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How Oil Price Changes Affect Inflation in an Oil-Exporting Country: Evidence from Azerbaijan

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Abstract: This research study aims to explore the inflationary effects of oil price rises in the case of Azerbaijan. The study covers 1997–2021 yearly data to estimate long- and short-term impacts while considering "oil price—money supply" interactions. Autoregressive Distributed Lag Bounds testing (ARDLBT), Fully Modified Ordinary Least Squares (FMOLS), and Canonical Cointegration Regression (CCR) cointegration methods are applied simultaneously. The research findings are: (1) oil price is a significant long-term determinant of inflation in Azerbaijan, affecting overall prices directly and indirectly via the money supply; (2) the effect is statistically significant in the short-term and happens indirectly, moderated by the money supply; and (3) oil price moderates the impact of the money supply over inflation in the short-term. A major limitation of the current study is that it omits the possible moderation impact of oil prices over inflation in Azerbaijan through the resulting inflationary pressure due to oil price rises in trade-partner countries and the government's fiscal policy. Research findings require the Central Bank to consider indirect effects of oil price changes, especially due to money supply changes, when targeting inflation and addressing policy sustainability in Azerbaijan.

Keywords: oil price; inflation; money supply; moderating effect; oil-exporting country; Azerbaijan

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1. Introduction

The fact that crude oil is an important but limited resource has been a major research topic for researchers for many years. At present, crude oil is considered the most efficient natural resource for the entire world economy. In addition, it is an essential resource for oil-consuming countries and a significant source of income for oil producers. Oil price fluctuations and production volatilities have a significant impact on the local and global economy. It is already known in the field of economics that it was only with the onset of the oil crisis in the 1970s that scholars began to pay attention to the relationship between fluctuations in oil prices and macroeconomic indicators [1].

Given that the price of oil is determined internationally, it is the main benchmark price for many oil-related and non-oil industries, creating strong links between them [2]. This is reflected in varying domestic prices, depending on the level of a country's economic specifications. Oil price changes also trigger inflation by increasing the cost of production. In this regard, field experts, academia, and ordinary citizens are also sensitive to oil price changes as an initial inflation signal. Therefore, the inflationary impact of oil price changes has both scientific and practical relevance in contemporary economies.

The relationship between oil prices and inflation is often viewed as a causal one. As oil prices rise, inflation, a measure of general price trends in an economy, rises in the same direction. On the other hand, when oil prices fall, inflation does not decrease completely, but only a relative decrease is observed [3]. Until recently, it was believed that oil prices influence inflation expectations, but new data cast doubt on this conclusion. Although the variables are cointegrated, there is an asymmetric association in the long run that inflation significantly responds to oil price rises while oil price reductions do not affect general prices significantly [4]. Moreover, high oil prices allow governments to inject more resource earnings into the economy, increasing the “heat” and pushing prices upward.

Regarding the case discussed here, namely Azerbaijan, the country enjoyed an oil boom after 2005 [5] and injected resource revenues into non-oil sectors to foster economic growth [6]. However, natural resources still maintain their dominant influence in the economy, generating nearly half of the national output and around 90% of total exports, leading to debates on resource curse symptoms in Azerbaijan (see [7–10]). The country imports major goods for consumption. Therefore, oil price changes display themselves in inflation through “imported sources” [11]. Meanwhile, natural resource export earnings and the direct transfers to the state budget (see [5]) increase demand for domestic currency under an almost fixed exchange rate system. That is why oil price changes also reflect monetary expansion, which creates inflationary pressure.

This study explores the inflation–oil price relationship in the case of Azerbaijan. In the past, numerous studies have investigated the relationship for the same case [10,12–16]. The main novelty in this study is to consider the oil price—money supply interaction in determining the annual inflation rate. Results from Autoregressive Distributed Lag Bounds testing (ARDLBT), Fully Modified Ordinary Least Squares (FMOLS), and Canonical Cointegration Regression (CCR) cointegration methods confirm the existence of association via direct and indirect channels in the short-term, while the impact is disputable in the long term.

2. Literature Review

There are vast studies on the inflationary effects of oil price changes for crude oil exporter and importer countries. Chen, Zhu, and Li. (2020) [17] reveal oil price changes to be a primary determinant of inflation in China, which affects imports and the cost of production. Oil price is a main determinant of inflation in Saudi Arabia [18], Nigeria [19], and Turkey [20–22] concludes with symmetric and asymmetric impacts of oil prices on inflation in various sectors in Malaysia. Simultaneously, existing studies strengthen the evidence in favor of the inflationary effects of oil price changes to be asymmetric in Pakistan [23], Brazil [24], Algeria [25], and Nigeria [26]. Studies also support the non-linear feature of the causal relationship between oil price changes and inflation levels [24,25,27].

Numerous studies have explored the impact of oil price changes on the inflation rate for a group of countries [4,28–34]. According to Živkov et al. (2018) [28], the inflationary effects of oil price rises are stronger in the long term for Central and Eastern European Countries. Research reveals the asymmetric impact in Gulf Cooperation [4], Sub-Saharan African [33], and OECD countries [32]. Strong long-run and asymmetric impacts were revealed in both oil-exporter and importer countries [30,31,35,36]. Based on a study of 49 countries, López-Villavicencio and Pourroy (2019) [28] conclude that asymmetries in the inflationary effects of oil price changes on inflation could be diminished with inflation targeting.

Regarding the cse of Azerbaijan, the existing literature includes numerous studies. Yildirim and Arifli (2021) [16] examine the responsiveness of selected macroeconomic indicators to the negative oil price shocks in the Azerbaijan economy. Using monthly data spanning 2006–2018 and the recursive VAR model, the authors determine that a negative oil price shock creates inflationary pressure and decreases total economic activity [16]. In an earlier study, Hajiyev and Rustamov (2019) [13] employ the Vector Error Correction Model (VECM) to study the responsiveness of overall prices to oil price changes in Azerbaijan. Their study results in statistically significant short-run responsiveness [13]. Employing VAR models based on quarterly data over the 2002–2018 period, a study by Zulfigarov and Neuenkirch (2020) [15] reveals inflation to be responsive to both oil price increases and decreases in Azerbaijan. According to Zulfigarov and Neuenkirch (2020) [15], inflation reacts to oil price falls because of the accommodative monetary policy stance, while there is a direct reaction when the price of oil increases.

Mukhtarov et al. (2019) [12] take a wider coverage (1995–2017) to estimate the relationship between inflation and oil prices, use yearly data, and rely on VECM models. The authors conclude that there was a statistically significant long-run impact of oil price changes in both directions on the inflation rate in Azerbaijan. Meanwhile, the research shows the exchange rate to be a transmission channel from oil price changes to inflation [12]. Mukhtarov et al. (2020) [14] have also estimated the impact of oil price changes on selected macroeconomic indicators, including the inflation rate. The study employs the Johansen cointegration test and VECM methods for the monthly data of 2005–2019, revealing that oil price changes have statistically significant effects on inflation in the case of Azerbaijan. Additionally, Niftiyev (2020) [10] identifies urban and rural inflation to be linked to oil prices and oil revenues in the country.

Although previous studies present enough support for a significant oil price–inflation relationship, the current study incorporates non-linearity (possible interaction effect via money supply) into the empirical model specifications for the case of Azerbaijan. Meanwhile, estimations based on broader data coverage (1997–2021) and the application of various cointegration techniques should bring new insights to the existing literature.

3. Materials and Methods

Because the research period (1997–2021) is limited, this study considers only two potential determinants of inflation among many others: oil price (Oprc) and money supply (Money). The dependent variable is annual inflation (CPI_Y) based on the Consumer Price Index (CPI). Oil price data were retrieved from the Statista database [37], measured in USD. Both the money supply (measured in million Azerbaijani manats) and annual inflation (measured in percent) data were obtained from the Central Bank of the Azerbaijan Republic [38]. The money supply consists of broad money in the national currency, AZN. Figure 1 depicts the historical dynamics of the model variables. The money supply and oil price are presented in natural logarithmic form. According to common wisdom and accumulated knowledge,

$$Inflation = f(Money\ supply,\ oil\ price,\ X), \tag{1}$$

where X covers all remaining known and unknown determinants of inflation in Azerbaijan. Based on Equation (1) and the proposed interaction effect, the following benchmark model appears:

$$CPI\_Y_t = \gamma_0 + \gamma_1 * \log(Money)_t + \gamma_2 * \log(Oprc)_t + \gamma_3 * \log(Money)_t * \log(Oprc)_t + \gamma_4 * D1 + \gamma_5 * D2 + u_t. \tag{2}$$

Here, D1 and D2 are dummy variables added to the regression model to account for the effects of economic shocks. The former one (D1) equals 0 for the pre 2009 period and 1 for 2009 and afterwards. Noting that a sharp decline in inflationary pressure from 2008 to 2009 is also linked to an oil price fall (see Figure 1), the dummy's inclusion is expected to affect revealed causality patterns between the price of oil and inflation in Azerbaijan. On the other hand, D2 takes into account the impact of currency devaluation shocks (twice in a year during 2015) following sharp oil price declines, equaling 1 for 2016 and 0 otherwise. Estimation outcomes confirm the importance of both dummies' inclusion to the econometric model.

The primary focus of the current study is to reveal the impacts of the price of oil on inflation in Azerbaijan. Therefore, it could be acceptable to claim that factors in X are not significant determinants of world oil prices. Meanwhile, because the exchange rate is almost fixed and the major foreign source of currency is oil exports, the money supply should be less elastic to the changes in other determinants of inflation. In this regard, estimated model parameters should be much more likely unbiased, while the de-trending factor has also been considered.

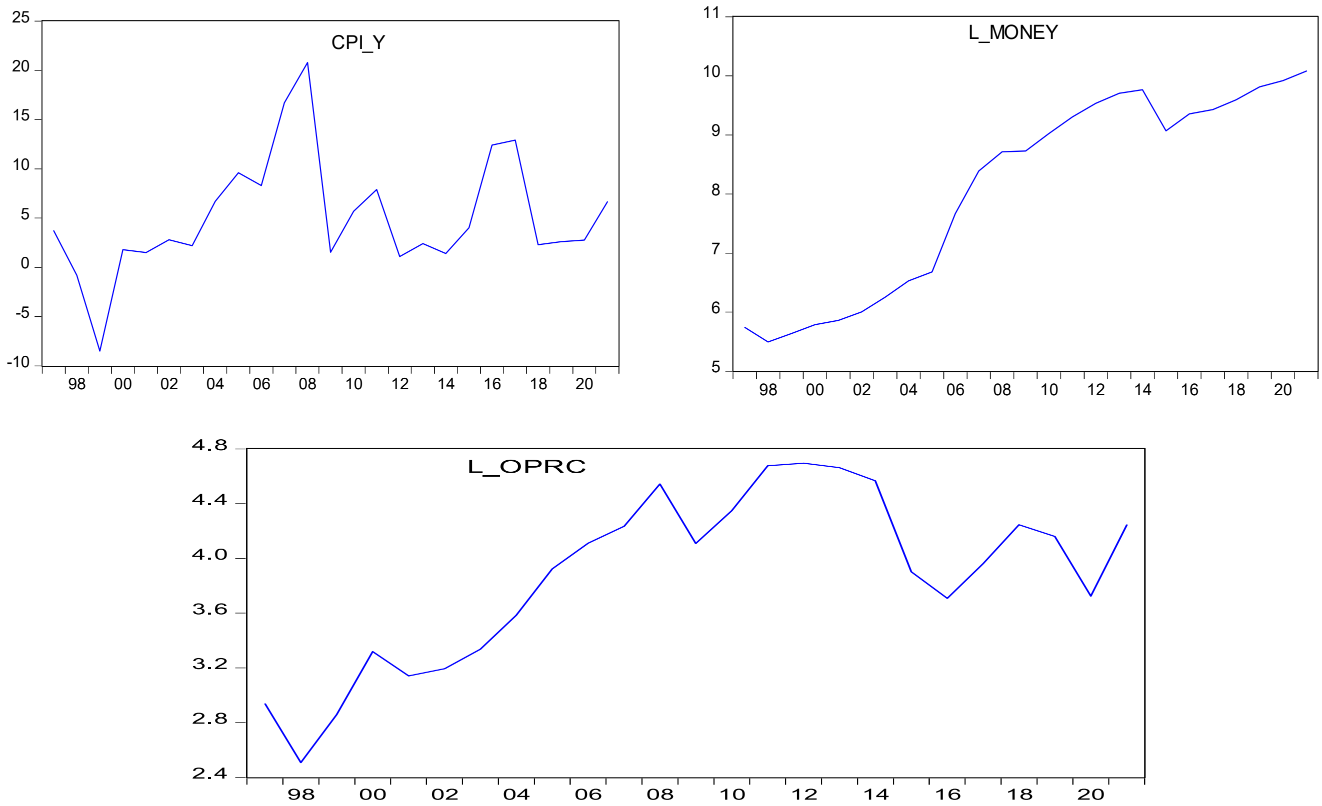

Figure 1. Profile of the model variables.

Numerous cointegration methods were simultaneously applied to the annual data covering 1997–2021 to obtain robust empirical findings. Firstly, each variable's order of integration was tested using augmented Dickey–Fuller [39] and Phillips–Perron [40] unit root tests. If the same order of integration was revealed, we employed the ARDLBT method [41] and FMOLS [42] and CCR [43] cointegration methods to estimate long-run regression parameters. The advantage of the ARDLBT is that it simultaneously estimates the long-run and short-run coefficients. We added a linear trend to the model in all cases.

4. Results and Interpretations

To determine the methods to be applied to estimate long-term and short-term regression coefficients, we needed to identify the order of integration of model variables. Table 1 tabulates the results from the ADF and PP unit root tests with intercept and trend and intercept. Both ADF and PP tests yielded very close outcomes that oil price and money supply are I(1), regardless of whether the trend was included. There was negligible confusion regarding the annual inflation rate. CPI_Y was found to be weak stationary ($0.05 < p < 0.1$) without a trend. When the trend was added to the model, both tests revealed the variable to be I(1).

However, finding the dependent variable to be even weak stationery required further support in order to be able to apply the cointegration methods. In Figure 1, we observe a break in CPI_Y around 2008–2009. Note that we already considered this break (before and after 2009) in our modelling framework by including D1. Therefore, applying the breakpoint unit root test would be more informative from this perspective. When applied, the breakpoint unit root test reported CPI_Y to be non-stationary (without a trend, break date 2008) at level ($p = 0.3701$) and stationary (without a trend, break date 2008) at first difference ($p < 0.01$).

Table 1. Unit root test results.

	Variable	The ADF Test				The PP Test	
		Level	k	First Difference	k	Level	First Difference
Intercept	CPI_Y	−2.88 *	0	−5.53 ***	1	−2.85 *	−9.15 ***
	Oprc	−1.74	0	−4.35 ***	0	−1.72	−4.30 ***
	Money	0.41	0	−4.36 ***	0	0.41	−4.36 ***
Trend and intercept	CPI_Y	−2.93	0	−5.66 ***	1	−2.92	−11.67 ***
	Oprc	−1.74	0	−4.33 **	0	−1.82	−4.32 **
	Money	−2.05	0	−4.52 ***	0	−2.05	−4.52 ***

Note: *, ** and *** denote significance levels of 10%, 5%, and 1% levels, respectively. p-values are one-sided MacKinnon's (1996) [44] values. Lag length is defined automatically based on Schwarz information criteria (SIC) of 10 maximum lags.

Therefore, we decided that at 95% confidence level, all model variables were I(1) with intercept and with trend and intercept. Consequently, we could apply ARDLBT, FMOLS, and CCR cointegration methods to estimate the long-term and short-term regression coefficients.

4.1. Results from ARDLBT

The first step to applying the ARDLBT approach to cointegration was optimal lag size selection. The research data was annual, with 1997–2021 coverage. Therefore, estimating Error Correction Models (ECM) at 0, 1, and 2 lags and choosing the optimal one was enough to determine the optimal lag size. Results are given in Table 2, below.

Table 2. Optimal lag size selection.

k	AIC	SBC	χ^2_{SC} (2)
0	4.818	5.358	4.316 [0.0413]
1	4.454	5.194	4.592 [0.0617]
2	1.631	2.573	17471 [0.0053]

Note: k is a lag order while AIC and SBC are Akaike and Schwarz information criteria, respectively. χ^2_{SC} (2) is the LM statistics for testing no residual serial correlation against lag orders 2. Probabilities are in brackets.

Methodologically, an ECM with the optimal lag size should be chosen among those that have no serial correlation problem. According to Table 2, there is a serial correlation problem in ECMs with 0 and 2 lags ($p < 0.05$). At 95% confidence level, we did not reveal a serial correlation problem in the ECM with 1 lag. Consequently, we decided to continue with the ECM with 1 lag.

The second step was to test whether there was a cointegration relationship in the chosen ECM (see Table 3). According to the test output, the calculated F-statistic value was higher than the upper bound of Pesaran et al. (2001) [45] and Narayan's (2005) [46] critical values. Consequently, we had strong evidence to reject the null hypothesis, and decided that there was a cointegration relationship in the ECM with 1 lag size.

Table 3. Cointegration test results: ARDLBT.

The Sample F-Statistic	Significance Level	Pesaran et al. (2001) [45] Critical Values		Narayan (2005) [46] Critical Values	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
$F_w = 15.26$	1%	3.65	4.66	5.20	6.64
	5%	2.79	3.67	3.71	4.88
	10%	2.37	3.20	3.09	4.12

Note: F_w is the F-value of testing the null hypothesis that there is no cointegration in the Wald Test. Critical values are taken from the combination of 4 lagged level regressors, restricted intercept and no trend (See: Pesaran et al., 2001, p. 300) [45] and 60 observations (Narayan, 2005, p. 1987 [46]).

After eliminating insignificant ($p > 0.10$) short-run coefficients and re-estimating the model, we obtained the final ARDL specification. Table 4 tabulates the final model specification outcomes alongside the residual diagnostic test results. According to residual diagnostics test outputs, (1) there was no serial correlation and heteroscedasticity (according to BPG test) problem, (2) the model was correctly specified in its current functional form, and (3) residuals were normally distributed. Therefore, we could proceed with the interpretation of estimation results.

Table 4. Final ARDL specification and residuals diagnostics tests results.

Variables	Coefficients	Std. Error.	Prob.
Panel A: The estimated final ARDL Specification			
c	−168.2	32.36	0.0002
CPI_Y_{t-1}	−1.077	0.095	0.0000
$\log(Oprc)_{t-1}$	34.74	7.456	0.0004
$\log(Money)_{t-1}$	26.88	5.038	0.0001
$\log(\text{Oprc})_{t-1} * \log(Money)_{t-1}$	−4.928	0.984	0.0002
$\Delta\log(Money)_{t-1}$	9.270	3.744	0.0278
$\Delta\log(Oprc)_{t-1} * \Delta\log(Money)_{t-1}$	−24.26	11.79	0.0603
$D1$	−11.29	3.099	0.0030
$D2$	26.47	7.924	0.0053
t	−1.125	0.311	0.0031
Panel B: Statistics and Residuals Diagnostics tests results			
$\sigma = 1.895$, χ^2_{SC} (2) $= 0.607$ [0.5623], χ^2_{ARCH} (2) $= 4.123$ [0.0336], $\chi^2_{BPG} = 1.344$ [0.3044], $JB_N = 1.21$ [0.5467], $F_{FF} = 1.74$ [0.1063]			

Notes: Dependent variable is ΔCPI_Y$_t$; σ is standard error of regression; χ^2_{SC} (2), χ^2_{ARCH} (2), χ^2_{BPG} denote chi-squared statistics to test the null hypotheses of no serial correlation, no autoregressive conditioned heteroscedasticity (ARCH test) [47], and no heteroscedasticity in the residuals (Breusch-Pagan-Godfrey (BPG) test) [48]; JB_N and F_{FF} indicate F statistics to test the null hypotheses of normal distribution (Jarque-Bera test) [49] and no functional form misspecification (Ramsey RESET test) [50], respectively; Probabilities in brackets; Estimation period: 1997–2021.

Lagged dependent variable's coefficient was negative, very close to 1, and statistically significant ($p < 0.01$), which confirmed stability. All short-run deviations corrected towards long-run equilibria within a year. All remaining long-run coefficients were also statistically significant ($p < 0.01$) and economically meaningful. Results confirmed that in the long run, inflation depends on both oil price and money supply levels as well as their interaction simultaneously. In the short run, however, estimation results displayed no significant evidence for the role if oil price changes on inflation, directly. However, there was a weak indirect short-run impact via the money supply ($p < 0.1$).

Employing Bewley's transformation (Bewley, 1979) [51], we can obtain the long-run coefficients:

$$CPI\_Y_t = 156.2 + 32.26 * \log(Orpc)_t + 24.96 * \log(Money)_t - 4.576 * \log(Orpc)_t * \log(Money)_t \,. \quad (3)$$

Therefore, results obtained from employing ARDLBT supported the existence of a significant long-run causal relationship between the price of oil and inflation levels in Azerbaijan, supporting the outcomes of previous studies [10,12,14]. However, the current study also reveals a long-run moderating effect of the price of oil on inflation via the amount of base money in circulation.

4.2. Results from FMOLS and CCR

To obtain more reliable estimates regarding the long-run effects of oil prices on the annual inflation rate, FMOLS and CCR cointegration methods should provide further evidence. At the first stage, we started with testing whether there was a cointegration relationship in the estimated model (see Table 5). Both the Engle–Granger [52] and the Phillips–Ouliaris [53] cointegration tests rejected the "no cointegration" hypothesis at 5% significance level. Therefore, we could proceed to interpret the estimation outcomes (Table 6).

Table 5. Cointegration test results: FMOLS and CCR.

	Engle–Granger Test		**Phillips–Ouliaris Test**	
	Tau-Statistic	**Z-Statistic**	**Tau-Statistic**	**Z-Statistic**
FMOLS	−5.170 **	−25.07 ***	−5.360 **	−23.04 **
CCR	−5.170 **	−25.07 ***	−5.360 **	−23.04 **

Note: Null hypothesis is there is no cointegration. ** and *** denote significance levels of 5%, and 1% levels, respectively.

Table 6. Long-run coefficients by FMOLS and CCR.

Variables	**Coefficients**	**Std. Error.**	**Prob.**
Panel A: Results from FMOLS			
C	−88.40	22.72	0.0011
$\log(Oprc)_t$	19.60	6.889	0.0108
$\log(Money)_t$	11.55	3.124	0.0017
$\log(\text{Oprc})_t * \log(Money)_t$	−2.128	0.849	0.0220
$D1$	−14.60	2.745	0.0000
$D2$	7.928	3.145	0.0214
Panel B: Results from CCR			
C	−91.79	26.85	0.0031
$\log(Oprc)_t$	20.70	8.352	0.0233
$\log(Money)_t$	11.94	3.724	0.0049
$\log(\text{Oprc})_t * \log(Money)_t$	−2.255	1.058	0.0471
$D1$	−14.54	3.271	0.0003
$D2$	7.758	3.795	0.0559

All estimated model coefficients (including the parameter of interaction term) were statistically significant at 5%, which also provided strong evidence to argue the moderating role of oil price in the money supply–inflation relationship. According to estimated models using FMOLS and CCR, we should be 95% confident that oil price significantly impacts the annual inflation rate.

4.3. Simulation

However, because the impact of the price of oil on the annual inflation rate depends on the size of the money supply, and oil price changes determine the impact volume by the change in the money supply, we performed simulations to observe the actual effects.

With results shown in Table 7, we simulated the direct impact (left-hand) and moderating role (right-hand) of oil price changes on the annual inflation rate. On the left-hand side, we can observe the marginal impact of oil price changes on the annual inflation rate at a different volume of money supply ranging from AZN 4 billion to AZN 20 billion. On the contrary, the right-hand side depicts the marginal impact of money supply growth over annual inflation at different oil price levels ranging from USD 20 to USD 100. In both cases, we can observe that oil price and money supply move together to affect the annual inflation in Azerbaijan in the long run. In the short run, oil price affects the inflation only indirectly, via affecting the money supply.

Table 7. The impact of oil price over inflation: simulation outcomes.

Broad Money (mln AZN)	$\frac{\Delta CPI_{year}}{\Delta oprc\ \%}$	Oil Price (USD)	$\frac{\Delta CPI_{year}}{\Delta Money\ \%}$
Panel A: Simulation results from ARDLBT			
4000	−0.0569	20	0.1125
6000	−0.0755	30	0.0940
8000	−0.0887	40	0.0808
10,000	−0.0989	50	0.0706
12,000	−0.1072	60	0.0622
14,000	−0.1143	70	0.0552
16,000	−0.1204	80	0.0491
18,000	−0.1258	90	0.0437
20,000	−0.1306	100	0.0389
Panel B: Simulation results from FMOLS			
4000	0.0194	20	0.0516
6000	0.0108	30	0.0430
8000	0.0047	40	0.0369
10000	−0.0001	50	0.0321
12,000	−0.0040	60	0.0282
14,000	−0.0073	70	0.0249
16,000	−0.0101	80	0.0221
18,000	−0.0126	90	0.0196
20000	−0.0148	100	0.0174
Panel C: Simulation results from CCR			
4000	0.0200	20	0.0518
6000	0.0108	30	0.0427
8000	0.0043	40	0.0362
10,000	−0.0007	50	0.0312
12,000	−0.0048	60	0.0270
14,000	−0.0083	70	0.0236
16,000	−0.0113	80	0.0206
18,000	−0.0139	90	0.0179
20,000	−0.0163	100	0.0155

Source: Authors' own creation.

5. Conclusions and Discussion

Oil price volatility is an important determinant of many macroeconomic indicators in modern economies. Among many others, inflation requires more attention at societal and governmental levels, which has economic and non-economic implications. In this context, there are a number of studies devoted to exploring the relationship between the price of oil and inflation in different individual country cases as well as within a panel data analysis framework. The current study re-considers the relationship between oil price changes and the annual inflation rate in a small oil exporter, Azerbaijan. Because the country is small, to determine the international oil prices, we adopted the price to be exogenous and included the money supply to the modeling framework while estimating the short- and long-term associations between oil price changes and the annual inflation rate. The primary novelty of this study was to consider the interaction of oil prices and money supply in determining the inflation rate.

Employing ARDLBT, FMOLS, and DOLS cointegration methods over a time-series dataset of the 1997–2021 period, current research findings present strong evidence for a long-term causal relationship between oil prices and the annual inflation rate in Azerbaijan, in line with previous studies [10,12,14]. However, this study reveals an interaction relationship between the money supply and the price of oil that affects the annual inflation rate in the target country, both in the short- and long-term. Finding significant short-term causality between oil price changes and the annual inflation rate in Azerbaijan is in line with the selected previous research findings such as Hajiyev and Rustamov (2019) [13], Zulfigarov and Neuenkirch (2020) [15], and Yildirim and Arifli (2021) [16]. However, to our best knowledge, existing studies do not consider any indirect effect of oil price changes via the money supply amount.

An interaction between the price of oil and the money supply affecting inflation is quite plausible for a resource-rich country such as Azerbaijan where the exchange rate is fixed and the country's major (more than 90%) foreign earnings come from oil exports. The government has massively used its resource revenues to maintain sustainable economic development in the country and has implemented large investment projects through direct transfers from the State Oil Fund of Azerbaijan Republic (SOFAZ) [54]. According to the revenue management model in Azerbaijan, resource export earnings should accumulate in SOFAZ, and the Fund delivers direct transfers to the state budget in accordance with the corresponding year's budget law. Meanwhile, oil price changes also affect the magnitude of direct transfers from the State Oil Fund of Azerbaijan Republic to the national budget to finance increased public spending [5].

The Azerbaijan government has changed the state budget plan within a fiscal year in response to oil price fluctuations. Therefore, the price of oil is a determinant of fiscal policy changes, and increasing public spending requires monetary expansion. Foreign reserves are converted to the national currency by the SOFAZ to realize the planned transfers, which creates additional inflationary pressure. This research supports that oil price changes causes inflation indirectly in the short-run, via changing the money supply

Although this research makes a substantial contribution, it has a number of limitations. Firstly, as underlined by Rahimov et al. (2016) [11], inflation in Azerbaijan could be strongly linked to foreign countries' price changes and fiscal policies. Current research does not cover these two macro-level indicators. Oil price changes are likely to affect overall prices in Azerbaijan indirectly moderated by foreign inflation and the country's fiscal policy cyclicity following the commodity's price changes. Azerbaijan's severe dependency on imported consumption products should be considered while exploring the inflationary effects of oil price changes. Nevertheless, the link to foreign country price levels relies on oil price changes or oil-price-driven exchange rate changes. Within the country, the exchange rate has been almost fixed. The 2015 and 2016 are exceptions when two currency devaluations were observed following a sharp decline in the price of oil price, and the rate fluctuated for a certain period before later being corrected [55]. Therefore, this consideration should not substantially affect the reliability of our research outcomes. Regarding the impact via fiscal policy implementation, future research should consider this aspect in more detail. However, considering the simultaneous movement of the money supply, fiscal policy implementation following oil price changes could make it difficult to realize ceteris paribus effects. Another shortcoming of the current study could be that it uses annual data, which refer to average yearly oil price levels. However, oil prices fluctuate within a year, and the mean price may poorly represent overall effects, especially in the short run.

Overall, oil plays an important role in Azerbaijan's economy. From the perspective of policy sustainability and price stability, the government should take oil price changes more seriously into consideration. It should be noted that inflation is important for sustainable economic growth [56,57]. For now, the government pursues a policy of a relatively fixed exchange rate regime and single-digit inflation rate targeting. Lessons from 2015 demonstrated how policy sustainability is at risk in response to a negative oil price shock. Based on the current study's findings, the responsible body, the Central Bank of Azerbaijan Republic, needs to consider the interaction between oil price changes and the money supply while evaluating oil-price-driven inflationary pressures in Azerbaijan's economy.

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References

1. Zhang, B.; Ai, X.; Fang, X.; Chen, S. The Transmission Mechanisms and Impacts of Oil Price Fluctuations: Evidence from DSGE Model. *Energies* **2022**, *15*, 6038. [CrossRef]
2. Horobet, A.; Vrinceanu, G.; Popescu, C.; Belascu, L. Oil Price and Stock Prices of EU Financial Companies: Evidence from Panel Data Modeling. *Energies* **2019**, *12*, 4072. [CrossRef]
3. Bala, U.; Chin, L. Asymmetric Impacts of Oil Price on Inflation: An Empirical Study of African OPEC Member Countries. *Energies* **2018**, *11*, 3017. [CrossRef]
4. Nusair, S.A. Oil price and inflation dynamics in the Gulf Cooperation Council countries. *Energy* **2019**, *181*, 997–1011. [CrossRef]
5. Aliyev, K. The curse of transfers? Modelling fiscal policy effectiveness in Azerbaijan. *ASERC J. Socio-Econ. Stud.* **2019**, *2*, 77–87.
6. Aliyev, K.; Gasimov, I. Retrospective of economic and trade policies focused on agricultural development: Case of Azerbaijan. In *Establishing Food Security and Alternatives to International Trade in Emerging Economies*; IGI Global: Hershey, PA, USA, 2018; pp. 177–195.
7. Hasanov, F. Dutch Disease and the Azerbaijan Economy. *Communist Post-Communist Stud.* **2013**, *46*, 463–480.
8. Shaw, D.L. Good Governance in the Post—Soviet South: Testing Theories of the Resource Curse in Azerbaijan. *J. Politics Int. Stud.* **2013**, *9*, 520–561.
9. Gasimov, I. Resource Curse and Dutch Disease in Azerbaijan: Empirical Analysis. Ph.D. Thesis, Eastern Mediterranean University (EMU)-Doğu Akdeniz Üniversitesi (DAÜ), Famagusta, Northern Cyprus, 2014.
10. Niftiyev, I. Analysis of Inflation Trends in Urban and Rural Parts of Azerbaijan: Main Drivers and Links to Oil Revenue. *SSRN Electron. J.* **2020**. [CrossRef]
11. Rahimov, V.; Adigozalov, S.; Mammadov, F. *Determinants of Inflation in Azerbaijan*; Working Paper Series No.07/2016; Central Bank of the Republic of Azerbaijan: Baku, Azerbaijan, 2016.
12. Mukhtarov, S.; Mammadov, J.; Ahmadov, F. The Impact of Oil Prices on Inflation: The Case of Azerbaijan. *Int. J. Energy Econ. Policy* **2019**, *9*, 97–102. [CrossRef]
13. Hajiyev, N.; Rustamov, A. How oil price drops are reflected by imported inflation in Azerbaijan? *Int. J. Energy Econ. Policy* **2019**, *9*, 182–193.
14. Mukhtarov, S.; Aliyev, S.; Zeynalov, J. The effect of oil prices on macroeconomic variables: Evidence from Azerbaijan. *Int. J. Energy Econ. Policy* **2020**, *10*, 72–80. [CrossRef]
15. Zulfigarov, F.; Neuenkirch, M. The impact of oil price changes on selected macroeconomic indicators in Azerbaijan. *Econ. Syst.* **2020**, *44*, 100814. [CrossRef]
16. Yildirim, Z.; Arifli, A. Oil price shocks, exchange rate and macroeconomic fluctuations in a small oil-exporting economy. *Energy* **2021**, *219*, 119527. [CrossRef]
17. Chen, J.; Zhu, X.; Li, H. The pass-through effects of oil price shocks on China's inflation: A time-varying analysis. *Energy Econ.* **2020**, *86*, 104695. [CrossRef]
18. Aloui, C.; Hkiri, B.; Hammoudeh, S.; Shahbaz, M. A multiple and partial wavelet analysis of the oil price, inflation, exchange rate, and economic growth nexus in Saudi Arabia. *Emerg. Mark. Financ. Trade* **2018**, *54*, 935–956. [CrossRef]
19. Adebayo, T.S. Dynamic relationship between oil price and inflation in oil exporting economy: Empirical evidence from wavelet coherence technique. *Energy Econ. Lett.* **2020**, *7*, 12–22. [CrossRef]
20. Köse, N.; Ünal, E. The effects of the oil price and oil price volatility on inflation in Turkey. *Energy* **2021**, *226*, 120392. [CrossRef]
21. Sek, S.K. Impact of oil price changes on domestic price inflation at disaggregated levels: Evidence from linear and nonlinear ARDL modeling. *Energy* **2017**, *130*, 204–217. [CrossRef]
22. Sek, S.K. A new look at asymmetric effect of oil price changes on inflation: Evidence from Malaysia. *Energy Environ.* **2022**. [CrossRef]
23. Sarwar, M.N.; Hussain, H.; Maqbool, M.B. Pass through effects of oil price on food and non-food prices in Pakistan: A nonlinear ARDL approach. *Resour. Policy* **2020**, *69*, 101876. [CrossRef]
24. Osei, J. The Asymmetric Impact of Oil Price Dynamics on Inflation in Brazil. *Eur. J. Econ.* **2022**, *2*, 39–50. [CrossRef]
25. Lacheheb, M.; Sirag, A. Oil price and inflation in Algeria: A nonlinear ARDL approach. *Q. Rev. Econ. Financ.* **2019**, *73*, 217–222. [CrossRef]
26. Shitile, T.S.; Usman, N. Disaggregated Inflation and Asymmetric Oil Price Pass-Through in Nigeria. *Int. J. Energy Econ. Policy* **2020**, *10*, 255–264. [CrossRef]
27. Davari, H.; Kamalian, A. Oil price and inflation in Iran: Non-linear ARDL approach. *Int. J. Energy Econ. Policy* **2018**, *8*, 295.

28. Živkov, D.; Ðurašković, J.; Manic, S. How do oil price changes affect inflation in Central and Eastern European countries? A wavelet-based Markov switching approach. *Balt. J. Econ.* **2018**, *19*, 84–104. [CrossRef]
29. Lòpez-Villavicencio, A.; Pourroy, M. Inflation target and (a) symmetries in the oil price pass-through to inflation. *Energy Econ.* **2019**, *80*, 860–875. [CrossRef]
30. Kun, S.S. Effect of oil price pass-through on domestic price inflation: Evidence from nonlinear ARDL models. *Panoeconomicus* **2019**, *66*, 69–91.
31. Raheem, I.D.; Bello, A.K.; Agboola, Y.H. A new insight into oil price-inflation nexus. *Resour. Policy* **2020**, *68*, 101804. [CrossRef]
32. Adekoya, O.B.; Adebiyi, A.N. Oil price-inflation pass-through in OECD countries: The role of asymmetries, impact of global financial crisis and forecast evaluation. *Int. J. Energy Sect. Manag.* **2020**, *14*, 126–147. [CrossRef]
33. Babuga, U.T.; Naseem, N.A.M. Asymmetric Effect of Oil Price Change on Inflation: Evidence from Sub Saharan Africa Countries. *Int. J. Energy Econ. Policy* **2021**, *11*, 448–458. [CrossRef]
34. Oloko, T.F.; Ogbonna, A.E.; Adedeji, A.A.; Lakhani, N. Oil price shocks and inflation rate persistence: A Fractional Cointegration VAR approach. *Econ. Anal. Policy* **2021**, *70*, 259–275. [CrossRef]
35. Salisu, A.A.; Isah, K.O.; Oyewole, O.J.; Akanni, L.O. Modelling oil price-inflation nexus: The role of asymmetries. *Energy* **2017**, *125*, 97–106. [CrossRef]
36. Aluko, O.A.; Opoku, E.E.O.; Ibrahim, M. Investigating the environmental effect of globalization: Insights from selected industrialized countries. *J. Environ. Manag.* **2021**, *281*, 111892. [CrossRef] [PubMed]
37. Sönnichsen, N. OPEC Oil Price Annually 1960–2022. 2022. Available online: https://www.statista.com/statistics/262858/change-in-opec-crude-oil-prices-since-1960/ (accessed on 19 January 2023).
38. CBAR. Statistical Bulletin. 2022. Available online: https://www.cbar.az/page-40/statistical-bulletin?language=en (accessed on 19 January 2023).
39. Dickey, D.A.; Fuller, W.A. Likelihood ratio statistics for autoregressive time series with a unit root. *Econom. J. Econom. Soc.* **1981**, *49*, 1057–1072. [CrossRef]
40. Phillips, P.C.; Perron, P. Testing for a unit root in time series regression. *Biometrika* **1988**, *75*, 335–346. [CrossRef]
41. Pesaran, H.M.; Shin, Y. An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis. *Econom. Soc. Monogr.* **1998**, *31*, 371–413.
42. Phillips, P.C.B.; Hansen, B.E. Statistical inference in instrumental variables regression with I (1) Processes. *Rev. Econ. Stud.* **1990**, *57*, 99–125. [CrossRef]
43. Park, J.Y. Canonical cointegrating regressions. *Econometrica* **1992**, *60*, 119–143. [CrossRef]
44. Mackinnon, J. Numerical distribution functions for unit root and cointegration tests. *J. Appl. Econom.* **1996**, *11*, 601–618. [CrossRef]
45. Pesaran, M.H.; Shin, Y.; Smith, R.J. Bound testing approaches to the analysis of level relationships. *J. Appl. Econom.* **2001**, *16*, 289–326. [CrossRef]
46. Narayan, P. The saving and investment nexus for China: Evidence from cointegration tests. *Appl. Econ.* **2005**, *37*, 1979–1990. [CrossRef]
47. Engle, R.F. Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of United Kingdom Inflation. *Econometrica* **1982**, *50*, 987–1007. [CrossRef]
48. Breusch, T.S.; Pagan, A.R. A Simple Test for Heteroskedasticity and Random Coefficient Variation. *Econometrica* **1979**, *47*, 1287–1294. [CrossRef]
49. Jarque, C.M.; Bera, A.K. Efficient tests for normality, homoscedasticity and serial independence of regression residuals: Monte Carlo evidence. *Econ. Lett.* **1981**, *7*, 313–318. [CrossRef]
50. Ramsey, J.B. Tests for Specification Errors in Classical Linear Least Squares Regression Analysis. *J. R. Stat. Soc. Ser. B.* **1969**, *31*, 350–371.
51. Bewley, R.A. The direct estimation of the equilibrium response in a linear dynamic model. *Econ. Lett.* **1979**, *3*, 357–361. [CrossRef]
52. Engle, R.F.; Granger, C.W.J. Co-integration and error correction: Representation, estimation, and testing. *Econometrica: J. Econom. Soc.* **1987**, *55*, 251–276. [CrossRef]
53. Phillips, P.C.; Ouliaris, S. Asymptotic Properties of Residual Based Tests for Cointegration. *Econometrica* **1990**, *58*, 165–193. [CrossRef]
54. (SOFAZ) State Oil Fund of The Republic of Azerbaijan. Annual Reports. 2021. Available online: https://www.oilfund.az/en/report-and-statistics/report-archive# (accessed on 19 January 2023).
55. CBAR. Statistical Bulletin. 2020. Available online: https://uploads.cbar.az/assets/e2fc29656b59b7689006ee1c9.pdf (accessed on 19 January 2023).
56. Danladi, J.D. Inflation and sustainable output performance in the West African sub-region: The threshold effect. *Am. J. Econ.* **2013**, *3*, 252–259.
57. Girdzijauskas, S.; Streimikiene, D.; Griesiene, I.; Mikalauskiene, A.; Kyriakopoulos, G.L. New approach to inflation phenomena to ensure sustainable economic growth. *Sustainability* **2022**, *14*, 518. [CrossRef]