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Oil Price Volatility and Unemployment in Iraq: A Two-Stage Approach Using Generalized Autoregressive Conditional Heteroskedasticity-Mixed-Data Sampling

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ABSTRACT

Iraq is a rentier economy heavily reliant on oil revenues as the primary source of public spending and development financing. Under this dependency, oil price volatility plays a critical role in shaping macroeconomic performance, particularly in the labor market. This study investigates the relationship between oil price volatility and unemployment in Iraq during the period 1991-2023. A two-stage approach was adopted: Oil price volatility was first estimated using the GARCH model, followed by an assessment of its dynamic impact on unemployment through the MIDAS technique. The findings reveal a significant positive relationship, indicating the vulnerability of Iraq's labor market to external energy shocks. The lag structure indicates a nonlinear effect - strong initially, then gradually fading, before slightly reemerging - aligning with the hypothesis of economic sluggishness. Additionally, the study identifies structural imbalances in the Iraqi economy, as traditional relationships such as Okun's Law and the Phillips Curve do not hold. This suggests that labor market dynamics in Iraq diverge from conventional economic models, shaped instead by the characteristics of a rentier system and its institutional and political constraints. The results underscore the importance of diversifying income sources and investing in human capital to enhance labor market resilience and reduce dependency on oil revenues.

Keywords: Oil Price Volatility, Unemployment Rate, Generalized Autoregressive Conditional Heteroskedasticity Model, Mixed-Data Sampling Technique, Iraq
JEL Classifications: Q43, J64, E24, C22

1. INTRODUCTION

The vitality of any economy is a fundamental factor in achieving the collective well-being of current and future generations (Jawad and Niazi, 2017). This vitality depends on several factors, most notably the abundance of natural resources and the prevailing economic structure (Dornbusch et al., 2014; Chu et al., 2021; McNally, 2017). Iraq stands as a typical case in this regard, with immense natural wealth - chiefly crude oil - alongside promising demographic factors such as a large market and a young population structure (Rasheed, 2023). However, Iraq's economic performance does not reflect the potential of these resources due to its deep structural dependence on the oil sector and its price volatility (Tang et al., 2010; Ogboru et al., 2017). These challenges have been exacerbated by repeated global oil market shocks since the early 1980s (Riaz, 2016; Ibrahim et al., 2019), making oil price volatility a key determinant of Iraq's economic trajectory.

This situation reflects what is known as the "Dutch Disease," where excessive reliance on a booming extractive sector (such as oil) leads to the weakening of other productive sectors (Corden, 1992). This phenomenon is evident in the Iraqi case, as documented by various studies (AL-Shammaria et al., 2020; Drebee and Razak, 2022; Al-Shamri and Al-Salem, 2022; Rasheed, 2023). Iraq's

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economy has become fragile and highly exposed to external shocks, which impact the business and employment environment, deepen external imbalances, and weaken the local currency, as confirmed by World Bank reports (2006-2020) and the Global Competitiveness Index (2019).

In global economic literature, the impact of oil prices and their volatility has been a major concern for both policymakers and researchers, particularly in rentier economies dependent on energy exports. Hamilton (1983) noted that most U.S. recessions after World War II were associated with sharp oil price increases. Later studies (Guo and Kliesen, 2005; Ogunsakin and Oloruntuyi, 2017; Zhang and Liu, 2020) confirmed that oil price volatility negatively affects not only GDP but also key indicators such as unemployment—through supply and demand channels, rising production costs, reduced competitiveness, and investment slowdown.

From an aggregate supply perspective, rising oil prices reduce output by increasing production costs and lowering labor productivity, which adversely affects employment levels (Xesibe and Nyasha, 2020; Villaverde and Maza, 2009). If real wages do not decline in parallel with productivity, firms tend to reduce labor, leading to higher unemployment (Brown and Yucel, 2002). This is one of the main transmission channels through which oil shocks affect labor markets, especially in oil-dependent developing countries. Iraq, being one of the most oil-dependent economies, is no exception to these effects, as emphasized by studies such as Breton (2013) and Zhang and Liu (2020).

Although the oil sector accounts for more than half of Iraq's GDP (58.4%) (Central Bank of Iraq, 2022), the non-oil sector represents only 41.6%, with near-total dependence on oil revenues (96% of total exports and 95% of government revenues) and imports for approximately 98% of basic needs. Successive crises in global oil markets - such as those in 2016 and 2020—have highlighted the fragility of Iraq's economy in the face of oil price fluctuations. For example, the 2014-2016 crisis led to a drop in oil prices from $114 to $32.6 per barrel, a contraction in GDP, and a surge in unemployment. The COVID-19 crisis in 2020 caused an even more severe shock, with prices plummeting to $15.54 per barrel, resulting in the worst economic recession in four decades (Central Bank of Iraq, 2022).

While extensive literature has examined the link between oil prices and either economic growth or unemployment in global and Arab contexts, evidence specific to Iraq remains limited - particularly in terms of rigorous economic modeling that accounts for oil price volatility rather than price levels alone. Studies such as AL-Shammaria et al. (2020), Al-Shamri and Al-Salem (2022), Drebee and Razak (2022), and Rasheed (2023) confirmed a strong relationship between oil price volatility and Iraq's economic performance. However, they did not sufficiently explore the impact on labor markets - specifically unemployment - nor did they employ models capable of precisely quantifying these effects. Therefore, this study aims to fill this research gap by analyzing the impact of crude oil price volatility on unemployment rates in Iraq.

2. LITERATURE REVIEW

The impact of oil prices on unemployment and the broader economy has become a central issue that has attracted wide scholarly attention (Papapetrou, 2001; Robalo and Salvado, 2008; Löschel and Oberndorfer, 2009, among others). Empirical literature reveals variation in the relationship between oil price volatility and unemployment across developed, developing, and Arab countries - including Iraq.

In the international context, Hooker (1996) demonstrated that the relationship between oil price volatility and U.S. macroeconomic variables, first emphasized by Hamilton (1983), weakened after the mid-1980s, as oil price declines no longer led to improvements in GDP or unemployment, with a structural break identified around 1973. Using an efficiency wage model, Carruth et al. (1998) found oil prices to be a strong explanatory factor for unemployment fluctuations in the U.S. from 1954 to 1995 - stronger than interest rates. Papapetrou (2001) confirmed the immediate and negative impact of oil price shocks on employment in Greece. Similarly, Robalo and Salvado (2008) observed that oil prices had a stronger effect on unemployment in Portugal during 1968-1985 than afterward.

Kooros et al. (2006), in a study on Louisiana, found that rising oil prices increased unemployment and reduced output and corporate profits. Löschel and Oberndorfer (2009) showed that oil price hikes led to higher unemployment in Germany. Mellquist and Femermo (2007) found mixed results in Sweden, with no clear directional effect. Meanwhile, Najimi and Shorkar (2019) found a positive relationship between oil price changes and unemployment in Sweden. Kocaarslan et al. (2020) confirmed that rising oil prices increased U.S. unemployment, with a stronger role for reduced oil price uncertainty in lowering unemployment. Kocaaslan (2019) found that unemployment responds asymmetrically to oil shocks, with price uncertainty amplifying the impact of negative shocks. Adamczyk (2022) showed that oil price volatility affects labor structure in Eastern Europe - especially in manufacturing - depending on exchange rate regimes and energy import dependence.

In developing countries, the literature on oil prices and unemployment is less definitive. Fofana et al. (2009) reported that rising oil prices reduced employment and GDP in South Africa by around 2%. Jha et al. (2011) found that oil price impacts vary by economic structure across Asia, with inconclusive results for unemployment. Ahmad (2013) found significant effects of oil prices on unemployment in Pakistan, while Shaari et al. (2013) noted a long-term negative relationship in Malaysia. Senzangakhona (2014) found that crude oil prices had a positive long-term and negative short-term effect on unemployment in South Africa.

Conversely, Trang et al. (2017) reported no clear relationship between oil and unemployment in Vietnam. Zhang and Liu (2020), using data from China and the U.S., supported the efficiency wage model, showing that oil volatility affects unemployment through multiple channels. Baidoo (2022) found that crude oil prices positively affected long-term unemployment in major African oil-exporting countries, despite a negative long-term impact from oil revenues themselves.

In the Arab context, Bouchaour and Al-Zeaud (2012) showed that oil prices negatively affected unemployment and exchange rates in Algeria in the long run, with no significant short-term effect. Qatoush (2018) found a negative link between oil prices and unemployment in Algeria. Driouche and Hamrit (2020) noted that negative oil shocks had a stronger impact on unemployment than positive ones, reflecting asymmetry. Mesbah and Taherin (2023) reported a negative relationship between oil price volatility and unemployment in a group of Arab oil-exporting countries, including Iraq. Chaoui (2023) found that the oil–unemployment relationship varied across oil and non-oil countries - being inverse in Saudi Arabia and Algeria, and direct in Tunisia and Morocco.

In the case of Iraq, AL-Shammaria et al. (2020) found that negative oil price shocks reduced GDP and government spending, while increasing unemployment; however, positive shocks had less consistent effects. Fahd (2021) identified a long-term, nonlinear, and negative relationship between oil prices and unemployment in Iraq, where price increases led to a multiplied drop in unemployment, and vice versa. Khalaf (2024) also confirmed the adverse effect of oil price volatility on Iraq's unemployment rate during 2006-2022.

3. MODEL AND DATA

To examine the relationship between oil price volatility and unemployment rates in Iraq, while also testing the applicability of Okun's Law in the Iraqi context and describing the dynamic behavior of the unemployment model, the study employs the following general model in a semi-logarithmic form:

$$ln\ U_t = C + Oil\ \ Price\ Volatility_t + Growth_t + \sum_{k=1}^{k} \beta_k X_t^k + \epsilon_t \quad (1)$$

Where (U_t) denotes the dependent variable, representing the unemployment rate in Iraq at time t (for t = 1,2,..,n), and C represents the constant term. The independent variables include oil price volatility (Oil Price $Volatility_t$), and economic growth rate ($Growth_t$), the latter being included to assess the validity of Okun's Law in Iraq. X_t^k denotes a vector of potential control variables, while ϵ_t represents the error term with its usual statistical properties. In identifying the vector of control variables ($\sum_{k=1}^{k} \beta_k X_t^k$), this study follows the approach of previous literature, including Roa et al. (2008), Xesibe and Nyasha (2020), Zhang and Liu (2020), and Louail and Benarous (2021), which highlight key determinants of unemployment such as physical and human capital per capita, exchange rate, financial depth, foreign direct investment, trade balance, and inflation.

To estimate the model, the study utilizes annual time series data for Iraq covering the period 1991-2023, totaling 33 annual observations. This period was selected because the International Labour Organization (ILO) does not provide cross-country unemployment rates prior to 1991. The dataset includes a wide range of indicators for Iraq, compiled from multiple databases. A detailed description of these variables and their data sources is provided in Table A in the appendix.

3.1. Estimating Oil Price Volatility

Since the volatility of financial variables - such as oil prices - only becomes apparent in high-frequency data, this study utilizes monthly data for crude oil prices (West Texas Intermediate, in USD) to estimate volatility. The Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, proposed by Bollerslev (1986), is employed for this purpose. The model aims to capture the variance dynamics of the oil price series. The GARCH(1,1) model takes the following form:

$$\text{dln (Crude oil)}\ {}_t|i_{t-1} = \alpha + \beta X_t + u_t \quad \text{Conditional mean equation} \quad (2)$$

$$\begin{cases} \alpha + \beta X_t \\ |\delta_t^2 = \lambda_0 + \lambda_1 u_{t-1}^2 + \lambda_2 u_{t-1}^2 \end{cases} \quad \text{Conditional variance equation}$$

Where dln (Crude oil) represents the first log-difference of crude oil prices, capturing volatility more precisely. The model is conditional on past information (i_{t-1}). The term α denotes the constant (i.e., the average of the oil price series), while X_t represents the vector of factors influencing oil prices. The error term u_t follows an independent and identically distributed process: $u_t|_{i_{t-1}} \sim iid\ N(0, \delta_t^2)$, where δ_t^2 indicates time-varying variance (i.e., heteroskedasticity).

The terms u_{t-1}^2 and u_{t-1}^2 refer to the squared lagged error and lagged conditional variance, respectively. If either λ_1 or λ_2 equals zero, the variance becomes constant, implying no ARCH effect. Therefore, all coefficients in the conditional variance equation must be positive, and 0 < λ < 1 must hold for the presence of an ARCH effect. The choice of the GARCH(1,1) model - using one lag of both the error term and its variance - is supported by empirical studies, which demonstrate its superiority over higher-order ARCH models. GARCH(1,1) is statistically efficient, parsimonious, and performs better in capturing volatility while preserving degrees of freedom. Thus, it serves as a robust method for modeling oil price volatility.

Table 1 presents the estimation results of the conditional variance equation. As shown, the coefficients are statistically significant, positive, and less than one - confirming the presence of ARCH effects in the Brent oil price series and thereby validating the existence of volatility. Tables 2 and 3 present, respectively, the descriptive statistics of the study variables and the correlation matrix among them.

Descriptive statistics reveal that the average unemployment rate in Iraq stood at a high 10.01% during the study period, reflecting a persistent structural challenge in the labor market—especially under unstable economic and political conditions. In contrast, oil price volatility showed substantial variation, highlighting Iraq's vulnerability to external shocks due to its heavy reliance on oil exports as the primary source of public revenue. The correlation analysis supports this view: No statistically significant direct relationship was found between unemployment and oil price volatility. This suggests a more complex dynamic, where the effects may not be immediate and could operate through intermediary channels such as economic growth, foreign investment, and public spending. This apparent disconnect underscores the need for deeper dynamic analysis using advanced tools like regression models, causality tests, and impulse response functions to capture the temporal and structural impacts of oil shocks on Iraq's labor market.

4. ESTIMATION METHODOLOGY: MIDAS TECHNIQUE

Traditional regression models require all explanatory variables to match the frequency of the dependent variable. However, this constraint is often relaxed in empirical work—as in the present study, where oil price volatility is observed monthly, while unemployment and other variables are annual. Historically, two approaches have addressed this issue: The equal-weight aggregation method and the distributed lag method.

This study adopts a more advanced method: Mixed-data sampling (MIDAS) regression, proposed by Ghysels et al. (2007) and Andreou et al. (2010). MIDAS enables incorporating variables with different frequencies in a single model. Specifically, it allows a low-frequency dependent variable (e.g., annual) to be explained by current and lagged values of higher-frequency regressors (e.g., monthly or quarterly), alongside other annual variables and lagged values of the dependent variable itself. Technically, the MIDAS model is a generalized form of the autoregressive distributed lag (ARDL) model. It leverages high-frequency data to flexibly forecast low-frequency outcomes.

The general form of the MIDAS regression is as follows:

$$y_t = X_t \cdot \beta + f\left(\left\{X^H_{t-s}\right\}, \theta, \lambda\right) + \varepsilon_t \quad (3)$$

Where, y_t; low-frequency dependent variable at time t. X_t; low frequency regressors. $\left\{X^H_{t-s}\right\}$; high frequency regressors. And f; weighting function describing the influence of high-frequency variables on the low-frequency outcome. λ, θ, β; parameter vectors to be estimated.

The MIDAS framework offers a range of weighting schemes that balance the two traditional approaches. These schemes reduce the number of parameters by constraining the lag effects of high-frequency variables. The most widely used is the Almon lag polynomial (also called polynomial distributed lag, PDL), which imposes structure on the lag coefficients and is well-suited for mixed-frequency modeling.

In this framework, the coefficients for lagged high-frequency variables are modeled using a polynomial of degree ρ in the parameters θ. This results in a restricted regression model where the number of estimated parameters depends on the polynomial order, not the number of lags.

$$y_t = X_t \cdot \beta + \sum_{\tau=0}^{k-1} X^H_{t-\tau/S} \cdot \left[\sum_{J=0}^{\rho} \tau^J \theta_j\right] + \varepsilon_t \quad (4)$$

5. RESULTS AND DISCUSSION

Following the verification of stationarity for all study variables - and ensuring that none required second differencing (a key condition for applying the MIDAS technique) - the regression model was found free from common econometric issues, confirming the reliability of the results. The regression outcomes are presented in Table 4.

Model (1) in Table 4 reflects the simplified version of the study's framework. It examines the effect of oil price volatility on unemployment while controlling economic growth, physical and human capital per worker, and the exchange rate. Subsequent models progressively incorporate additional unemployment determinants, culminating in Model (5), which represents the full specification.

In Model (1), high-frequency oil price volatility has a positive and statistically significant effect on Iraq's unemployment rate (low-frequency), with a coefficient of 0.5304 (PDL01), significant at the 10% level. This implies that a one-unit increase in oil price volatility leads to an average 0.53% increase in unemployment over the long run. The actual lag coefficients are derived by applying weighting functions to this general coefficient, and the shape of this weighting function is determined by the remaining MIDAS parameters.

The negative and significant estimate for θ_1 (PDL02 = −0.4823) indicates a sharp initial decline in lag effects, followed by a slight rebound - as shown by the positive and significant θ_2 (PDL03 = 0.0833). This is illustrated in the lower part of Table 4, which plots the lag distribution. Overall, the lagged effects of oil price volatility are initially strong but gradually fade, later reappearing at much weaker levels. (Note: θ_3 was constrained to zero and thus does not appear in the results.)

Table 1: Estimation of oil price volatility using the GARCH (1,1) model

Dependent variable: *dln (Crude oil, Average)*					
Method: ML-ARCH					
Variable	Coef. Symbol	Coefficient	Standard error	z-statistic	Prob.
Constant	α	0.003227	0.003039	1.062088	0.2882
Variance equation					
C	λ_0	0.000493	6.96e-05	7.090512	0.0000***
RESID(−1)^2	λ_1	0.366550	0.035173	10.42149	0.0000***
GARCH(−1)	λ_2	0.696585	0.021110	32.99785	0.0000***

***, **, * indicate significance at 1%, 5% and 10% respectively

Table 2: Descriptive statistics of the study variables, 1991-2023

Variables	Unit	Obs	Mean	Median	Standard deviation	Min	Max	Normality test
Dependent variable								
Unemployment	(% of total labor)	33	10.01	8.596	2.686	7.965	16.17	[9.8174]***
Independent variable								
Crude oil price	(US$ per Barrel)	396	51.14	47.89	29.46	11.28	133.9	[28.919]***
Oil price volatility	(Scale)	396	-0.001	0.010	0.095	-0.571	0.542	[1139.1]***
Real GDP growth	(annual %)	33	6.813	5.312	22.07	-66.12	54.16	[13.240]***
Control variables								
Physical capital per worker	(Constant LUC)	33	100.2	96.17	23.42	70.65	70.65	[0.0024]***
Human Capital per worker	(Scale)	33	2.052	2.104	0.241	1.574	2.433	[2.1104]
FDI, net inflow	(% GDP)	33	-0.211	0.000	1.843	-4.542	4.562	[2.7535]
Financial depth	(% GDP)	33	4.964	2.682	3.821	1.267	13.31	[4.3332]
Trade balance	(% GDP)	33	7.447	3.767	16.88	-40.09	31.93	[3.2899]
Exchange rate	(LUC per US$)	33	1048.5	1170	373.8	104.1	1468.8	[7.7062]**
Inflation	(annual %)	33	48.05	6.874	107.0	-16.12	448.5	[107.19]***

***, **, * indicate significance at 1%, 5% and 10% respectively

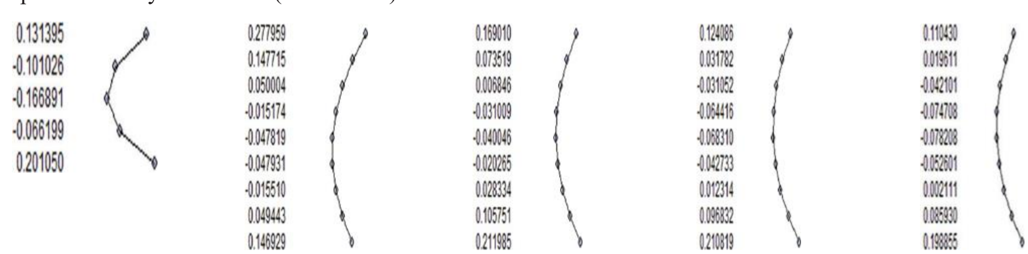
Table 3: Correlation matrix of the study variables, 1991-2023

Variables		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ln Unemployment	(1)	1									
Oil Price Volatility	(2)	−0.025	1								
Real GDP growth	(3)	−0.105	0.060	1							
ln Physical Capital per worker	(4)	0.813[a]	−0.172	−0.133	1						
Human capital per worker	(5)	0.702[a]	0.061	−0.022	0.491[a]	1					
Exchange rate	(6)	0.381[b]	0.208	0.035	−0.028	0.828[a]	1				
Financial depth	(7)	0.896[a]	−0.073	−0.073	0.877[a]	0.789[a]	0.373[b]	1			
FDI, net inflow	(8)	−0.512[a]	0.165	−0.167	−0.555[a]	−0.380[b]	−0.091	−0.612[a]	1		
Trade balance	(9)	0.182	−0.146	0.113	0.306[c]	−0.221	−0.451[a]	0.125	−0.273	1	
Inflation	(10)	−0.257	−0.036	−0.241	0.003	−0.586[a]	−0.636[a]	−0.308[c]	0.149	0.291	1

a, b, c indicate significance at 1%, 5% and 10% respectively

Table 4: Estimation of the impact of oil price volatility on unemployment in Iraq

Dependent variable: ln Unemployment					
Method: MIDAS (PDL/Almon [polynomial degree: 3])					
Independent variables	**Reg (1)**	**Reg (2)**	**Reg (3)**	**Reg (4)**	**Reg (5)**
Oil price volatility (PDL01)	0.5304 (1.896)*	0.4407 (2.627)**	0.2933 (2.969)***	0.2459 (3.526)***	0.2304 (3.282)***
(PDL02)	−0.4823 (−2.763)**	−0.1790 (−2.845)***	−0.1387 (−3.817)***	−0.1365 (−5.564)***	−0.1345 (−5.293)***
(PDL03)	0.0833 (2.820)**	0.0163 (2.804)**	0.0144 (4.335)***	0.0147 (6.576)***	0.0146 (6.268)***
Real GDP growth	0.0003 (0.583)	6.7e−7 (0.001)	7.9e−5 (0.269)	0.0002 (0.935)	0.0002 (0.774)
ln Physical Capital per worker	1.2378 (8.215)***	0.8931 (3.843)***	0.4350 (3.230)***	0.4898 (5.329)***	0.4984 (5.158)***
Human Capital per worker	−0.8641 (−3.158)***	−0.9755 (−3.635)***	−0.3892 (−2.317)**	−0.2796 (−2.414)**	−0.2939 (−2.436)**
Exchange rate	0.0007 (4.566)***	0.0007 (4.165)***	0.0003 (3.039)***	0.0003 (4.137)***	0.0003 (4.479)***
Financial depth		0.0314 (2.119)**	0.0449 (5.165)***	0.0389 (6.352)***	0.0380 (6.034)***
FDI, net inflow			0.0104 (1.857)*	0.0164 (4.094)***	0.0166 (3.991)***
Trade balance				0.0012 (2.791)**	0.0014 (3.695)***
Inflation					1.6e−6 (0.028)
Constant	−10.938 (−7.988)***	−6.8127 (−2.675)**	−2.4156 (−1.667)	−3.2402 (−3.250)***	−3.3258 (−3.189)***
Adjusted R-squared	91.7%	91.9%	97.9%	99.1%	99.02%
Lags selection	5	9	9	9	9
Lags	Oil price volatility/coefficient (distribution)				
0	0.131395	0.277959	0.169010	0.124086	0.110430
1	-0.101026	0.147715	0.073519	0.031782	0.019611
2	-0.166891	0.050004	0.006846	-0.031052	-0.042101
3	-0.066199	-0.015174	-0.031009	-0.064416	-0.074708
4	0.201050	-0.047819	-0.040046	-0.068310	-0.078208
5		-0.047931	-0.020265	-0.042733	-0.052601
6		-0.015510	0.028334	0.012314	0.002111
7		0.049443	0.105751	0.096832	0.085930
8		0.146929	0.211985	0.210819	0.198855



***, **, * indicate significance at 1%, 5% and 10% respectively

As more control variables are introduced in subsequent models, the positive effect of oil price volatility on unemployment remains consistent, though the magnitude of the effect declines slightly while its statistical significance improves. This trend reflects reduced bias as more unemployment determinants are accounted for. In the main model (Model 5), a one-unit increase in oil price volatility results in a 0.23% increase in unemployment over the long term. This confirms that Iraq's heavy dependence on oil revenues makes its labor market particularly vulnerable to oil price shocks. Fluctuating oil prices negatively affect employment, though the impact tends to diminish over time and then reappear weakly, consistent with the economic slowdown theory, which holds that oil shocks may trigger prolonged adverse effects before fading and then mildly resurfacing. This pattern suggests that while the labor market may adapt over time, persistent oil price instability continues to undermine job stability.

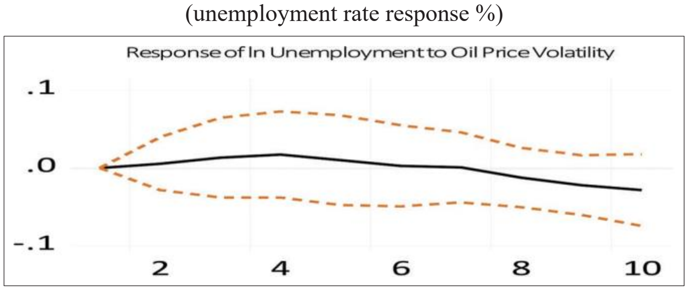
These findings align with prior research (e.g., Hamilton, 2003; AL-Shammaria et al., 2020; Driouche and Hamrit, 2020; Adamczyk, 2022). Oil-dependent economies are particularly sensitive to oil price volatility, which indirectly affects unemployment by altering investment environments and economic growth trajectories. From a theoretical perspective, the resource dependence theory explains Iraq's vulnerability: Oil-exporting economies are more exposed to external shocks, leading to unstable growth and higher unemployment. Price volatility also increases uncertainty, discouraging private investment and job creation.

Moreover, the unemployment determinants in the model remain largely consistent. Notably, economic growth does not significantly impact unemployment, indicating Okun's Law does not hold in Iraq. Likewise, inflation has no significant effect, suggesting no Phillips Curve relationship exists in this context. Conversely, several variables exert a positive effect on unemployment: Physical capital per worker increases employment costs due to the need for greater investment to generate jobs. Exchange rate fluctuations harm the investment climate. Foreign direct investment (FDI) has a negative employment effect, likely due to Iraq's political and security instability repelling long-term investors. A positive trade balance effect on unemployment suggests that trade liberalization is not benefiting the Iraqi labor market. The only variable with a negative and significant effect on unemployment is human capital per worker, confirming that investments in education and workforce skills are the most effective means of boosting employment in Iraq.

5.1. Dynamic Behavior of the Model

Figure 1 illustrates the impulse response function (IRF) of unemployment to shocks in oil price volatility, based on a Structural Vector Autoregression (SVAR) framework.

Figure 1: Impulse response functions results (unemployment rate response %)



The results indicate that shocks in oil price volatility affect Iraq's unemployment rate dynamically and nonlinearly over time. Initially, a positive shock leads to a gradual increase in unemployment, peaking in the fourth period. This reflects the high sensitivity of Iraq's labor market to fluctuations in oil revenues, given the economy's dependence on oil as the main source of public spending. However, starting from the eighth period, the effect begins to fade and becomes negative, suggesting that the economy may adapt gradually to such shocks, or that policy interventions may mitigate their effects. This dynamic pattern supports the economic slowdown hypothesis, where shocks cause strong short-term impacts that eventually diminish over time, though not necessarily disappearing entirely.

Variance decomposition results show that unemployment is largely explained by its own internal dynamics, accounting for over 66% of its forecast error variance across all periods. Meanwhile, the contribution of oil price volatility rises gradually from 0.38% to 8.18%, indicating a delayed and cumulative impact of oil shocks on the labor market. Physical capital consistently explains about 11% of unemployment fluctuations, while human capital, economic growth, and financial depth have more limited roles. In contrast, foreign direct investment and inflation exert relatively weak effects. These findings highlight the need to reform Iraq's labor market and diversify income sources away from oil.

6. CONCLUSION

One of the most damaging aspects of Iraq's oil dependency lies in the indirect transmission of instability through public finances. For example, Iraq's oil sector generates over 95% of government revenue, 96% of total exports, and 58.4% of GDP in 2022. According to Corden and Neary (1982), these are clear signs of Dutch Disease. Given this background, it becomes essential to empirically investigate the role of non-oil sectors, which account for 41.6% of GDP - distributed as 18.5% from distributive activities, 13.8% from services, and 9.3% from non-oil goods-producing sectors (Central Bank of Iraq, 2022). A critical empirical question remains: Should we be more concerned with the level of oil prices or their volatility?

This study focuses on the impact of oil price volatility on unemployment in Iraq, offering a richer perspective on this relationship. The research covers the period 1991-2023, marked by multiple oil crises. It employs a two-stage methodology: (i) Estimating oil price volatility using the GARCH model, (ii) Analyzing its dynamic impact on unemployment using the MIDAS technique. Additionally, the model's dynamic behavior is explored using SVAR-based impulse response functions and forecast error variance decomposition.

The study concludes that oil price volatility has a significant positive impact on unemployment in Iraq, highlighting the vulnerability of its labor market to external shocks in energy markets. The lag structure indicates that this effect is nonlinear - strong at first, then fading, only to reappear weakly - consistent with the economic slowdown hypothesis. The impulse response analysis confirms that shocks raise unemployment until peaking in the fourth period, then gradually decline starting from the eighth period, indicating some degree of self-adjustment or governmental response. Variance decomposition shows that unemployment is primarily driven by domestic factors, while oil price volatility exhibits a cumulative, medium-term influence. Physical capital plays a steady role, whereas human capital, economic growth, and financial depth have a limited impact.

Importantly, the results reveal structural imbalances in Iraq's economy: (i) There is no evidence for Okun's Law, as economic growth does not reduce unemployment. (ii) Similarly, the Phillips Curve does not hold, since inflation shows no significant link to unemployment. These outcomes suggest that Iraq's labor market dynamics do not follow conventional economic patterns, but are shaped by the country's rentier structure, as well as institutional and political challenges. The study underscores the urgent need to: Diversify Iraq's income sources beyond oil. Invest in human capital, the only variable showing a clear negative relationship with unemployment. Strengthen institutional and macroeconomic stability and Improve the business environment to mitigate the adverse effects of oil shocks and support sustainable job creation.

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APPENDIX

Table A. Data description and sources

Source	Description	Data
(WBI)	Unemployment, total (% of total labor force) (modeled ILO estimate)	Unemployment
(FRED)	The spot price of crude oil: West Texas Intermediate (WTI) (US dollars per barrel)	Crude Oil Price
(PWT)	Physical capital stock per worker (at constant 2017 national prices)	Physical Capital per worker
(PWT)	Human capital stock per worker	Human Capital per worker
(WBI)	Foreign direct investment, net inflows (% of GDP)	FDI
(WBI)	Domestic credit to private sector (% of GDP)	Financial depth
(WBI)	Domestic credit to private sector (% of GDP)	Trade balance
(WBI)	Official exchange rate (LCU per US$, period average)	Exchange rate
(WBI)	Inflation, consumer prices (annual %)	Inflation