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The counter-cyclical role of remittances in Algeria's economic resilience a time series analysis (1970-2023)

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Abstract--This study explores whether remittance transfers help stabilize Algeria's economy, which is highly dependent on oil revenues and therefore susceptible to outside shocks. The study examines the dynamic relationships between changes (decrease) in the price of crude oil and important macroeconomic indicators, such as GDP, GDP growth, inflation, and remittance factors, using annual data from 1970 to 2023 and a Vector Autoregression (VAR) model. A negative shock to oil prices causes notable contractions in GDP and GDP growth, together with a brief increase in inflation, according to impulse response research. Remittance inflows, on the other hand, rise after such shocks, exhibiting a counter-cyclical trend and underscoring the ability of remittances to mitigate economic downturns. Remittances help to strengthen economic resilience by gradually increasing in importance in the composition of GDP, even though they cannot completely counteract the adverse effects of fluctuations in oil prices. The results highlight how crucial it is to use remittance flows as part of larger plans for economic stability and diversification in rentier nations such as Algeria.

Keywords--Remittances, Economic Resilience, Rentier State Economy, Time Series Analysis.

1. Introduction

Rentier economies rely significantly on revenue from natural resources, which often leads to instability characterized by price volatility and fluctuations. As a

result, achieving economic stability remains a significant challenge for these nations. Algeria, noted as one of Africa's largest oil-exporting countries, serves as a prime example of this ongoing struggle.

Historically, the country has faced macroeconomic vulnerabilities brought on by changes in the price of oil globally, which have a significant effect on its economic performance (World Bank & KNOMAD, 2024). The nation's overall prosperity and economic revenue are strongly impacted by the volatility of oil prices. The nation continues to experience oil price shocks despite the government's numerous attempts to lessen reliance on oil earnings by adopting various policies and encouraging entrepreneurship, with little to no success. In this context, we explore one financial resource that could reduce the negative impact of hydrocarbon price shocks. Remittance inflows could be a huge financial relief for the country in case of an economic crisis and could potentially stabilize the economy (Page, 2005).

Remittances, a monetary transfer from migrant citizens to their home countries to support their families or friends, could be significant for the economy considering the large number of Algerian migrants. They can influence many macroeconomic indicators like consumption and household revenues (World Bank & KNOMAD, 2024). These transfers could be large enough to absorb some of the negative effects of oil price volatility, they can provide liquidity to households and businesses, contributing to internal demand stability and stimulating economic activity. Thereby enhancing economic resilience against shocks. The logic behind this assumption is the fact that remittance inflows tend to increase during economic crises and periods of uncertainty (Chami, 2008).

In a report titled Migration and Development Brief, June 2024, the World Bank and the KNOMAD institution reported that the estimated yearly remittances sent by Algerian migrants are between 1.5 and 2 billion dollars. Compared to nearby nations, where these transfers have a far greater impact on their economy, this number is quite low. The nature of the national banking system, transfer laws, and foreign exchange restrictions are the main causes of Algeria's declining remittance numbers. Because there is a parallel exchange rate market, many migrants turn to unofficial means of moving money.

During the last twenty years official remittance inflows remained below 0.80% of Algeria's GDP annually yet they stand as the second biggest foreign currency source following oil earnings. The value of these financial transfers exceeds Algeria's non-hydrocarbon export revenues and surpasses the country's annual Foreign Direct Investment (FDI) inflow which demonstrates their importance to the national economy. Through improved banking regulations and more confidence in the financial sector, remittances, a vital financial resource, can be used more effectively. Finding creative strategies to direct remittances into sustainable development projects that support the national economy is imperative given the current economic difficulties and fluctuating oil prices.

Many studies can be found in literature examining the relationship between remittances and oil price volatility, and many have highlighted the role of remittances in economic stability. However, only a few have studied the case of

Algeria. This study aims to address this gap by exploring the mechanism through which remittances can promote economic stability in the event of an oil price shock in Algeria. Additionally, the primary issue we aim to address in our research is: To what extent can remittances serve as a stabilizing factor in an economy that depends heavily on oil, such as Algeria? In particular, do remittances surge when oil prices fall, partially counteracting the detrimental effects on economic stability?

To answer the question, we used a time series analysis to examine the relationship between crude oil prices and remittances along with other macroeconomic indicators. A vector autocorrelation model (VAR) was chosen to address the matter and capture the dynamic relationship between the different variables. Tests and data composition determined that the VAR model is adequate for this analysis because it accommodates bidirectional causality and interdependence among variables without requiring strict assumptions about exogeneity (Maina, 2024). Furthermore, impulse response function was used to measure the impact of oil price shock on remittances and economic stability.

Our main objective is to answer the research question, offer empirical evidence, and provide valuable insights for policymakers in Algeria about what could be a significant factor in reducing the negative impact of oil price volatility and increasing overall economic stability.

2. Literature review

The importance of remittances as a key foreign exchange source and economic stabilizer for Global South economies has become more widely acknowledged. Research has extensively investigated how migrant remittances influence both macroeconomic and microeconomic factors in developing and emerging economies. Algeria continues to receive minimal attention in research on remittance time series dynamics and their economic stability impact despite their significance.

An early study on the role of remittances in protecting rural Mexican households from agricultural shocks was carried out by Wyatt and Taylor (1996), who discovered that remittances were an essential source of income for reducing volatility. In the same way, Glytsos (2002) showed that, to differing degrees, remittances increased final consumption in Mediterranean nations. By examining 71 developing countries, Page, Richard, and Adams (2005) broadened the empirical scope and discovered that a 10% increase in remittance transfers decreased the number of people living in poverty by 3.5%. The foundation for comprehending how remittances stabilize and reduce poverty in national economies was established by these studies.

Chami et al. (2008) highlighted that remittances could serve more as supplemental income than as productivity boosters in the Middle East and North Africa (MENA) region, occasionally lowering labor incentives. According to Acosta et al. (2007), remittances decreased poverty, but they also ran the risk of making the gap between those that received and those that did not worsen. The

complexity of remittance movements and its macro-distributive effects are highlighted by these two findings.

Additional nuance is provided by more recent research. For example, Panthi and Devkota (2024), with a focus on Nepal, demonstrated that although remittances helped to boost GDP over the long run, their combination with financial development resulted in diminishing marginal returns. These findings highlight the necessity of formalizing remittance channels and creating legislative frameworks that reroute finances toward beneficial purposes in countries with inadequate financial infrastructures, like Algeria. Remittances have a long-term positive impact on economic growth and poverty reduction, especially in institutional environments with stronger governance and corruption control—conditions, Algeria is working to improve in its post-2019 economic reforms. This was confirmed by Ekanayake and Moslares (2020), who studied 21 Latin American countries.

Algeria's case is made more compelling by Margolis et al. (2014), who provided a rare within-country analysis using original survey data from two Algerian regions. Their findings showed a 13-percentage point drop in poverty due to remittances, with notable regional disparities. One region, benefiting from long-standing diaspora networks, experienced greater poverty and inequality reductions than the other region, where “double loss” households (non-remitting migrants) were prevalent. This microeconomic evidence, though region-specific, offers valuable insights into how remittance effectiveness varies with historical migration patterns and social infrastructure.

Crucial policy insights can be learned from comparative foreign instances. For example, Bangladesh has formalized remittance flows using cash incentives and regulatory changes, increasing its GDP contribution to 4.6% as opposed to Algeria's anticipated 0.7% (World Bank & KNOMAD, 2024) (Md Mizanur Rahman & Brenda S.A. Yeoh, 2008). By making investments in energy efficiency, green infrastructure, and education, Chand and Singh (2024) connected remittances to sustainable development. Their results imply that remittances might act as a buffer against the negative economic and environmental effects of reliance on hydrocarbons, which is particularly relevant for Algeria.

Olivié and Santillán O'Shea's (2022) policy-focused research highlighted how nations such as Morocco did better than Algeria when it came to using remittances for sustainable development. Morocco formalized flows and improved household welfare using financial incentives, diaspora involvement initiatives (like PRIME Africa), and legal frameworks. In contrast, Algeria has implemented tight capital regulations that unintentionally force remittances through unofficial channels, so compromising their potential for development (Margolis, 2014).

When combined, these studies demonstrate the diverse ways in which remittances support economic stability, alleviate poverty, and act as a buffer against macroeconomic shocks. They also emphasize important mediating factors, such as policy contexts, migration histories, financial sector development, and governance quality. Algeria's reliance on hydrocarbons, informal remittance channels, and weak institutional frameworks have so far offset the favorable

macroeconomic impacts observed in comparable countries. Building on these conclusions, this study uses a time series analysis to examine whether remittances could help Algeria maintain economic stability in times of crisis like fluctuations in the price of oil.

3. Methodology

In this paper we used a time series analysis to answer the research's question and test hypotheses. Multiple statistical tests have been performed to determine the adequate model for the study and its robustness. Furthermore, impulse response analysis has been used to measure the effect of personal remittance inflows on economic resilience in Algeria, in case of oil price shock or economic crisis. All data analysis and statistical tests have been performed using Eviews.

3.1 Stationarity and model selection

Augmented Dickey-Fuller test has been performed, to determine whether the series are stationary or not. Results have shown that multiple series are non-stationary, crude oil prices, GDP, inflation, and personal remittance inflows. Thus, after using the Johansen cointegration test, we determined that there are no cointegration relationships between the non-stationary variables, which makes the VECM (Vector Error Correction Model) unsuitable for the study. Therefore, we opted for a vector autoregression model (VAR) to perform the study, all non-stationary variables were rendered stationary using first differencing. The following table shows the full results for stationarity test, the null hypothesis is that the variable has a unit root (non-stationary).

Table 1. Stationarity test results

Variables	Test statistic	1%CV	5%CV	10%CV	p-value	Stationarity decision
Crude oil Prices	-1.533	-3.56	-2.917	-2.596	0.5092	Non stationary
GDP	0.1099	-3.56	-2.917	-2.596	0.9636	Non stationary
GDP GROWTH	-9.01	-3.56	-2.917	-2.596	0.000	stationary
INFLATION	-2.299	-3.56	-2.917	-2.596	0.1758	Non stationary
Remittance inflows	-2.6568	-3.56	-2.917	-2.596	0.088	Non stationary
Remittance ratio of GDP	-3.1938	-3.56	-2.917	-2.596	0.0259	stationary

We chose a lag length of 2 rather than the optimal lag length of 1 suggested by lag length criteria, the reason behind this decision is to achieve better stability.

3.2 Variables:

We selected six variables for our model, the selection has been made based on literature review and data availability.

- Crude oil prices: oil revenues represent the main drive of Algerian economy, which is highly dependent and sensitive to its fluctuations, we wanted to highlight how remittances could reduce the negative effect of crude oil fluctuations.
- GDP: this variable was selected because it is a good indicator for economic stability.
- GDP growth: for a better understanding and measurement of economic performance.
- Inflation: another economic stability indicator, measured as an annual percentage.
- Remittance inflows: which is the amount of money transferred by Algerian migrants abroad to their families and friends in the country.
- Remittances ratio of GDP: measures the weight of remittances in the economy, which provides a comparative measure for a better understanding.

All data has been collected from the World Bank database with no alteration or modification. Data is structured on a yearly basis. The period of the study is from 1970 to 2023 (54 observations).

3.3 Stability and robustness

Before using our model for analysis, we tried to make it as stable and robust as possible. Multiple tests have been conducted to ensure the stability and robustness of our model, mainly: Inverse Roots of the Characteristic AR Polynomial and Autocorrelation test. First, we are going to show results for the Inverse roots of the characteristic AR polynomial test in the following figure:

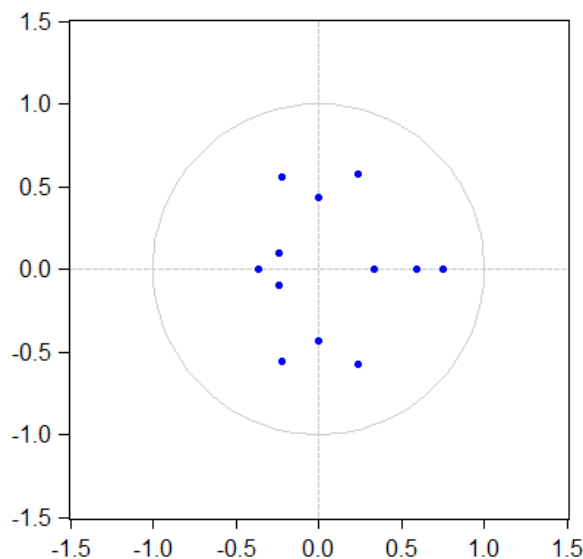


Figure 1. Inverse roots of the characteristic AR polynomial test

All the characteristic polynomial roots are inside the circle, so we conclude that the VAR model is stable. Which means that a shock to the system will fade away over time rather than amplifying explosively (Lütkepohl, 2005).

The second test shows results for residual autocorrelation, which occurs when residuals of a time series are correlated with their own lagged values, and this violates the essential assumption that residuals are white noise (random). The Breusch-Godfrey Lagrange Multiplier (LM) test (Godfrey, 1978) has been performed to check for residual autocorrelation, the null hypothesis assumes no autocorrelation up to lag order h ($h=2$). Results are shown in table 02:

Table 2. Godfrey Lagrange Multiplier (LM) test results

	Rao F-stat	p-value	Result
Lag 1 (only)	0.980409	0.5098	No autocorrelation
Lag 2 (only)	0.951119	0.5543	No autocorrelation
Lags 1-2 combined	0.935074	0.6176	No autocorrelation

As shown in the table, the null hypothesis can't be rejected at a significance level of $\alpha=0.05$. which means that our VAR model's residuals are free from autocorrelation satisfying the white noise assumption.

4. Results and Discussion

To answer the research question and test hypothesis, we used impulse response function, we applied a negative shock to crude oil price and analyzed the effect on the other variables, starting by GDP and GDP growth rate, then inflation rate and finally remittance inflow and remittance ratio of GDP. The following figure shows the new line of crude oil price (at 1st difference) over 10 time periods:

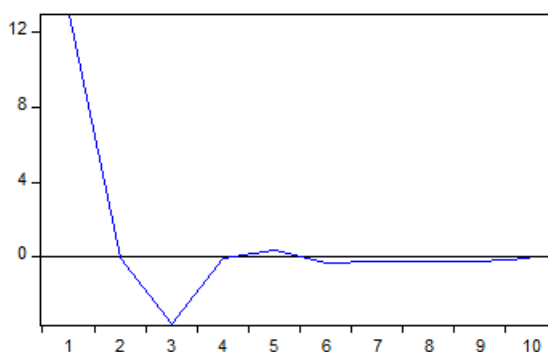
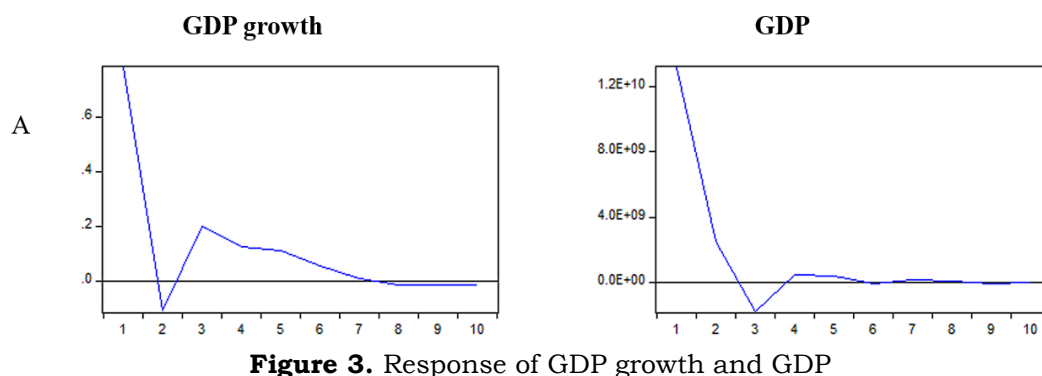


Figure 2. new crude oil price line after the shock

As shown in figure 2, there is a sharp and immediate decline in the first period, followed by a brief rebound and gradual convergence to zero. It is worth noting that these are not the crude oil price values, but the first difference between its values. The next two figures show the response of GDP and GDP growth, to crude oil prices' decrease:



A negative shock to oil prices causes a huge negative impact on both GDP and GDP growth initially, this result is expected since Algerian economy relies heavily on oil revenues. Furthermore, there are noticeable fluctuations in GDP growth in the short term, which could be due to the government adjustments to the shock. Eventually both GDP and GDP growth stabilize at a new and lower level, which indicates that the effect of oil price shock has disappeared, and the government has somehow adapted to the new situation, by using reserves or taking other measures. Thus, GDP and GDP growth have not returned to the same level before the shock meaning that the economy could not fully recover, and the overall welfare and prosperity are lower than before the shock.

These results are aligned with economic theory and are expected because of the nature of Algerian economy, which is highly dependent on oil revenues. Therefore, if oil prices drop this will certainly cause GDP to contract, and since Algerian economy has a very low diversification level, this could explain why GDP never recovered and didn't return to the first level before the oil price drop. The next figure shows the response of inflation. The variable was included in our model because it is a good indicator for economic stability:

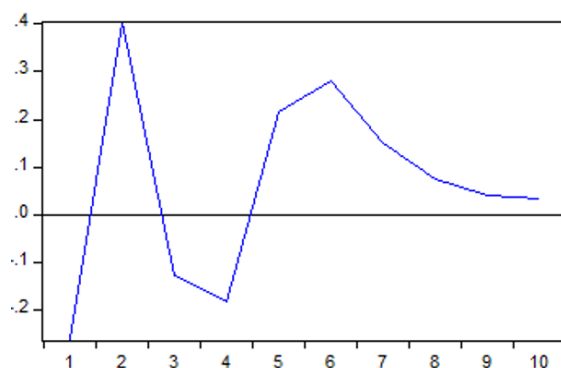


Figure 4. Response of inflation to crude oil price shock

As shown in figure 4, Inflation immediate response to crude oil price's negative shock, is a rapid and sharp increase in the short term, this could be due to various reasons. The country relies a lot on imported goods to cover its needs, and with oil price decline, Algerian currency will depreciate causing higher inflation level, another reason why low oil price would cause higher inflation levels

is money printing to cover budget deficit, this strategy has been adopted before by the Algerian economy in times of crisis.

After the sharp rise in inflation there is a rapid decrease, this could be a result of government intervention to control the situation, by taking measures like limiting imports and imposing a tight monetary policy. The initial increase in inflation could also be caused by firms' overreaction to the oil price drop, then they rapidly adjust their prices, which explains why the level has rapidly decreased. Furthermore, the inflation level increases again and then drops before it slowly stabilizes at a higher level than the initial one. Finally, we are going to show the response of remittance inflows and remittance ratio of GDP in the next figure:

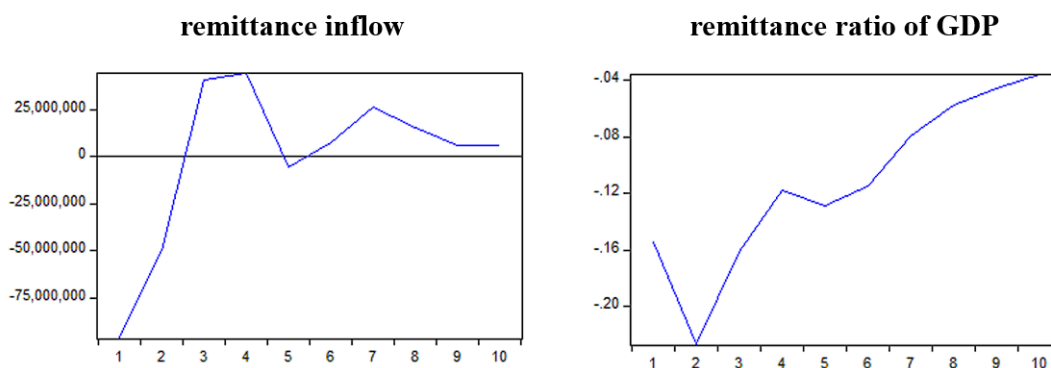


Figure 5. Response of Remittance

This result is expected and aligned with economic theory. Emigrants abroad are expected to send more money during times of economic crisis to help their families and relatives. On the other hand, the remittance ratio of GDP decreased initially following the shock despite the increase of remittance inflow, this means that the change in GDP (decrease) is much higher than the change in remittance inflows (increase) in the first few years.

After the drop, the ratio starts to rise, which means that GDP is starting to stabilize and is decreasing at a slower pace, so the ratio of remittance inflows becomes more significant in GDP composition. The increase of remittance ration starts to slow down and stabilizes at a higher level, which means that remittance inflows have become more important than before in GDP composition. This consolidates the idea that remittance will become more important and help the economy to stabilize. Thus, remittance inflows don't completely offset the negative impact of crude oil prices' shock, because GDP level stays lower than before the shock.

5. Conclusion

The purpose of this study was to determine how much remittances stabilize Algeria's oil-dependent economy, especially in times of oil price volatility. Using annual data from 1970 to 2023 and a vector autoregression (VAR) model, the study evaluated the relationship between changes (decrease) in oil prices, GDP, inflation, and remittance by testing hypotheses using impulse response functions.

Important conclusions show that remittances rise dramatically in the early aftermath of a shock and show a countercyclical response to drops in the price of oil. This increase, however, only lessens the negative impact that fluctuations in oil prices have on economic stability. The remittance-to-GDP ratio first decreases as a result of the disproportionate loss of GDP in comparison to remittance growth, even while remittance inflows stabilize at high levels after the shock. As GDP stabilizes over time, the ratio gradually improves. Over time, the ratio recovers as GDP stabilizes, underscoring remittances' delayed but meaningful role in buffering economic instability.

These findings are consistent with models of risk diversification driven by migration, which assume that migrant households offset income shocks in their home countries. Remittances, however, are insufficient to completely balance long-term GDP losses in Algeria, which sets it apart from other resource-dependent countries. This is due to structural flaws such as a lack of economic diversification and a reliance on imports. By exposing the limitations of such inflows in economies with embedded vulnerabilities and proving their conditional utility as a stabilizing mechanism, the study contributes to the empirical understanding of remittances in oil-reliant contexts.

6. Recommendations

Based on the study's results we can highlight the following recommendations:

- Remittances should be officially acknowledged by Algerian officials as stabilizing tool and a part of the planning process for macroeconomic stability. This means incorporating remittance data into crisis response plans. Furthermore, the Algerian government should promote and Encourage Remittance Flows. The volume and dependability of these flows can be raised by lowering transaction costs, streamlining regulatory processes, and extending official channels for remittance transfers. Government-sponsored programs like matched savings plans or diaspora bonds could increase the leverage of remittances for profitable ventures.
- In addition, encouraging remittance-receiving households to participate in the formal financial system—through savings accounts, insurance products, or microcredit—can amplify the developmental impact of these funds and reduce vulnerability to external shocks.
- Promote Economic Diversification, while remittances offer short-term relief, long-term stability requires reducing Algeria's dependency on oil revenues. Policymakers should prioritize structural reforms that foster private sector development, attract non-oil investment, and enhance human capital to build a more diversified and resilient economy.
- Continuous monitoring and analysis of remittance patterns, especially during periods of economic turbulence, can inform timely and targeted policy interventions. Investing in data quality and real-time analytics will enhance policy effectiveness.

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