Vol.7 Issue.2 June 2022

RSEP Review of Socio - Economic Perspectives
ISSN: 2149 - 9276
E-ISSN: 2547-9385

The double whammy of COVID-19 and oil price collapse: Spillover effects on inflation and exchange rates

Aissa Djedaiet[1,•] **, Hicham Ayad** [2,♦]
[1] *Assistant professor, Department of economics, Djilali Bounaama University, Khemis Miliana, Algeria*
[2] *Lecturer, Department of economics, The University Center in Maghnia, Algeria*

Article History

Received: 12 March 2022 Revised: 16 May 2022 Accepted: 20 May 2022 Available Online: 1 June 2022

Keywords: Algeria, COVID-19, Oil Price shocks, Exchange Rate, Inflation Rate, ARDL, NARDL
JEL classification: C32, F31, E31

Citation: Djedaiet, A. & Ayad, H. (2022). The double whammy of COVID-19 and oil price collapse: Spillover effects on inflation and exchange rates, *Review of Socio-Economic Perspectives, Vol 7(2),* 11-23.

Abstract

The paper addresses two main issues. What is the response of the Algerian exchange rate (REER) to the double whammy of COVID-19 and oil price collapse? To what extent can the previous combination spill over into the inflation rate? For this purpose, we use monthly data covering the period January 2010 to June 2021, and we run both ARDL and NARDL models. The results show that the oil price and its shocks have a clear effect on inflation in both linear and non-linear modeling, especially in the short term. While there seems to be some inconsistencies concerning the influence of oil prices on REER and REER on inflation, owing mainly to the dinar devaluation policy, lower import bills, and the phase-out of basic commodities subsidies. The evidence also clearly reveals that the COVID-19 pandemic has a substantial negative effect on the REER and a positive effect on the inflation rate in the short term linear estimation.

1. Introduction

Late in 2019, coronavirus disease, 19 (COVID-19)[1] was just seen as a China shock, before spreading abroad in January and February. On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a global pandemic. Thus, social distancing policies have become the best way to confront the contagion through a number of measures, including home confinement, travel and business restrictions, the closure of schools and public transportation networks, the suspension of sporting events, and so on. Furthermore, given the high level of economic uncertainty, individual and corporate economic activity was characterized by panic and irrationality.

The COVID-19 pandemic has had far-reaching implications that go far beyond catastrophic health concerns; it has also been obvious for a while that the global economy has been brought to its knees. In a sufficiently large sample (64 countries), Ashraf (2020) finds that as the number of confirmed cases rises, so do stock markets, and business sectors in G7 countries have suffered during the COVID-19 pandemic period (Izzeldin, Muradoglu, Pappas, and Sivaprasad 2021). Therefore, the world has been struck by a magical wand, which has wreaked havoc on health and the economy, as well as creating a crucial dilemma over whether to safeguard livelihoods or lives. However, the impact of this pandemic on individuals and the economy has already surpassed what the 2007-8 global recession did (Georgieva, 2020).

Algeria is a mono-export economy that depends entirely on hydrocarbon revenues (oil and gas accounted for more than 95 per cent of total exports, two thirds of state revenues, and one third of GDP), and largely on food imports. Even after several decades, it has been unable to diversify its economy. Thus, in early 2020, it has faced a dual shock from the coronavirus pandemic and a collapse in oil prices. It was expected to be short-lived at

• **E-mail:** a.djedaiet@univ-dbkm.dz & **ORCID:** https://orcid.org/0000-0002-4971-013X
♦**E-mail:** a_hichem210@hotmail.fr & **ORCID:** https://orcid.org/0000-0003-1624-3456

DOI: https://doi.org/10.19275/RSEP126
Article Type: Original Paper

[1].On 11 February 2020, WHO officially renamed "2019-nCoV" as "COVID-19", with 'CO' meaning 'corona'.

initially, but it has lasted, causing severe fluctuations in macroeconomic indicators, the most important of which are inflation and the exchange rate, which act as direct receivers of the twin shock spillovers. Several studies have recently focused on the impact of oil prices on inflation (LeBlanc and Chinn, 2004; Blanchard and Galí, 2007; Ozturk, 2015; Malik, 2017; Cerra, 2019) and on exchange rate (Mohammadi and Jahan-Parvar, 2012; Beckmann et al. 2017; Delgado et al. 2018; Chkir et al. 2020). A common finding of these studies is that oil price changes have a crucial role in determining the behavior of both indicators, irrespective of the nature of the relationship (short or long term, symmetrical or not...). Even though it was difficult to immediately identify the impact of the COVID-19 pandemic on previous indicators, a few studies, however, have concluded that COVID-19 has notable influence on oil prices (Devpura and Narayan, 2020), exchange rates (Iyke, 2020; Rai and Garg, 2021) and on inflation rate (Binder, 2020; Dietrich et al. 2022).

At present, most of the existing literature mainly focuses on either the impact of the pandemic on oil prices (Narayan, 2020; Gil-Alana and Monge, 2020; Kartal, 2020; Albulescu, 2020; Devpura and Narayan, 2020), or the performance of capital markets in conjunction with the rapid spread of coronavirus and uncertainty, some studies, moreover, included low oil prices (Dietrich et al. 2022; Baker et al. 2020; Altig et al. 2020; Sharif et al. 2020; Zhang and Hamori, 2021). However, there is little evidence available on the effect of the COVID-19 pandemic on oil prices and exchange rates (Prabheesh and Kumar, 2021), while other evidence focuses either only on the inflation rate (Binder, 2020; Dietrich et al. 2022), or only on the exchange rate (Iyke, 2020; Feng et al., 2021). These research efforts have neglected to check the triangular relationships among oil prices, inflation and exchange rates during the pandemic period. Hence, our paper attempts to bridge this gap through two main contributions. First, we investigate the impact of oil price fluctuations on the real effective exchange rate (REER), taking the impact of the coronavirus disease into account. Second, we analyze the repercussions of previous relationships (OIL, REER and COVID-19) on inflation. As for the selection of Algeria is made, on the one hand, because it is one of the world's largest oil exporting countries, and it is currently facing a double whammy of COVID-19 and oil price collapse as never before and, on the other hand, Algeria has not yet been fully studied, as is the case with other oil-exporting countries, and this analysis paves the way for future studies to better understand similar countries.

The remainder of the paper is structured as follows: Section 2 discusses Algeria's twin shocks; Section 3 presents the review of the literature; Section 4 describes our data and methodology; Section 5 discusses empirical results, and finally, Section 6 concludes the paper.

2. Algeria's Twin Shock

On February 25, 2020, Algeria reported the first confirmed case of COVID-19, and the first death on March 12, 2020; by the end of the year, there had been a total of 80,000 confirmed cases and 2,666 deaths[2]. The government imposed a stringent containment policy that included the closing of schools, universities, restaurants, and businesses, as well as the cancellation of flights and the suspension of public transit. Half of government servants and workers in the economic public sector were given a mandatory leave with full compensation.

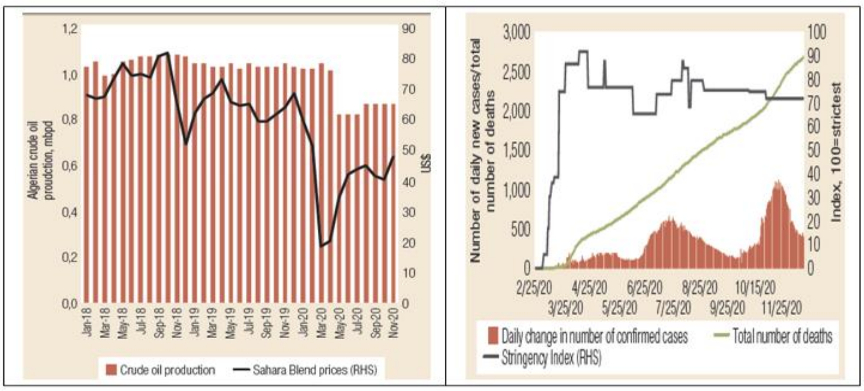


Figure 1. Sahara Blend Prices and Production Quotas and Waves of COVID-19

Source: World Bank Group, fall 2020.

[2]. See: "Algerian health minister confirms first COVID-19 case". Africa Times. 25 February 2020. Available at: https://africatimes.com/2020/02/25/algerian-health-minister-confirms-first-covid-19-case/

A free fall of oil prices was recorded as the COVID-19 pandemic gripped the world by the end of February, with some prices even reaching negative levels. Prices for the Sahara Blend decreased drastically from US$50.9 per barrel in February 2020 to US$17.9 per barrel in March 2020, i.e. each barrel lost about two-thirds of its value. Therefore, Algeria, as an OPEC member, committed to reduce its oil production by 200 kbpd until the end-2020, in accordance with a production cut agreement reached at the OPEC+ extraordinary meeting in April 2020. This correspondingly reduced Algeria's oil production by 11.9 percent between January and November 2020 compared to the same period the previous year, while prices were at historically low levels, with Sahara Blend prices falling by 39.4 percent in the first nine months of 2020.

Consequently, the Algerian status in 2020 has been marked by unprecedented twin shock, beginning with the health crisis as the coronavirus spread, and subsequently exacerbated by the drop in oil prices. Thus, the double whammy of COVID-19 and the oil price collapse has dragged the economy into a state of near total deficit.

The Algerian undiversified economy adds insult to injury as it relies solely on oil and gas exports (hydrocarbons account for 98% of exports, 60% of tax revenues). Foreign currency reserves, which were the first line of defense against the consequences of the 2008 financial crisis, have been rapidly depleting since 2014 (from $193.6 billion in 2014 to $62 billion in February 2020). This poses a new threat to the economy, since macroeconomic indicators in general, and monetary indicators in particular, are heavily influenced by frequent hard currency monetization, but more importantly, the performance of the Algerian bank and its adopted instruments are completely reliant on oil rents.

3. Literature Review

Given the large-scale studies on the pandemic and its spillover effects on relevant indicators, the temptation to drift a review of the literature far afield is always strong. To avoid this, the following literature review is structured around aspects that are most revealing in this respect.

In the run up to the COVID-19 pandemic, there was a battery of literature that focused on the potential impact of oil price fluctuations on inflation rates. The most common finding is that oil price hikes positively influence inflation rates (Tang et al. 2010; Qianqian, 2011; Wu and Ni, 2011; Bala and Chin, 2018; Bilgin and Adali, 2020). In the same vein, other studies provide evidence of a drop in oil price pass-through to domestic inflation, implying that the link has lately weakened due to several factors including monetary policy credibility and a reduction in the degree of exchange rate pass-through and oil intensity (LeBlanc and Chinn, 2004; De Gregorio et al. 2007; Blanchard and Galí, 2007; Chen, 2009; Choi et al. 2018). Regarding the relationship between oil prices and real exchange rates, Mohammadi and Jahan-Parvar, (2012) find a weak long-run effect of oil prices on exchange rates. In contrast, Beckmann et al. (2017) find a strong link between them that is frequently observed over the long run, even though it is strongly time-varying. For oil-exporting countries, Yang et al. (2018) find a negative relationship between oil prices and exchange rates, but an uncertain relationship for oil-importing countries. The same relationship was investigated by Turhan et al. (2014) for G20 countries, and their results reveal that they are negatively correlated to each other.

Ha et al. (2021) analyze the evolution and drivers of inflation during the pandemic and the likely trajectory of inflation in the near-term using three global variables: global inflation (based on core consumer and producer price inflation), global output growth, and oil price growth. They reported important findings on global inflation, which witnessed the most muted and shortest-lived decrease among the five global recessions over the previous 50 years, while also experiencing the fastest increase since May 2020. They also pointed out that four-fifths of the global inflation decline from January-May 2020 was driven by the collapse in global demand, while oil prices drove another one-fifth.

Coulibaly (2021) provides three key pieces of evidence about the COVID-19 pandemic and its effects on the consumer price index (CPI) for West African Economic and Monetary Union (WAEMU) countries. First, the CPI was positively affected by the COVID-19 confirmed cases, whereas the overall government policy responses index had a negative impact on the CPI. Second, the government accommodative policies for COVID-19 in other countries have a positive impact on the host country's CPI. Finally, world food prices, as well as oil prices, influenced the CPI positively. According to Agyei et al. (2021), in a similar context and for Sub-Saharan Africa, COVID-19 negatively influenced food prices through the demand and supply conditions of the food market of the sampled countries, and external environmental shocks aggravated this condition. They also find that crude oil prices, inflation, and the exchange rate all exerted a detrimental effect on food prices.

As for the European Union members and the candidate countries, ERDOĞAN et al. (2020) investigate recent macroeconomic problems during the pandemic, taking inflation as a core indicator to examine, since it is directly affected by many macroeconomic variables. Their findings reveal that the increase in inflation is mainly triggered by both money supply ratios and the exchange rate. The latter itself has become increasingly volatile due to the increase in confirmed cases, as reported in a study that included many European, Asian, and American countries, although the economic response policies implemented by those governments during the pandemic, including income support, fiscal measures, and international aid, have had a restraining effect on exchange rate volatility (Feng et al., 2021).

Villarreal-Samaniego (2021) examines the dynamics of oil prices and the previous relationship (the COVID-19 pandemic and the exchange rate) in five emerging economies: two oil-importers and three oil-exporters. The analysis discovered a negative relationship between oil prices and exchange rates in all five countries during the first quarter of 2020. Indeed, several studies have attempted to examine the impact of COVID-19 on the Euro/USD exchange rate by taking into account oil prices or other variables such as the stock market index and gold prices. Overall, the results indicated that the exchange rate, during the pandemic era, is notably influenced by those variables compared to the pre-pandemic era (Konstantakis et al., 2021; Devpura, 2021).

Despite different contexts in the previously cited literature, the linkages among the COVID-19 pandemic, inflation (or CPI) and exchange rate were separately examined. Therefore, there is a research gap that, for the most part, characterizes the rentier economies. More specifically, the overlapping of the aforementioned linkages during the COVID-19 pandemic while simultaneously accounting for oil prices.

4. Data and Methodology

The main series in our study are inflation, real effective exchange rate, and oil prices, in addition to the coronavirus dummy variable series. For this reason, we used monthly data with 138 observations for each variable from January 2010 to June 2021. To achieve our target goal, we depend on two models. The first is the internal balance, which is used to detect the effects of oil prices and the REER on inflation. The second expresses the external balance in order to detect the effects of oil prices on Algeria’s REER, with coronavirus as a dummy variable in both models. While coronavirus is treated as a dummy variable in both models, the digit 0 for the period January 2010 to December 2019; and the digit 1 for the period January 2020 to June 2021, whereas the two models are as follows:

$$model\ 1:\ INF_t = a_{10} + a_{11} OIL_t + a_{13} REER_t + a_{14} COV_t + \varepsilon_{1t} \quad (1)$$

$$model\ 2:\ REER_t = a_{20} + a_{21} OIL_t + a_{22} COV_t + \varepsilon_{2t} \quad (2)$$

Where INF is the inflation rate calculated using the CPI and sourced from the IMF database; OIL is the price of the Sahara Blend, the Algerian crude oil benchmark, obtained from the OPEC monthly oil market report; and REER is the real effective exchange rate obtained from the Bank for International Settlements database. Finally, COV stands for coronavirus dummy variable. The parameters and white noise terms, respectively, are aij and εit.

5. Empirical Results and Discussion

5.1. ARDL Estimation

5.1.1. Unit Root Test Results

The first step in the study is to test the integration order of all the series; for this reason, we use two different tests (Augmented Dickey Fuller ADF and Phillips Perron PP tests) for the trend and intercept equation. The results obtained from table 1 show that all three series for the two tests are I(1) series, i.e. the probability of a co-integration relationship among the variables under the two models above.

Table 1. Unit Root Test Results

Variables	**ADF**		**PP**		**Decision**
	Statistic	**probability**	**Statistic**	**probability**	
OIL	-2.112	0.533	-2.159	0.507	/
REER	-3.480	0.045	-2.867	0.176	/
INF	-3.041	0.125	-3.371*	0.059	/
D(OIL)	-8.323***	0.000	-7.529***	0.000	I(1)
D(REER)	-4.657***	0.000	-9.717***	0.000	I(1)
D(INF)	-4.523***	0.000	-19.886***	0.000	I(1)
***the significance at 10, 5 and 1% significance level.					

Source: Author’s calculations using Eviews 12.

5.1.2. Non-linearity Test

The BDS test is used as a second step to detect nonlinearity behavior for the three series, since we are using monthly data for three well-known series with nonlinear behavior. The results in the table below show that we cannot reject the hypothesis of nonlinearity for all the series at the 5% level of significance. As a result, we will use nonlinear methods to detect relationships and effects among variables in order to get a clear idea about the co-movement of the variables under study and their effects.

Table 2. BDS Test Results

OIL			
dimensions	**BDS statistic**	**Normal probability**	**Bootstrapprobability**
2	0.170635	0.0000	0.0000
3	0.284317	0.0000	0.0000
4	0.358634	0.0000	0.0000
5	0.406302	0.0000	0.0000
6	0.432817	0.0000	0.0000
INF			
2	0.197352	0.0000	0.0000
3	0.335198	0.0000	0.0000
4	0.430827	0.0000	0.0000
5	0.499239	0.0000	0.0000
6	0.549153	0.0000	0.0000
REER			
2	0.146916	0.0000	0.0000
3	0.242410	0.0000	0.0000
4	0.304344	0.0000	0.0000
5	0.337695	0.0000	0.0000
6	0.356215	0.0000	0.0000

Source: Author's calculations using Eviews 12.

5.1.3 Co-integration Analysis

Since all the variables are I(1) series, we can run co-integration tests. The ARDL procedure is used in this case to detect the co-movement of the variables and the long-run relationship in the two study models. Before we can estimate short and long run effects, we need to run a bounds test to see if there is a long-term relationship between the variables in the two models.

As shown in table 3, we cannot reject the null hypothesis of no co-integration relationship among the variables for the two models since the test statistics are greater than the critical values at 1% significance levels. This means that in the long run, the three series under investigation in our study behave in the same way.

Table 3. Bounds Test Results

Test statistic	**Model 1**		
	Significance	**I(0)**	**I(1)**
8.482	10%	2.713	3.453
	5%	3.235	4.053
	1%	4.130	6.393
Test statistic	Model 2		
	Significance	I(0)	I(1)
7.147	10%	3.113	3.610
	5%	3.740	4.303
	1%	5.157	5.917

Source: Author's calculations using Eviews 12.

5.1.4 Long Run Estimation

The next step in the study is to estimate the long run effects of the two models. In the first model, it is clear from the table below that both oil prices and REERs have no effect on the inflation rate because all of the p-values are greater than the 0.05 significant level, i.e. changes in oil prices and REERs do not stimulate inflation in Algeria in the long run. This stems from the fact that the Algerian bank has been adopting a sterilization monetary policy[3] to neutralize the foreign asset fluctuations caused by oil prices and associated REER variations by offsetting its domestic assets in parallel, resulting in the long-term fading of both inflationary and deflationary pressures. However, this may support the result obtained by Habermeier et al. (2009) regarding the importance of monetary policy in reducing the pass-through of exchange rate and oil price shocks to inflation rates.

Similar to the evidence provided by Mohammadi and Jahan-Parvar, (2012) and Delgado et al. (2018), our second model reveals that oil prices have a significant effect on the REER in the long run, confirming the relationship over the study period. As is well known, the higher the oil prices (which have increased by 10%), the higher the demand for local currency and, as a result, the higher the REER (appreciated by 12.7 percent).

Table 4. Long Run Estimation Results

Model 1			
Variables	**Coefficients**	**t- statistic**	**Probability**
OIL	-1.701	-0.889	0.375
REER	4.739	0.450	0.653
C	-50.634	-0.063	0.949
Model 2			
OIL	0.127	4.375	0.000
C	87.721	35.139	0.000

Source: Author's calculations using Eviews 12.

5.1.5. Short Run Estimation

According to Engel and Granger (1987), the ECM is the best model for detecting short run effects between co-integrated variables (Error Correction Model). In our case, the ECM model results in table 5 show that for the first model, both oil prices and REERs have a positive significant influence on the inflation rate.

The impact of oil prices on the CPI, and then inflation rates, passes through the channel of petrodollar monetization in the money market, which is frequently injected into various sectors of the national economy, and because oil prices have been falling since 2014, especially with the beginning of the pandemic; its impact remains marginal (4%). However, as previously demonstrated, this evidence was frequently confirmed.

A similar positive effect in the relationship between REERs and inflation may appear to contradict the theoretical background, since the REER appreciation has not resulted in deflationary pressures and therefore reduced prices. The explanation for this contradiction, however, is due to two fundamental causes; first, lowering the import bill to reduce the balance-of-payments deficits, especially the trade balance, as a result of reduced international returns following the drop in oil prices, and second, phasing out basic commodity subsidies to reduce government spending. If the former cause coincides with an inelastic production system in a rentier economy like Algeria, it will inevitably lead to a boom in both tradable and non-tradable goods, while the latter adds fuel to the fire whenever the subsidy, which is basically intended for goods involved in the CPI calculation, is reduced. As a result, even if the REER rises, both causes have led to higher prices. It should also be noted that the ECT parameter shows a very weak adjustment in the model after any long term shock.

The results also reveal that the COVID-19 variable has a significant positive effect on inflation in the short term, which is consistent with the results of Binder (2020). It is axiomatic that the coronavirus shock rages fear and pessimistic expectations fueled by uncertainty, resulting in an unprecedented increase in demand for goods marked by irrational consumer behavior. In addition to the disruption of supply chains and supply side fluctuations caused by the suspension of some industries as a precautionary measure imposed by the pandemic, all of these factors eventually contributed to a price increase.

In the second model, the ECT coefficient reveals a 15.8% adjustment of the model in the long term after any shock, indicating that any disruption in the model and co-movement of the two variables (oil prices and REERs) will take more than 6 months to return to equilibrium. Furthermore, the results in table 5 show that oil prices have a very small negative effect on REERs in the short term; Yang et al. (2018) found the same effect for oil-exporting countries.

However, to comprehend the aforementioned relationship, it is necessary to first understand that the Algerian bank has been devaluing the dinar since late 2014, when oil prices began to fall below $100 per barrel (the dinar has devalued by more than 50% and 70% against the euro and the dollar respectively during the period 2014-2021), in order to increase on the one hand the nominal value of oil rents, which have been locally monetized to meet the growth in domestic spending, and to mitigate the official reserve depletion on the other hand. In the

[3] For a discussion of the relevant literature, see Djedaiet and Ayad (2017).

short run, this has resulted in the oil price-REER connection having the opposite impact. It is also worth noting that, despite the rise in oil prices during such a pandemic, they have yet to reach a point where Algeria's economy is in balance (a price above the $100 per barrel ceiling), not to mention pushing the dinar value higher.

Furthermore, COVID-19 has a strong short term impact on the REER, since the pandemic has led to a REER depreciation of roughly 150 per cent. This result is consistent with the previously mentioned analysis of the REER devaluation, especially since the onset of the pandemic in early 2020, following a critical shortage of demand for Algerian dinar as a result of the global recession which has reduced global demand for oil. Therefore, the Algerian rentier economy had no other options for stemming the depletion of official reserves and absorbing public expenditure except through a nominal increase in the monetized petrodollar. This finding is in line with that of Iqbal et al. (2020), who found a strong negative relationship between the exchange rate and COVID-19 for a short period of time.

Table 5. Short Run Estimation Results

Model 1			
Variables	**Coefficients**	**t- statistic**	**Probability**
D(OIL)	0.0405	2.286	0.023
D(REER)	0.656	8.294	0.000
D(REER(-1))	-0.223	-2.891	0.004
COV	0.637	2.066	0.040
ECT	-0.0059	-5.892	0.000
Model 2			
D(REER(-1))	0.227	2.738	0.007
D(REER(-2))	0.027	0.344	0.730
D(OIL)	-0.051	-2.621	0.009
D(OIL(-1))	0.032	1.472	0.143
COV	-1.152	-3.481	0.000
ECT	-0.158	-4.669	0.000

Source: Author's calculations using Eviews 12.

5.1.6. Quality Tests

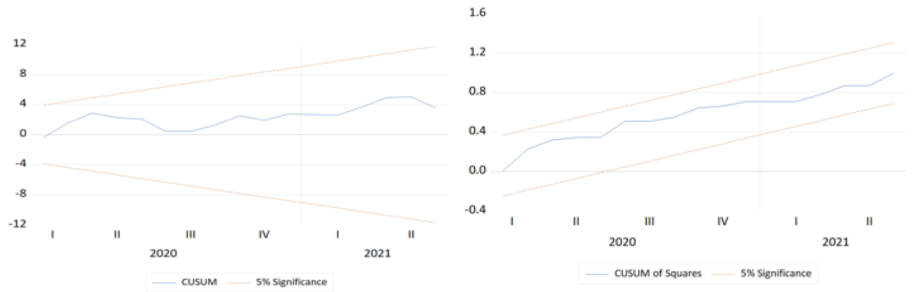
According to the quality tests (normality distribution of the errors; autocorrelation of the errors; heteroscedasticity problem; Ramsey test for model estimation), the error series are normal, and the model estimated is appropriate. All estimators are stable over time, as shown by the CUSUM and CUSUM Squares graphs for parameter stability in time, allowing us to forecast using the two models estimation.

Table 6. Quality Tests Results

Tests	**Jarque-Berra**	**Breusch-Godfrey**	**ARCH**	**Ramsey**
Model 1	0.330 (0.847)	1.760 (0.063)	0.659 (0.786)	1.495 (0.223)
Model 2	0.331 (0.847)	0.540 (0.883)	0.994 (0.459)	0.120 (0.729)
(.) Denotes the probability of the tests.				

Source: Author's calculations using Eviews 12.

Model 1



Model 2

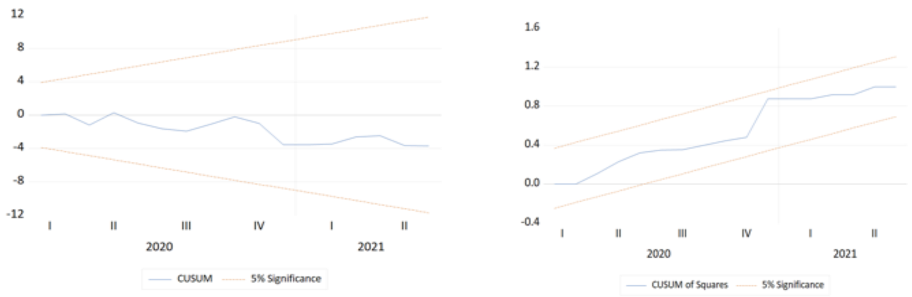


Figure 2. CUSUM and CUSUMSQ Graphs

5.2. NARDL Estimation

Because there is an asymmetrical effect of oil prices on macroeconomic variables, we will attempt to estimate a non-linear estimation for the two models using a NARDL approach to cope with positive and negative components of oil prices. The two models are as follows:

$$model\ 1: INF_t = a_{10} + a_{11}OIL_t + a_{13}REER_t + a_{14}COV_t + a_{15}OIL_t^+ + a_{16}OIL_t^- + \varepsilon_{1t} \quad (3)$$

$$(4) model\ 2: REER_t = a_{20} + a_{21}OIL_t + a_{22}COV_t + a_{23}OIL_t^+ + a_{24}OIL_t^- + \varepsilon_{2t}$$

Where OIL_t^+ and OIL_t^- are the positive and negative components of oil prices respectively.

5.2.1. Bounds Test

The NARDL estimation follows the same procedure as the ARDL estimation; the first step is to run the bounds test to detect the series' co-movement. The results in table 7 show that there is a co-integration relationship between the variables in both models since the statistical value is greater than the critical values at a 5% significant level, indicating that there is co-movement behavior between the cumulative components of oil prices, the REER, and the inflation rate in the first model, and between the cumulative components of oil prices and the REER in the second model.

Table 7. Bounds Test for NARDL Estimation Results

Test statistic	**Model 1**		
	Significance	**I(0)**	**I(1)**
3.982	10%	2.474	3.312
	5%	2.920	3.838
	1%	3.908	5.044
Test statistic	Model 2		
	Significance	I(0)	I(1)
6.767	10%	2.713	3.453
	5%	3.235	4.053
	1%	4.358	5.393

Source: Author's calculations using Eviews 12.

5.2.2. Long Run Estimation

The long run asymmetric effects estimation shows that both negative and positive oil price shocks have a significant effect on inflation rates, with a slight disparity in favor of negative ones, implying that the Algerian bank reaction to controlling inflation rates does not vary greatly depending on the different shocks.

The second model reveals that the REER responds only to negative oil price shocks at a 5% significance level; however, the relationship is a little messed up, owing to the Algerian bank's strong desire to keep the exchange rate in check through dirty floating interventions that effectively neutralize shocks.

Table. Long Run Estimation for NARDL Model Results

Model 1			
Variables	**Coefficients**	**t- statistic**	**Probability**
OIL_POS	0.137	2.137	0.034
OIL_NEG	-0.177	-3.255	0.001
REER	0.194	0.563	0.574
C	113.431	3.199	0.001
Model 2			
OIL_POS	0.070	1.697	0.092
OIL_NEG	0.091	2.852	0.005
C	103.088	50.191	0.000

Source: Author's calculations using Eviews 12.

5.2.3. Short Run Estimation

As shown in table 9, the ECT estimators are statistically significant in both models, as evidenced by the existence of an adjustment procedure after any shock, which accounts for 10.4 percent and 18.1 percent for the first and second models, respectively (low speed adjustment).

Based on the same table, the short term results for both models are not substantially different from their long run counterparts, with the exception of the larger influence of oil positive shocks on the inflation rate. A similar asymmetric impact was found by Choi et al (2018). It is important to stress that in the nonlinear estimation, the coronavirus variable has no influence on the inflation rate or the REER.

Table 9. Short Run Estimation for NARDL Model Results

Model 1			
Variables	**Coefficients**	**t- statistic**	**Probability**
D(OIL_POS)	0.130	4.270	0.000
D(OIL_NEG)	-0.018	-2.905	0.004
D(REER)	0.652	8.625	0.000
COV	-0.430	-1.182	0.239
ECT	-0.104	-4.531	0.000
Model 2			
D(REER(-1))	0.252	2.999	0.003
D(REER(-2))	0.096	1.099	0.273
D(OIL_NEG)	0.016	3.090	0.002
D(OIL_POS)	0.040	0.969	0.334
COV	-0.563	-1.358	0.176
ECT	-0.181	-5.269	0.000

Source: Author's calculations using Eviews 12.

5.2.4. Quality Tests

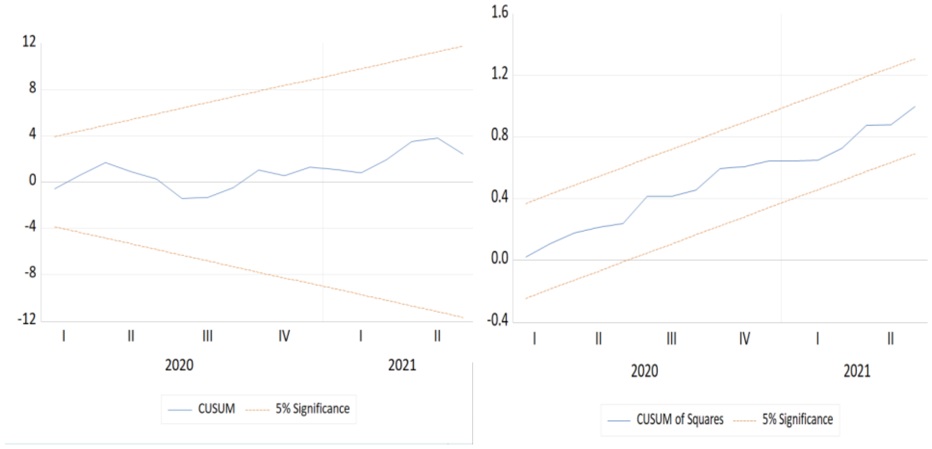
The quality test results of the NARDL estimation for the two models are the final step in this study, and it is clear from the results that both models are statistically acceptable because all of the tests are positive (the errors are normally distributed with no autocorrelation and with a homoscedasticity behavior for the error variance, the model is appropriate, as well as the parameters are stable over time).

Table 10. Quality Tests Results

Tests	**Jarque-Berra**	**Breusch-Godfrey**	**ARCH**	**Ramsey**
Model 1	0.396 (0.820)	1.282 (0.238)	0.853 (0.596)	0.094 (0.759)
Model 2	0.034 (0.982)	0.996 (0.457)	1.256 (0.255)	0.037 (0.847)

(.) Denotes the probability of the tests.

Model 1



Model 2

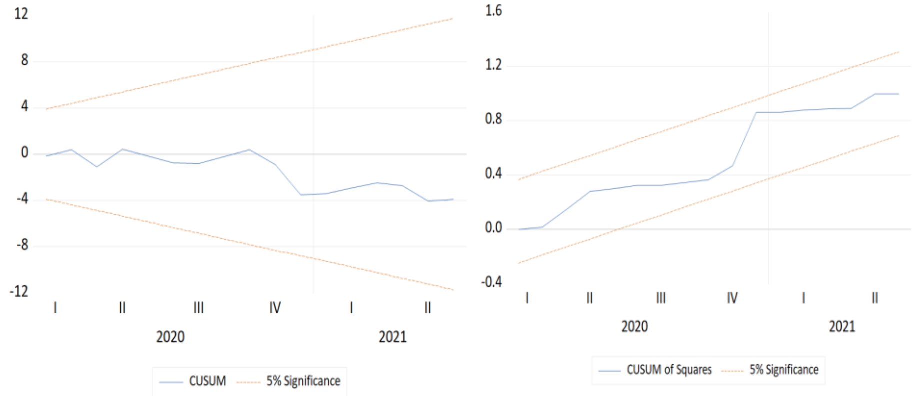


Figure 3. CUSUM and CUSUMSQ Graphs

6. Conclusion

This paper contributes to the emerging literature on the economic consequences of the COVID-19 pandemic, particularly in terms of monetary policy. Several papers have been published on various topics, the most important of which are: investigating the impact of the pandemic on oil prices and identifying the performance of capital markets while taking uncertainty into account. However, our contribution can be divided into two parts. First, we set up two models that represent both internal and external equilibrium to determine the interrelationship among variables (oil prices, REER, and inflation). Second, we examine how the aforementioned models reacted to the COVID-19 pandemic, which has coupled with a drop in oil prices in Algeria as a pure rentier economy.

Overall, the evidence suggests that both models have eloquently responded to the coronavirus only in the linear estimation, i.e. the COVID-19 pandemic had a substantial negative effect on the REER and a positive effect on the inflation rate in the short term linear estimation. This gives the impression of the Algerian economy's high vulnerability, which is also confirmed by the considerable positive effect of oil prices on inflation rates. However, the effect of the REER on inflation does not match the findings; this is mostly attributable to two factors: lowering the import bill and progressively reducing basic commodity subsidies. The former strives to minimize balance-of-payments deficits by reducing official reserve depletion, while the latter aims to alleviate the budget deficit by cutting public expenditure; both have driven inflation despite the REER appreciation.

The nonlinear estimation illustrates the long- and short-term responsiveness of inflation rates to both positive and negative oil price shocks, underlining once again the economic fragility in the face of oil price fluctuations. The relationship between the latter and the REER is a little hazy, as the Algerian bank does not allow it to float freely or even partially, as seen by the dinar devaluation strategy.

The costs of an undiversified economy should not be disregarded, as they have been in previous crises. In other words, unless the pandemic coincided with a wholly dependent on oil revenues, the impact on inflation and the exchange rate would not have been that severe. As a result, policymakers must put an end to this curse by making major efforts to diversify the economy in order to better absorb future shocks, as it is unacceptable to keep macroeconomic indicators out of check in this manner.

References

Agyei, S. K., Isshaq, Z., Frimpong, S., Adam, A. M., Bossman, A., &Asiamah, O. (2021). COVID-19 and food prices in Sub-Saharan Africa. *African Development Review*, 33, S102-S113.

Albulescu, C. (2020). Coronavirus and oil price crash. Available at SSRN 3553452.Albulescu, § Claudiu, Coronavirus and Oil Price Crash (March 12, 2020).

Altig, D., Baker, S., Barrero, J. M., Bloom, N., Bunn, P., Chen, S. & Thwaites, G. (2020). Economic uncertainty before and during the COVID-19 pandemic. *Journal of Public Economics*, 191, 104274.

Ashraf, B. N. (2020). Stock markets' reaction to COVID-19: Cases or fatalities?*Research in International Business and Finance*, 54, 101249.

Baker, S. R., Bloom, N., Davis, S. J., & Terry, S. J. (2020). Covid-induced economic uncertainty (No. w26983). National Bureau of Economic Research.

Bala, U., & Chin, L. (2018). Asymmetric impacts of oil price on inflation: An empirical study of African OPEC member countries. *Energies*, *11*(11), 3017.

Barro, R. J., Ursua, J. F., &Weng, J. (2020). The coronavirus and the great influenza epidemic. Lessons from the "Spanish Flu" for the coronavirus's potential effects on mortality and economic activity.(No. w26866). National Bureau of Economic Research.

Beckmann, J., Czudaj, R., & Arora, V. (2017). The relationship between oil prices and exchange rates: theory and evidence. *US Energy Information Administration working paper series*, 1-62.

Bilgin, B. A. R. İ., & ADALI, Z. (2020). How oil prices drive inflation in Turkish economy: Two different channels. *Fiscaoeconomia*, *4*(3), 705-721.

Binder, C. (2020). Coronavirus fears and macroeconomic expectations. *Review of Economics and Statistics*, *102*(4), 721-730.

Blanchard, O. J., & Gali, J. (2007). The Macroeconomic Effects of Oil Shocks: Why are the 2000s so different from the 1970s?.

Cerra, V. (2019). How can a strong currency or drop in oil prices raise inflation and the black-market premium?. *Economic Modelling*, *76*, 1-13.

Chen, S. S. (2009). Oil price pass-through into inflation. *Energy economics*, *31*(1), 126-133.

Chkir, I., Guesmi, K., Brayek, A. B., & Naoui, K. (2020). Modelling the nonlinear relationship between oil prices, stock markets, and exchange rates in oil-exporting and oil-importing countries. *Research in International Business and Finance*, *54*, 101274.

Choi, S., Furceri, D., Loungani, P., Mishra, S., & Poplawski-Ribeiro, M. (2018). Oil prices and inflation dynamics: Evidence from advanced and developing economies. *Journal of International Money and Finance*, *82*, 71-96.

Coulibaly, S. (2021). COVID-19 policy responses, inflation and spillover effects in the West African Economic and Monetary Union. *African Development Review*, 33, S139-S151.

De Gregorio, J., Landerretche, O., Neilson, C., Broda, C., & Rigobon, R. (2007). Another pass-through bites the dust? Oil prices and inflation [with comments]. *Economia*, *7*(2), 155-208.

Delgado, N. A. B., Delgado, E. B., & Saucedo, E. (2018). The relationship between oil prices, the stock market and the exchange rate: Evidence from Mexico. *The North American Journal of Economics and Finance*, *45*, 266-275

Devpura, N. (2021). Effect of COVID-19 on the relationship between Euro/USD exchange rate and oil price. *MethodsX*, 8, 101262.

Devpura, N., & Narayan, P. K. (2020). Hourly oil price volatility: The role of COVID-19. *Energy Research Letters*, 1(2), 13683.

Dietrich, A. M., Kuester, K., Müller, G. J., & Schoenle, R. (2022). News and uncertainty about covid-19: Survey evidence and short-run economic impact. *Journal of monetary economics*.

Djedaiet, A., & Ayad, H. (2017). Hard currency inflows and sterilization policy in Algeria: An ARDL approach. *Theoretical & Applied Economics*, 24(3).

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, 251-276.

Erdoğan, S., Yildirim, D. Ç, &Gedikli, A. (2020). Dynamics and determinants of inflation during the COVID-19 pandemic period in European countries: A spatial panel data analysis. *Duzce Medical Journal*, 22 (Special Issue), 61-67.

Feng, G. F., Yang, H. C., Gong, Q., & Chang, C. P. (2021). What is the exchange rate volatility response to COVID-19 and government interventions?*Economic Analysis and Policy*, 69, 705-719.

Georgieva, K. (2020). IMF managing director Kristalina Georgieva's statement following a G20 ministerial call on the coronavirus emergency. *International Monetary Fund*.

Ha, Jongrim and Kose, M. Ayhan and Ohnsorge (2020), Franziska, Inflation During the Pandemic: What Happened? What is Next?.

Habermeier, K., Otker-Robe, I., Jácome, L. I., Giustiniani, A., Ishi, K., Vávra, D., ... & Vazquez, F. (2009). Inflation pressures and monetary policy options in emerging and developing countries-A cross regional perspective.

Iqbal, N., Fareed, Z., Shahzad, F., He, X., Shahzad, U., & Lina, M. (2020). The nexus between COVID-19, temperature and exchange rate in Wuhan city: new findings from partial and multiple wavelet coherence. *Science of The Total Environment*, *729*, 138916.

Izzeldin, M., Muradoğlu, Y. G., Pappas, V., &Sivaprasad, S. (2021). The impact of Covid-19 on G7 stock markets volatility: Evidence from a ST-HAR model. *International Review of Financial Analysis*, 74, 101671.

Kartal, M. T. (2020). The effect of the COVID-19 pandemic on oil prices: Evidence from Turkey. *Energy Research Letters*, 1(4).

Konstantakis, K. N., Melissaropoulos, I. G., Daglis, T., &Michaelides, P. G. (2021). The euro to dollar exchange rate in the Covid-19 era: Evidence from spectral causality and Markov-switching estimation. *International Journal of Finance & Economics*.

Gil-Alana, L. A., & Monge, M. (2020). Crude oil prices and COVID-19: Persistence of the shock. *Energy Research Letters*, *1*(1), 13200.

LeBlanc, M., & Chinn, M. D. (2004). Do high oil prices presage inflation? The evidence from G-5 countries. *UC Santa Cruz Economics Working Paper*, (561), 04-04.

Leduc, S., & Liu, Z. (2020). The uncertainty channel of the coronavirus. *FRBSF Economic Letter,* 7, 1-05.

Malik, K., Ajmal, H., & Zahid, M. U. (2017). Oil price shock and its impact on the macroeconomic variables of Pakistan: A structural vector autoregressive approach. *Malik, KZ, Ajmal H, Zahid M U.," International Journal of Energy Economics and Policy*, *7*(5), 83-92.

Mohammadi, H., & Jahan-Parvar, M. R. (2012). Oil prices and exchange rates in oil-exporting countries: evidence from TAR and M-TAR models. *Journal of Economics and Finance*, *36*(3), 766-779.

Narayan, P. K. (2020). Oil price news and COVID-19—Is there any connection?.*Energy Research Letters*, 1(1), 13176.

Njindan Iyke, B. (2020). The disease outbreak channel of exchange rate return predictability: Evidence from COVID-19. *Emerging Markets Finance and Trade*, *56*(10), 2277-2297.

Ozili, P. K., &Arun, T. (2020). Spillover of COVID-19: impact on the Global Economy. Available at SSRN 3562570.

Ozturk, F. (2015). Oil price shocks-macro economy relationship in Turkey. *Asian Economic and Financial Review*, *5*(5), 846-857.

Prabheesh, K. P., & Kumar, S. (2021). The Dynamics of Oil Prices, Exchange Rates, and the Stock Market Under COVID-19 Uncertainty: Evidence From India. *Energy RESEARCH LETTERS*, *2*(3), 27015.

Qianqian, Z. (2011). The impact of international oil price fluctuation on China's economy. *Energy Procedia*, *5*, 1360-1364.

Rai, K., & Garg, B. (2021). Dynamic correlations and volatility spillovers between stock price and exchange rate in BRIICS economies: Evidence from the COVID-19 outbreak period. *Applied Economics Letters*, 1-8

Sharif, A., Aloui, C., &Yarovaya, L. (2020). COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. *International Review of Financial Analysis*, 70, 101496.

Tang, W., Wu, L., & Zhang, Z. (2010). Oil price shocks and their short-and long-term effects on the Chinese economy. *Energy Economics*, *32*, S3-S14.

Turhan, M. I., Sensoy, A., & Hacihasanoglu, E. (2014). A comparative analysis of the dynamic relationship between oil prices and exchange rates. *Journal of International Financial Markets, Institutions and Money*, *32*, 397-414.

Villarreal-Samaniego, D. (2021). The dynamics of oil prices, COVID-19, and exchange rates in five emerging economies in the atypical first quarter of 2020. *EstudiosGerenciales*, 37(158), 17-27.

World Bank Group. (2020). Algeria Economic Monitor, Fall 2020: Navigating the COVID-19 Pandemic, *Engaging Structural Reforms*.

Wu, M. H., & Ni, Y. S. (2011). The effects of oil prices on inflation, interest rates and money. *Energy*, *36*(7), 4158-4164.

Yang, L., Cai, X. J., & Hamori, S. (2018). What determines the long-term correlation between oil prices and exchange rates?. *The North American Journal of Economics and Finance, 44,* 140-152.

Zhang, W., &Hamori, S. (2021). Crude oil market and stock markets during the COVID-19 pandemic: Evidence from the US, Japan, and Germany. *International Review of Financial Analysis,* 74, 101702.