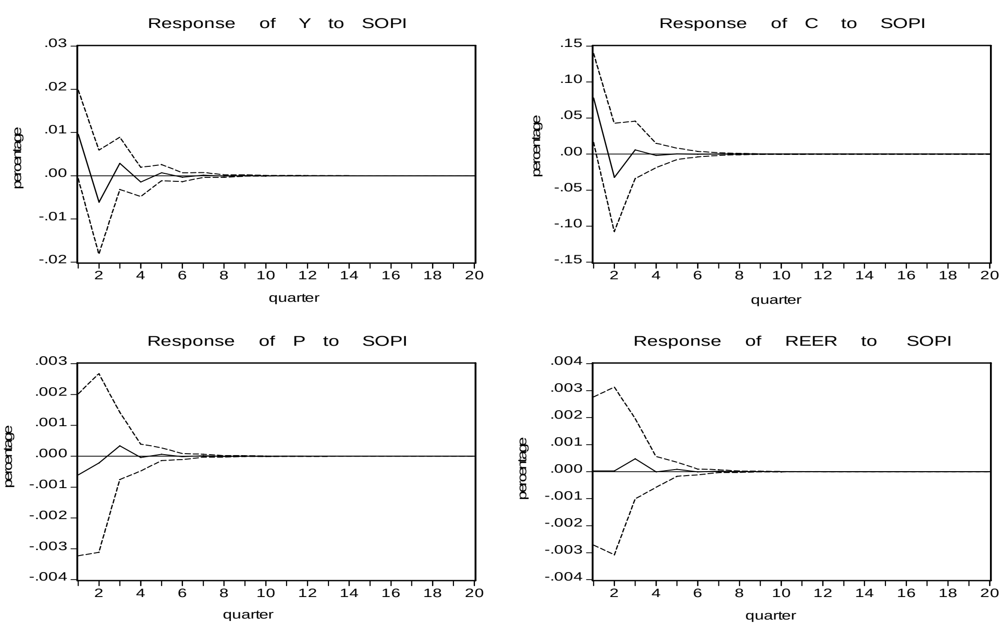
Impulse response functions of macroeconomics variables: (NOPI4 model)



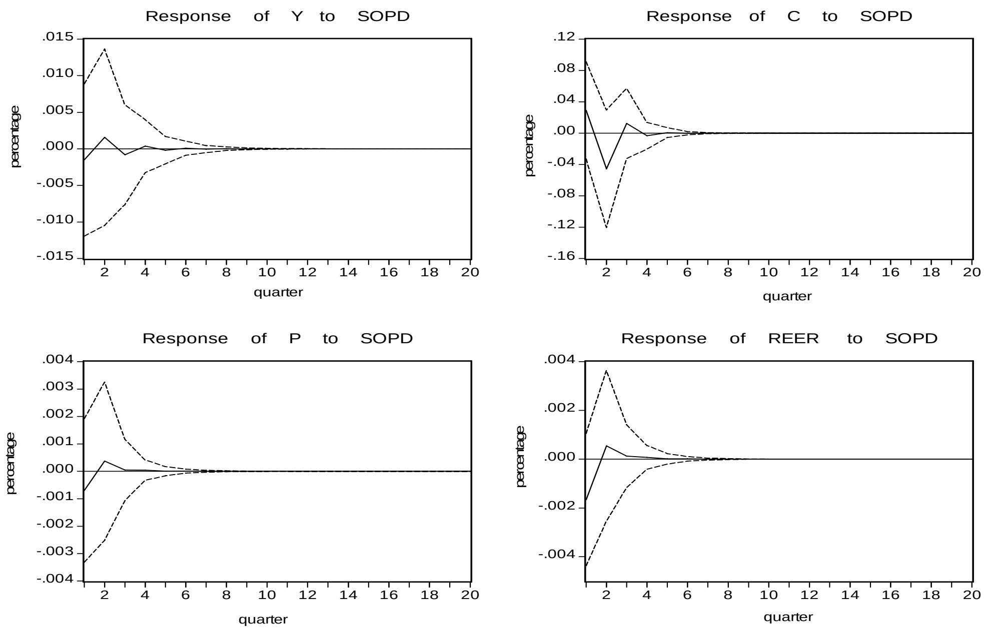
Impulse response functions of macroeconomics variables: (NOPI12 model)



Impulse response functions of macroeconomics variables: (SOPI model)



Impulse response functions of macroeconomics variables: (SOPD model)



These impulse response functions show that only the variable cash payments (C) in the linear models, NOPI4 and SOPI, are significant. The horizon for which the response is stabilized and turned over is limited in the short run (one or two quarters). Thus, oil price shocks can cause a turndown of the economic activity only indirectly. The impact of oil prices positively affects the short term expenditure of the operations of activities for Morocco. These results indicate that the oil prices can affect the economic growth via the policy of subsidy.

2.2. Variance decomposition

Table 4 summarizes the results of variance decomposition for all models in twelve quarters.

- For the **economic activity**, the oil price contributed to its variation only slightly. The SOPI model appears to be the most significant model. Indeed, oil price shock explains approximately 7% of the variation of the Moroccan GDP after twelve quarters. The share of contribution of the oil prices in the other models does not exceed the 4.27%. The contribution of the subsidy policy measured by the expenditure of the operations activities (Cash payments) is also limited for all models. It is also of a maximum of about 1% for model SOPI. In the same way, the contribution of the other variables (real exchange rate and inflation) is weak. Briefly, these moderate results (compared to the results of the impulse response functions) can be explained by the fact that Morocco had been a poor country in oil. For two year it starts to produce significant quantities which can reduce the impact of current rises of oil price.

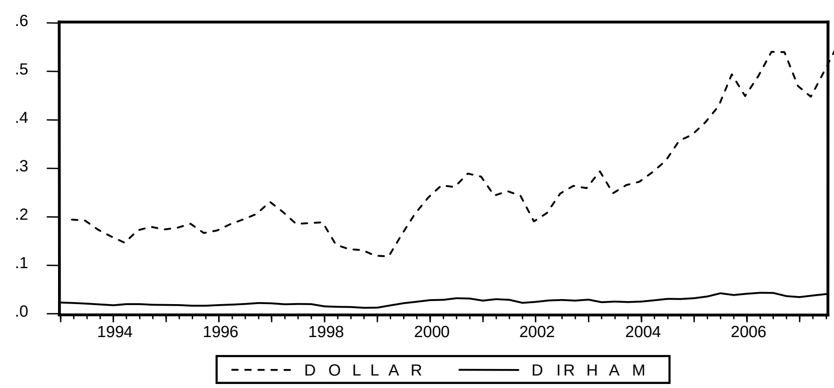
Table 4: Estimated orthogonal variance decomposition (in twelfth quarter)

ΔOil_t					
	Y	**ΔOil_t**	**P**	**TCER**	**C**
Y	98.512	0.408	0.946	0.046	0.086
ΔOil_t	0.241	98.373	0.502	0.841	0.0412
P	1.950	1.073	86.131	7.231	3.613
TCER	3.132	0.416	37.809	58.410	0.231
C	0.150	10.426	7.775	6.898	74.748
ΔOil_t^+					
Y	94.105	4.277	0.775	0.236	0.605
ΔOil_t^+	0.215	91.085	3.905	1.575	3.217
P	2.035	0.105	87.249	7.799	2.810
TCER	3.039	1.510	37.966	57.192	0.292
C	0.144	6.109	10.654	8.091	75.00
ΔOil_t^-					
Y	98.527	0.456	0.999	0.015	0.00021
ΔOil_t^-	1.443	97.553	0.269	0.142	0.589
P	2.111	0.218	86.782	7.411	3.475
TCER	3.206	0.661	37.586	58.381	0.164
C	0.372	6.243	8.040	7.762	77.580
NOPI4					
Y	98.100	0.524	1.253	0.035	0.086
NOPI4	1.578	97.467	0.511	0.436	0.0064
P	1.986	3.185	85.501	7.474	1.851
TCER	3.399	1.744	36.793	57.685	0.376
C	0.171	10.003	7.405	6.423	75.995
NOPI12					
Y	97.276	1.172	1.428	0.0544	0.0697
NOPI12	0.633	95.593	0.986	0.328	2.456
P	1.7023	4.646	84.312	7.175	2.162
TCER	2.957	2.855	35.106	58.719	0.360
C	0.228	3.052	8.462	6.976	81.279
SOPI					
Y	90.940	7.028	1.055	0.0361	0.939
SOPI	0.498	97.630	0.517	0.666	0.687
P	1.862	0.491	87.273	7.600	2.772
TCER	3.194	0.188	37.262	59.257	0.0973
C	0.171	9.468	8.299	6.970	75.090
SOPD					
Y	98.772	0.281	0.933	0.0075	0.0048
SOPD	0.818	97.830	0.398	0.797	0.152
P	1.971	0.584	86.866	8.0625	2.514
TCER	2.995	2.432	35.849	58.239	0.482
C	0.265	4.062	8.066	7.521	80.085

ΔOilt : Real oil price change, ΔOilt+ : Increase in real oil price, ΔOilt- Decrease in real oil price, NOPI4 : Net Oil Price Increase over previous four quarters, NOPI12 : Net Oil Price Increase over previous twelve quarters, SOPID: Scaled Oil Price Increases and SOPD: Scaled Oil Price Decreases.
P: inflation rate, C: cash paiments, Y: economic activity and REER: real effective exchange rate.

- For the **subsidy policy**, the real oil price constitutes the main cause of this policy. Indeed after twelve quarters, oil price is the most significant source of the variations of cash payments, by approximately 10.42% (linear model), 6.1% (Δoil_t^+), 6.2% (Δoil_t^-), 10% (NOPI4), 3.52% (NOPI12), 6.46% (SOPI) and 4.06% (SOPD). It is the variation of inflation rate which constitutes the second source of cash payments variation by approximately 8% in the majority of the models except (Δoil_t^+) model where it contributed by 10.65%. Finally, the real exchange rate contributes to the variation of the expenditure of the payments by approximately 6.5%.
- For **inflation**, it is the real exchange rate among the other variables which appears to be the principal cause of its variation. It contributed to the rise in inflation of about 7.5% for all the models. The price of oil and the other variables do not appear inflationary.
- For the **real exchange rate**, it is the inflation rate which was the principal source of its variation. Indeed, the inflation rate contributed to between 35.1% and 37.96% of real exchange rate variation. But figure 4 indicates that the real exchange rate plays a significant role as a policy to stabilize and attenuate the harmful effects of oil price.

Figure 4: real Oil price in $US (dollar) and in Moroccan dirham



CONCLUSION

In this paper we have investigated the role of subsidy policy in oil price shock for Morocco. The results confirm the findings of Jbir and Zouari-Ghorbel (2009) and can be summarized as follows:

- There is not a direct impact of oil price shock on economic activity.
- The oil price shock can affect economic activity through subsidy policy measured by cash payments. Indeed, the results of impulse response functions show that only the cash payments variable is significant.
- The subsidy policy can be considered as another channel of transmission of the impact of oil price shock.
- Finally, the linear and non linear models, especially NOPI and SOPI, have the same results so there is no asymmetric relationship between oil prices and economic activity.

DATA SOURCE

All quarterly data used in this study cover the period of 1993 Q1–2007 Q3, are obtained from the International Financial Statistics (IFS), IMF publication (2008).

Oil prices: the world real oil price expressed in US$ is calculated as the average of three references crude (WTI, Brent and Dubai) available in IFS (line0017A˜A DZF).

Inflation rate: proxied by the consumer price index.

Real effective exchange rate (REER) to measure the ability to compete is calculated from the rate of nominal effective exchange rate deflated by the consumer price index (IPC) of Morocco

Economic activity is measured by Moroccan GDP.

Subsidy Policy is represented by cash payments for operating activity.

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