THE MACROECONOMIC EFFECTS OF OIL PRICES FLUCTUATIONS IN ALGERIA: A SVAR APPROACH

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SUMMARY

The structural dependence of the Algerian economy on the hydrocarbons sector is of great concern, first because it represents the main foreign currency inflows to the economy; it also has been a source of pro-cyclicality to government spending and taxes policy.

The actual dual shock of the COVID-19 pandemic and the oil prices plunge makes it very important to conduct an analysis that assesses the direct and indirect effects of oil price fluctuations on the Algerian economic activity.

Using an SVAR model we analyze the dynamics of the GDP structure by subjecting its components to an exogenous shock. We use quarterly data covering the period 1999 to 2019 to evaluate the response of national account aggregates (from both the production and demand sides) to oil price shocks. We also explore the similarities in their fluctuations with the ones observed in oil prices and foreign reserves; we consider the later as a damper that can absorb foreign shocks. Our results show a strong and clear impact of international oil price fluctuations on GDP growth, hydrocarbon exports, and public spending.

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KEY WORDS: Oil prices, business cycle, national accounts, economic growth, SVAR.

JEL CLASSIFICATION: E32, C32, Q43

LES EFFETS MACROÉCONOMIQUES DES FLUCTUATIONS DES PRIX DU PÉTROLE EN ALGÉRIE: UNE APPROCHE SVAR

RÉSUMÉ

La dépendance structurelle de l'économie algérienne vis-à-vis du secteur des hydrocarbures est très préoccupante, d'abord parce que ce secteur représente la principales entrée en devises étrangères pour l'économie ; ensuite, il est également source de pro-cyclicité pour les dépenses publiques et la politique fiscale.

Frappé de plein fouet par une crise sanitaire due au COVID-19 jumelée à une baisse des prix du pétrole l'Algérie est menacé par l'avènement d'une crise économique. Dans ces circonstances, il nous semble plus important que jamais d'évaluer l'impact direct et indirect des fluctuations du prix du pétrole sur l'activité économique algérienne.

En utilisant un modèle SVAR, nous analysons la dynamique de la structure du PIB en soumettant ses composantes à un choc exogène. Nous utilisons des données trimestrielles couvrant la période 1999 à 2019 pour évaluer la réponse des agrégats de la comptabilité nationale (tant du côté de la production que de la demande) aux chocs des prix du pétrole. Nous explorons également les similitudes de leurs fluctuations avec celles observées dans les prix du pétrole et les réserves de change que nous considérons comme un amortisseur capable d'absorber les chocs étrangers. Nos résultats montrent un impact fort et clair des fluctuations internationales des prix du pétrole sur la croissance du PIB, les exportations d'hydrocarbures et les dépenses publiques.

KEY WORDS : Prix du pétrole, cycle économique, comptes nationaux, croissance économique, SVAR.

JEL CLASSIFICATION : E32, C32, Q43

الآثار الاقتصادية الكلية لتقلبات أسعار النفط في الجزائر: نهج SVAR

ملخص

إن الاعتماد الهيكلي للاقتصاد الجزائري على قطاع الهيدروكربونات يشكل مصدر قلق كبير لأنه يمثل المصدر الرئيسي لتدفقات العملات الأجنبية إلى الاقتصاد كما أنه يشكل مصدرًا لتقلب الدوري لسياسة الإنفاق الحكومي والضرائب.

إن جائحة COVID-19وهبوط أسعار النفط، تجعل من المهم للغاية إجراء تحليل يقيّم الآثار المباشرة وغير المباشرة لتقلبات أسعار النفط على النشاط الاقتصادي الجزائري.

استخدام نموذج SVAR نقوم بتحليل ديناميكيات هيكل الناتج المحلي الإجمالي من خلال إخضاع مكوناته لصدمة خارجية. نستخدم بيانات ربع سنوية تغطي الفترة من 1999 إلى 2019 لتقييم استجابة إجماليات الحسابات القومية (من جانبي الإنتاج والطلب) لصدمات أسعار النفط. كما نستكشف أوجه التشابه في تقلباتها مع تلك التي لوحظت في أسعار النفط والاحتياطيات الأجنبية. نعتبر هذه الاخيرة مخمدًا يمكنه امتصاص الصدمات الأجنبية. تظهر نتائجنا تأثيرًا قويًا وواضحًا لتقلبات أسعار النفط الدولية على نمو الناتج المحلي الإجمالي ، وصادرات الهيدروكربونات ، والإنفاق العام.

كلمات مفتاحية : أسعار النفط، دورة الأعمال، الحسابات القومية، النمو الاقتصادي، SVAR

تصنيف جال: E32, C32, Q43

INTRODUCTION

The year 2020 began with a global pandemic, the COVID-19; a pandemic of this magnitude has not appeared since the Spanish flu a century ago. In addition to the human toll, COVID-19 is having a dramatic economic impact. Supply, as well as demand, slowed all over the world causing what is expected to be one of the most severe global economic crises in the last 30 years.

The (IEA, 2020) indicates that oil demand in March declined by more than 10 MB/d relative to March 2019, pushing Q1 2020 demand in advanced economies down by 2.3 MB/d relative to March 2019. In the rest of the world, demand dropped by 3.3 MB/d across Q1 2020. Consequently, oil prices observed a huge drop since the spread of the virus in December 2019 in China.

As the hydrocarbons sector accounts for almost 20% of GDP's added value in Algeria and more than 80% of its exports in 2019, the plunge in oil prices is expected to exacerbate the structural vulnerabilities of the Algerian economy. It is often argued that oil revenue, channeled through government spending is the main driver of the economic activity, and hence the volatility of oil prices is at the core of economic fluctuations in such hydrocarbons -dependent economies.

Understanding the relationship between oil prices and economic performance is hence of great interest, and can be used to anticipate the impact of the latest oil prices drop caused by the COVID-19 pandemic on the Algerian economy. Several studies have examined the macroeconomic effects of oil price fluctuations in Algeria. Among them, more than few have investigated the existence of the resource curse, (Benramdane, 2017) argued that volatility of oil prices, rather than abundance, drives the "resource curse" paradox in Algeria, while (Belarbi et al., 2016; Chaouche et al., 2019) argued that it is the institutional quality that lies behind it. (Lacheheb and Sirag, 2019) examined the relationship between oil price changes and inflation and concluded that oil price fluctuations have an asymmetric effect on inflation. Furthermore the impact of oil price distortions on macroeconomic aggregates (GDP, unemployment, inflation, real

effective exchange rate and M2) was explored in (Bouchaour and Al-Zeaud, 2012).

In this context, we reignite interest in the relationship that exists between oil prices and macroeconomic performances. More precisely, we are interested in exploring the effect of oil price shocks on the different GDP's components from both the production and demand sides. Through this disaggregated investigation ,we intend to disentangle the spillover effects of oil price fluctuations on the different components of the economy.

We examine whether or not the GDP and its components do display the same cyclical behavior as the one observed in oil prices. Using a Structural Vector Autoregressive Approach, we will also examine the macro effects of oil price shocks. How do oil prices affect economic growth and through which sectors?

As far as we know this study is the first to shed light on the effect of oil price fluctuations on the GDP's components in Algeria and using quarterly data. The present paper is structured as follows: In the next section, we go through a brief literature review about studies that have explored the relationship between economic growth oil price fluctuations. In section two, we give a statistical description overview of the used data and some elements on econometric methodology we followed, namely the business cycle decomposition and the SVAR methodology. Our results are reported in section three, we conclude by reporting our main findings.

1- LITERATURE REVIEW

The impact of oil price fluctuations is of great importance for both importing and exporting countries. This interest can be very easily perceived when one considers the amount of scientific work devoted to assessing the macroeconomic effects of oil prices shocks, especially over the last fifty years starting with the stagflation episode which some experts attribute in part to the oil price shock of the 1970s (Bernanke et al., 1997; Hamilton, 1983; Hunt, 2006). (Barsky and Kilian, 2004) argue that although the monocausal role for oil prices

shocks in the contemporaneous recessions is hard to assess, it is undoubtedly true that many recessions since 1972 have been associated with major oil price increases, this appears to be also the case for the 2008 recession where (Hamilton, 2009) considers that oil prices seem to have made a material contribution in it.

Considering the important role that fossil energies play in the production process in industrialized countries, the volatility of its price is in the heart of the major world economic fluctuations studies, and many authors pointed out that oil price shocks were responsible for substantial aggregate fluctuations. The negative impact of oil price increases on the economic performance for importing countries is hence attributed to a supply-side shock. Other explanations include income transfers form oil-importing countries to oil-exporting ones (Brown and Yücel, 2002), a real balance effect (Kilian et al., 2009), and monetary policy (Bernanke et al., 1997). (Akinsola and Odhiambo, 2020) give a detailed review of this relationship.

Many studies also explored the economic response to oil price shocks for oil-exporting countries where it is expected that oil price increases would have a positive effect mainly on government revenues and eventually on growth through expansionary fiscal expenditure. (Nasir et al., 2019) using a Structural Vector Autoregressive (SVAR) model found that there are significant positive effects of oil price shocks on the GDP, inflation, and trade balance of the Gulf Cooperation Council (GCC) member countries. (Berument et al., 2010) also reported that oil price increases have a statistically significant and positive effect on the output of selected MENA countries including Algeria. However, (Iwayemi and Fowowe, 2011a) when conducting an empirical analysis of the effects of oil price shocks on Algeria, Egypt, Libya and Nigeria (largest African oil exporters) found little evidence of a short-run effect of oil price shocks on macroeconomic variables and concluded that oil price increases have not been channeled into improving economic activities.

The asymmetric effects of positive and negative oil price shocks have also been fully addressed. In an influential contribution (Mork,

1989) confirmed (Hamilton, 1983)'s results established for the US economy of the existence of a negative correlation between economic growth and oil price increases, however, this correlation almost fades away when considering oil price decreases. These asymmetries were further confirmed by (Hamilton, 1996; Jiménez-Rodríguez and Sánchez, 2005). (Charfeddine and Barkat, 2020; Emami and Adibpour, 2012; Iwayemi and Fowowe, 2011b; Nusair, 2016) are some examples of studies that explored the asymmetric effect of oil price increases and decreases for oil-exporting countries.

2- DATA AND METHODOLOGY

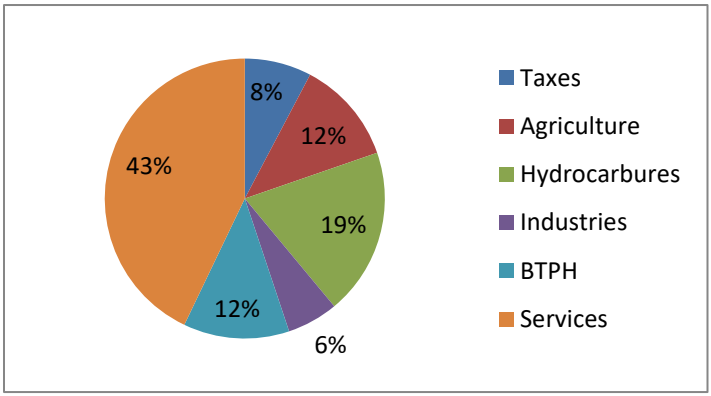
2.1- Data presentation

To examine the impact of oil prices shocks on the national accounts' aggregates, we use a quarterly data set spanning from1999:Q1 to 2019:Q4. The choice of this period is motivated by important price's variations and big positive and negative shocks in the international oil market, also thanks to availability of quarterly data for national accounts; the data was collected from three sources:

The global price of Brent Crude in US dollars retrieved from the FRED economic database was used to account for Oil prices, we also extracted from the same database the US GDP deflator that we used to deflate the oil prices à la (Blanchard and Gali, 2007).

The national accounts we analyzed are the GDP and four of its components from the production side namely: Agriculture (included forestry, and fisheries), Hydrocarbons, Construction, public works, and hydraulics (BTPH), and Traded services. These four sectors account for 84% of GDP in 2019, considering the small size of the industry 6% in the GDP we prefer not to include it in our analysis. The remaining 8% represents different taxes.

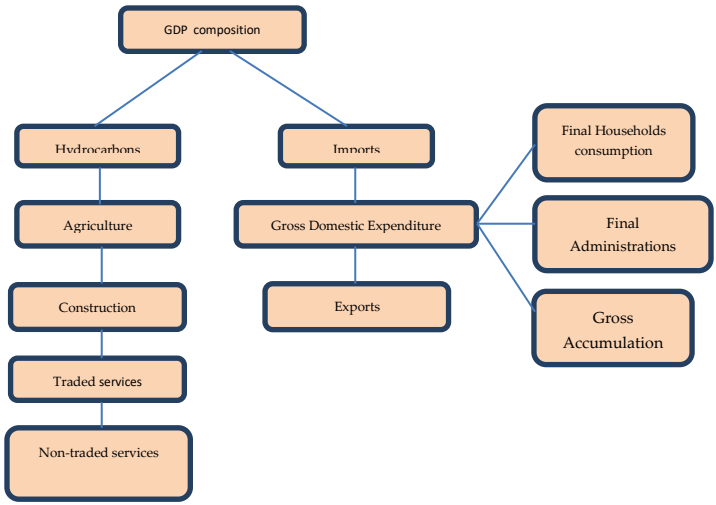
Figure1: GDP composition by sector added values for 2019 with ONS data



Our analysis explores also the effects of the oil prices on some of the GDP's components from the demand optic, this entails: Households final consumption; Public administration final consumption; Hydrocarbons exports; Imports.

All statistics on the national accounts aggregates are obtained from the National Office of Statistics and expressed in constant local currency terms (deflated by the quarterly year on year CPI base 2010 collected from the Bank of International settlements). Finally, all the data are tacked with a log transformation.

Figure 2: A diagram of GDP composition from a production and a demand optics



2.2- The business cycle decomposition

As we want to shed light on the cyclical behavior of our macroeconomic aggregates , we will isolate the cyclical component of each of the considered series using the approach proposed by (Hamilton, 2018) where he recommends to regress the variable y at t+h on its four recent values as of date t, which he considers a robust detrending approach and a better alternative to the HP filter.

$$y_{t+h} = \beta_0 + \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 y_{t-2} + \beta_4 y_{t-3} + \upsilon_{t+h}$$

$$\hat{\upsilon}_{t+h} = y_{t+h} - \hat{\beta}_0 - \hat{\beta}_1 y_t - \hat{\beta}_2 y_{t-1} - \hat{\beta}_3 y_{t-2} - \hat{\beta}_4 y_{t-3}$$

The residual $\hat{\upsilon}_{t+h}$ therefore offers a reasonable way to construct the transient component. In our application, we will choose h equal to 8 as recommended in (Hamilton, 2018) for quarterly data.

2.3- The Structural Vector Autoregressive (SVAR) model

We use a Structural Vector Autoregressive model to explore the dynamic relationship between Brent crude real oil prices and the GDP components from both the production and demand optics. We take the oil shock to correspond to the orthogonalized innovation to the (log) real oil prices. The effect of oil price on each of the components is explored using a bi-variate SVARs of the following general form:

Consider a 2-dimensional time series $Y_t = (Y_t^j, \ oil_t)'$ that is assumed to be generated by a stationary SVAR(p) process:

$$A_0 Y_t = A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + \varepsilon_t$$

Where Y_t^j represents the time series of the considered GDP's component, oil_t real oil prices, $A_i, i = 0, \dots, p$ are (2×2) coefficient matrices, u_t denotes a mean zero serially uncorrelated structural shocks vector, hence $E(\varepsilon_t, \varepsilon_t') = \Sigma_\varepsilon$ is diagonal by definition and typically normalized(Kilian, 2013).

Equivalently the model can be written more compactly as:

$$A(L)Y_t = \varepsilon_t$$

Where $A(L) \equiv A_0 - A_1 L - \cdots - A_p L^p$ is the autoregressive lag order polynomial.

In order to allow estimation of the structural model , we first need to drive its reduced form representation, which is:

$$Y_t = A_1^* Y_{t-1} + \cdots + A_p^* Y_{t-p} + u_t$$

Where $A_i^* = A_0^{-1} A_i$, $i = 1 \dots p$, and $u_t = A_0^{-1} \varepsilon_t$ is (2×1) vector of innovations. Consistent estimates of the reduced-form parameters, errors, and their covariance matrix $E(u_t, u_t') = \Sigma_u$ may be estimated either separately by ordinary least squares (OLS) or using generalized least squares (GLS) as shown in (Lütkepohl, 2005).

$$E(u_t, u_t') = A_0^{-1} E(\varepsilon_t, \varepsilon_t') A_0^{-1\prime}$$

$$\Sigma_u = A_0^{-1} \Sigma_\varepsilon A_0^{-1\prime}$$

$$\Sigma_u = A_0^{-1} A_0^{-1'}$$

Therefore, to disentangle the structural innovations ε_t we use the Cholesky decomposition on the variance-covariance matrix $\Sigma_u = PP'$, where P is (2×2) lower triangular. Although alternative economic-based approaches to identify the SVAR exist in the literature[1], we used mechanical Cholesky decomposition as no economic theory reports the relation between oil prices and the GDP components.

These obtained orthogonal innovations are preferred in an impulse response analysis as they allow to isolate the effect of shocks hitting the system.

Since we are interested in the impulse response analysis we abstract form testing for cointegration in our models, as the Wold moving average (MA) representation does not exist for nonstationary cointegrated processes (Lütkepohl and Krätzig, 2004), and when computed the impulse response may not converge.

3- EMPIRICAL RESULTS AND ANALYSIS:

3.1- Business cycle analysis

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 twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own. (Burns and Mitchell, 1946)

From the definition given above, it is clear that a business cycle is composed of two phases, an expansion phase and a recession phase, what differentiates one cycle from another is the duration and intensity of these phases. This phenomenon is repetitive, but in a non-regular way, and the factors that cause it are diverse and different each time.

[1] A survey on identification methods can be found in (Ramey, 2016).

This analysis will enable us to see in a disaggregated way which sector mimics the fluctuations observed on oil prices. We calculate the temporal cross-correlation $\rho(X_t, Y^j_{t+p})$ as in (Balashova and Serletis, 2020), to measure similarities in the cyclical co-movement of the examined national accounts Y^j with real oil prices X. Whether the contemporaneous cross correlation coefficient $\rho(X_t, Y^j_t)$ is negative, insignificant or positive can indicate whether GDP's components are counter-cyclical, a-cyclical or pro-cyclical respectively with oil prices. If the cross-correlation coefficient $\rho(X_t, Y^j_{t+p})$, $p > 0$ has maximum in absolute value, we say that X is leading the cycle by p periods.

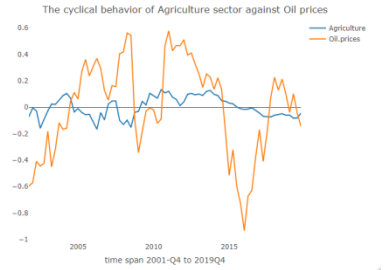
As we assume that we have a fairly large number of observations spanning from 2001:Q4-2019Q4 (we lost 11 observations in the regression) our cross correlation is said to be significant if it is greater than $2/\sqrt{n - |p|}$ where n is number of observation and k is the lag.

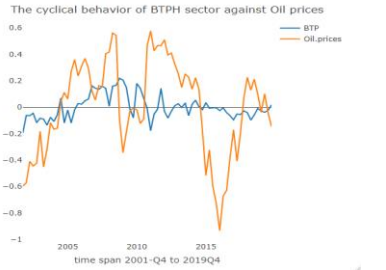
Table 1: Cyclical cross-correlation between crude oil prices and GDP's components leads

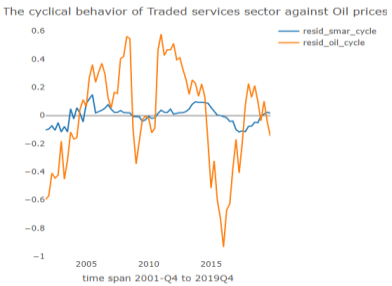
	0	1	2	3	4	5	6	7	8	9	10	11	12
Agriculture	0,1	0,155	0,173	0,214	0,215	0,132	0,043	-0,06	-0,129	-0,207	-0,253	-0,289	-0,328
Hydrocarbons	0,93	0,826	0,696	0,607	0,512	0,402	0,307	0,185	0,084	0,06	0,032	-0,039	-0,093
Construction	0,221	0,181	0,156	0,194	0,136	0,052	0,049	0,061	0,049	0,065	0,076	0,074	0,042
T services	0,463	0,361	0,224	0,145	0,056	-0,065	-0,129	-0,175	-0,238	-0,242	-0,225	-0,189	-0,161
GDP	0,87	0,756	0,592	0,512	0,426	0,313	0,217	0,11	0,005	-0,028	-0,059	-0,158	-0,252
Ad consumption	0,28	0,22	0,167	0,18	0,187	0,203	0,191	0,167	0,163	0,182	0,16	0,073	-0,011
H consumption	0,321	0,237	0,137	0,044	-0,01	-0,064	-0,081	-0,088	-0,066	-0,018	-0,034	-0,073	-0,1
Imports	0,229	0,114	-0,014	-0,07	-0,083	-0,072	0,001	0,039	0,077	0,168	0,23	0,255	0,257
Exports	0,845	0,711	0,627	0,589	0,504	0,412	0,315	0,186	0,114	0,104	0,044	-0,042	-0,093

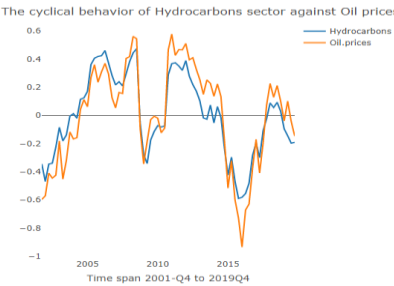
Table 1 represents the contemporaneous and cross-correlation coefficients between the cyclical component of crude oil and the cyclical components of National accounts in Algeria at leads from 1 to 12 quarters.

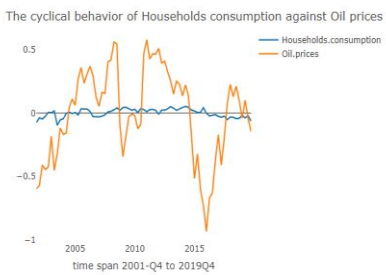
Figure 3: Cyclical behavior of real oil prices and national accounts series

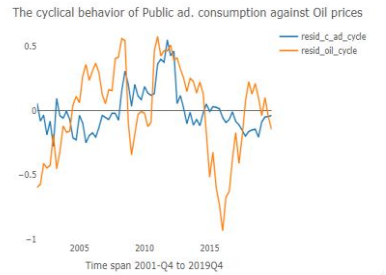

The cyclical behavior of Agriculture sector against Oil prices
Agriculture
Oil.prices
time span 2001-Q4 to 2019Q4

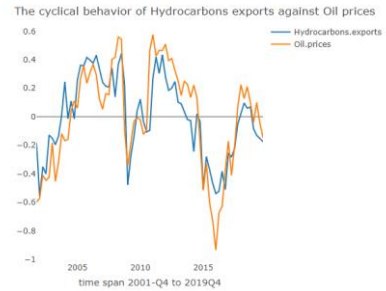

The cyclical behavior of BTPH sector against Oil prices
BTP
Oil.prices
time span 2001-Q4 to 2019Q4

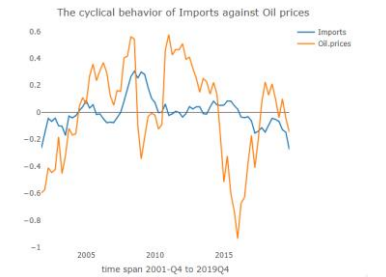

The cyclical behavior of Traded services sector against Oil prices
resid_smar_cycle
resid_oil_cycle
time span 2001-Q4 to 2019Q4

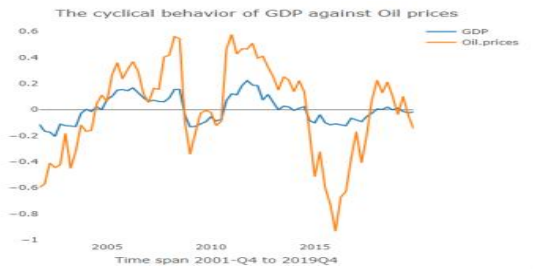

The cyclical behavior of Hydrocarbons sector against Oil prices
Hydrocarbons
Oil.prices
Time span 2001-Q4 to 2019Q4


The cyclical behavior of Households consumption against Oil prices
Households.consumption
Oil.prices
time span 2001-Q4 to 2019Q4


The cyclical behavior of Public ad. consumption against Oil prices
resid_c_ad_cycle
resid_oil_cycle
Time span 2001-Q4 to 2019Q4


The cyclical behavior of Hydrocarbons exports against Oil prices
Hydrocarbons.exports
Oil.prices
time span 2001-Q4 to 2019Q4


The cyclical behavior of Imports against Oil prices
Imports
Oil.prices
time span 2001-Q4 to 2019Q4



The isolation of the business cycle component in the real oil prices series shows for the period spanning from 2001:Q1 to 2019:Q4 mainly three cycles, the first was triggered with the beginning of the 2000s as all commodities prices increased, with a broad upswing in the price of oil beginning in 2004, which accelerated sharply in 2007 due to the emerging economies and china's, in particular, strengthening demand. This cycle ends with the collapse in the global demand caused by the 2008 financial and economic crisis and the global uncertainty it generated. The second cycle starts with the recovery from the 2008 crisis and ends with the 2014 great plunge in oil prices, which was caused by the rapid growth of unconventional oil supply and the OPEC's decision to abandon price targeting in November 2014. The period spanning from the beginning of the 2000s until 2014 is referred to in the literature as the commodity supercycle (Baffes et al., 2015). The last cycle is the one taking place currently as the COVID 19 is causing a global demand and a supply crisis making oil prices fall again.

There have also been some other more minor supply disruptions over this period. These include the combined effects of the second Persian Gulf War and strikes in Venezuela beginning in December 2002, and the Libyan Revolution in February 2011 (Hamilton, 2013).

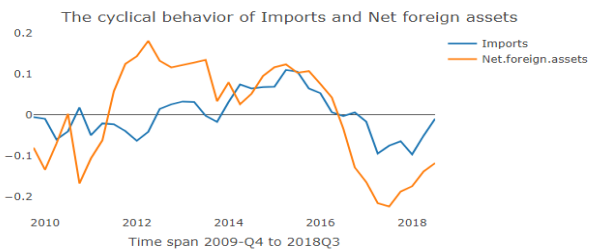
The cross-correlations results showed in Table 1 and the plots indicate that crude oil prices are pro-cyclical with the GDP, Hydrocarbons sector, and hydrocarbons exports. The contemporaneous correlations between the cyclical component of the crude oil prices and these three sectors are very strong; the correlation coefficients vary between 0.84 to 0.93. Hence we can say that crude oil prices drive significantly the cycle of GDP, hydrocarbon sector, and exports.

A contemporaneous pro-cyclical relationship is also observed between oil price cycle and traded services as well as domestic global demand represented here by household and public administration consumptions, however, these correlations are much smaller than the precedent ones and range from 0.46 to 0.28.

The agriculture sector becomes negatively correlated with oil prices towards the 10th lead making it counter-cyclical and lagging the oil prices cycle.

The construction sector and import cycles are not correlated with the real oil prices cycle. However ,when testing for the cross-correlation between net foreign assets and imports leads we found a strong contemporaneous correlation equal to 0,568. We consider net foreign asset as a smoothing mechanism that dampens foreign shocks, especially those of oil prices.

We note that the period considered here is smaller than the one in the above analysis, as data published by the Bank of Algeria for Net Foreign Asset in quarterly frequencies span from 2007Q1 to 2018Q3.



3.2 Unit root test

We check the stationarity of our series as it represents a necessary condition for the stability of the VAR model. The test we conduct is the Augmented Dickey-Fuller test starting by the broader model containing a trend and a constant (M3), then if necessary we go to the model with only a constant (M2), and finally , in case the constant is also insignificant , we test the existing of unit root using the simplest model without trend or constant (M1).

Table 2: ADF unit root test results

ADF unit root test						
Varibles	ADF test results					Stationarity result
Level						
	M3		M2		M1	
	$H_0 : \varphi = 0$	H_0^3:(φ,β,c)=(0,0,c)	$H_0 : \varphi = 0$	$H_0^2 : (\varphi,c) = (0,0)$	$H_0 : \varphi = 0$	
GDP (log)	-1,7495	3,2967	-2,4746	5,0507	/	DS
Agriculure (log)	-2,9847	4,6245	-1,0459	3,6401	2,3923	DS
Hydrocarbons (log)	-2,6145	4,2246	-2,8717	4,2341	0,2962	DS
Traded services (log	-0,4077	3,2392	-2,5578	18,7124	/	DS
BTPH sector (log)	-1,8859	2,2806	-1,4392	4,7703	/	DS
Real oil prices (log)	-2,2726	2,2089	-2,5275	3,3375	0,2394	DS
Households consumption (log)	-1,4042	1,4333	-1,0779	13,0597	/	DS
Public ad, Consumption (log)	-1,2743	1,1529	-1,2473	2,1544	1,5429	DS
Hydrocarbons exports (log)	-2,5147	4,4579	-2,9246	/	0,4482	DS
Imports (log)	0,0454	4,3588	-2,7269	6,1916	/	DS
Diffrence						
	M3		M2		M1	
GDP (log)	/	/	/	/	-5,5934	Stationary
Agriculure (log)	/	/	/	/	-6,9633	Stationary
Hydrocarbons (log)	/	/	/	/	-5,3335	Stationary
Traded services (log	/	/	/	/	-5,0643	Stationary
BTPH sector (log)	/	/	/	/	-7,2079	Stationary
Real oil prices (log)	/	/	/	/	-6,8294	Stationary
Households consumption (log)	/	/	/	/	-5,2921	Stationary
Public ad, Consumption (log)	/	/	/	/	-8,5992	Stationary
Hydrocarbons exports (log)	/	/	/	/	-8,2025	Stationary
Imports (log)	/	/	/	/	-5,0124	Stationary

The critical values for H_0statistic are taken from (Hamilton, 1994), and those for joint tests are form (Dickey and Fuller, 1981).

The ADF test indicates that all our variables are integrated of order 1, I(1).

The estimation[2] of the different bi-VARs was conducted using our data in first differences. All the polynomials' roots were inside the unit circle. The models' structural stability was further confirmed using the CUSUM-test.

3.3 The impulse responses functions (IRF)

In what follow, we explore the impact of orthogonal real oil price shocks on the different estimated SVARs. Impulse response functions map out the dynamic response path of each variable due to one standard deviation structural shock.

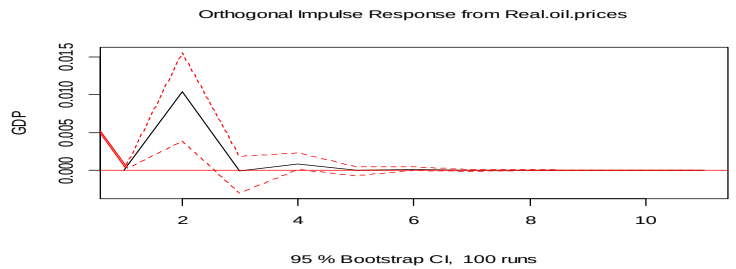
[2] The estimations and the several tests were conducted using the "vars" and "urca" R packages.

The impulse response functions reported here come from nine bi-VARs each estimated with a different national account component. As all our variables are expressed in difference log terms ,we will refer to their variations in growth rates.

Note that a bootstrap method was applied to construct the confidence intervals. All the estimations were conducted following (Pfaff, 2008).

The first IRF reports the growth rate of GDP in response to an orthogonal impulse shock form real oil prices. We notice that an unanticipated increase in oil prices impacts positively GDP's growth rate. However, the effect is short and fades away in almost 3 quarters.

Figure 4: GDP's response to real oil price orthogonal impulse

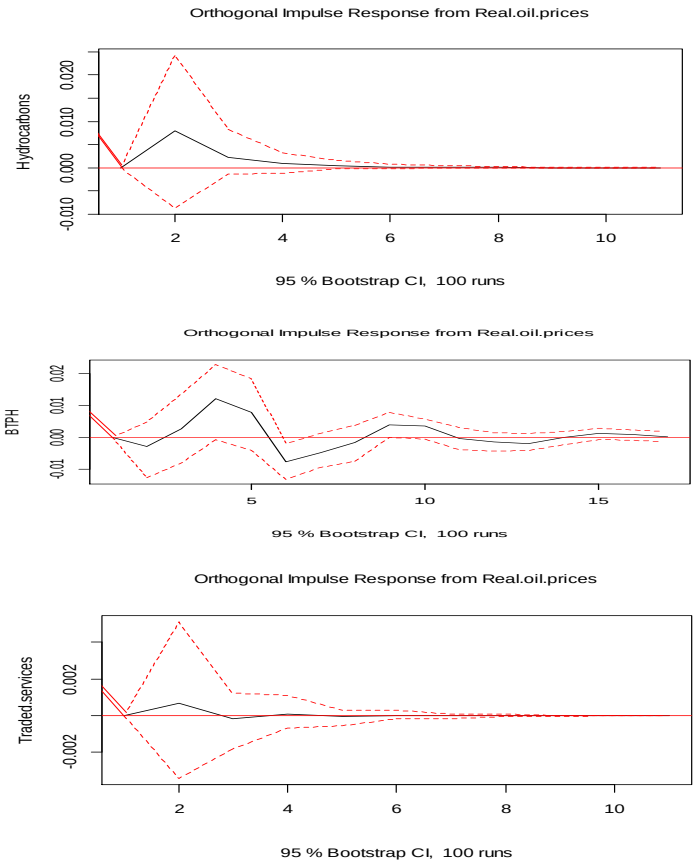


When considering the response of the different big sectors to an impulse from oil prices, we find that the hydrocarbons sector responds positively with a growth of up to 1% this result was expected as we found a strong correlation between oil price and hydrocarbons cycles.

The construction sector is also found to respond positively to an unexpected increase in oil price and take the longest time to return to steady-state, almost 15 quarters. As this sector is driven by government spending this response is clear evidence of expansionary fiscal channel. However, this result is at odds with our correlation results a potential explanation for it is that construction projects are launched with a priori existing budgets, which dampens the

downswing oil prices effect. In a smaller proportions the traded services sector also responds positively to an increase in oil prices.

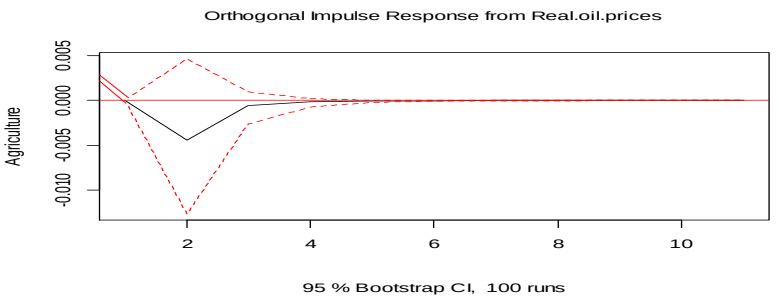
Figure 5: Hydrocarbons, Construction, and Traded services' responses to real oil price orthogonal impulse



The agriculture sector responds negatively to an increase in oil prices. This result is comforted by the negative correlation we found earlier but it remains inconclusive as the correlation becomes slightly significant only after 10 periods.

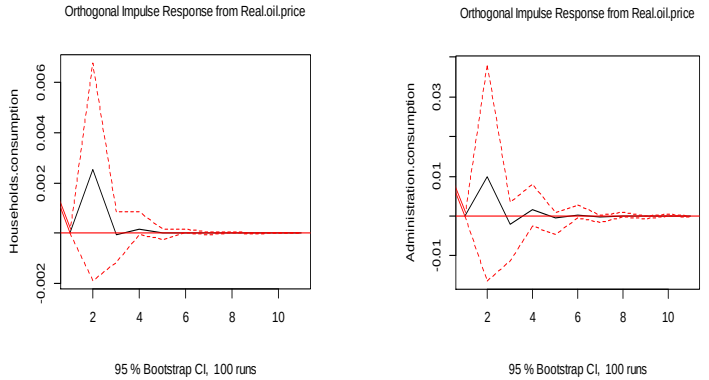
Intuitively we were expecting a positive response through government spending channel as this sector is strongly subsidized; however, the subsidies do not include the inputs of the agricultural production, for example, seeds that are mainly imported and hence depend on payment capacity and international prices. (Hanson et al., 1991) show that agricultural commodities are affected by oil price shocks in an industrial oil-importing country as they are energy-intensive, any increase in energy prices represent therefor a cost shock. We suspect that it's through an increase in imported input prices that the Algerian agricultural sector can be negatively impacted.

Figure 6: Agriculture's response to real oil price orthogonal impulse

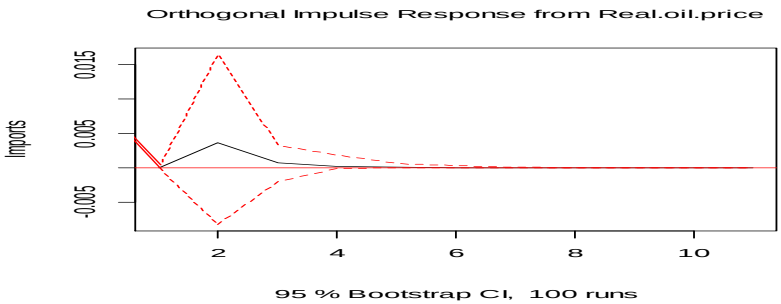


Turning to the demand side of GDP we find that positive real oil price shocks affect positively the growth rate of both final consumptions; households and administration. The positive growth rate in administration consumption is additional proof of an expansionary fiscal channel playing. As for the household consumption growth, we assume it is due to income redistribution which is supposed to enhance the purchasing power of consumers.

Figure 7: Households and administration's responses to real oil price orthogonal impulse



Finally the imports also respond positively to an impulse in real oil prices. Note that hydrocarbons exports response to real price shocks display the same movement as the one observed above for the hydrocarbons sector.



CONCLUSION

In this study, we found evidence that the Algerian economic activity fluctuations are closely linked to oil price fluctuations. This link is mainly due to the important share of the hydrocarbons sector's added value in GDP. However, this is not the only channel through which oil price shocks transfer to economic growth as the construction sector also is positively impacted by an unexpected oil price chocks.

Meanwhile, results show that a positive shock in oil prices has a very small impact on the traded sector, and a negative impact on the

agriculture sector. This last result remains the most intricate and inconclusive and needs further investigations in future studies.

We also found that real oil price shocks impact domestic global demand. The Administration's final consumption displays the most important response to oil price shocks; this can be explained by an expansionary fiscal channel playing. As for their impact on household consumption, we interpret it as potential proof of a redistribution mechanism. Finally, imports, likewise, respond positively to oil price impulses but in smaller proportion as we suspect net foreign assets to play the role of a smoothing mechanism that dampens foreign shocks, especially those of oil prices. This result will be further explored in future studies, as well as the industry sector that we abstracted from investigating in the present study.

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