



Examining the Impact of Oil Shocks on Unemployment Dynamics in Iran

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Abstract

This study investigates the impact of uncertainty in Iran's light crude oil prices on unemployment dynamics over the period 1380–1402 (2001–2023) using quarterly data. The main objective is to identify the nonlinear and threshold-based relationship through modeling oil price volatility and examining how it transmits to the dynamics of the unemployment rate. First, oil price volatility was modeled using the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model, and its results were employed as the threshold variable in a Logistic Smooth Transition Regression (LSTAR) model. The findings reveal that the relationship between oil price uncertainty and unemployment dynamics is nonlinear and exhibits regime-dependent behavior; at high levels of uncertainty, the sensitivity of unemployment to its past lags significantly increases, and the transmission of effects occurs gradually. Moreover, positive oil price shocks have a stronger impact than negative shocks in generating volatility. The results underscore the necessity of reducing Iran's economic dependence on oil revenues, promoting economic diversification, and strengthening stabilization policies to mitigate the vulnerability of the labor market to oil price fluctuations.

Keywords: Unemployment, Oil Price, Logistic Smooth Transition Regression Model, Iran.

JEL Classification: C24, E24, Q43, O53.

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1. Introduction

Unemployment remains one of the most critical macroeconomic and social challenges in developing countries, particularly in oil-dependent economies like Iran, which has consistently experienced double-digit unemployment rates over the past four decades. Given Iran's heavy reliance on oil export revenues, fluctuations and uncertainty in oil prices can significantly affect aggregate demand, public expenditure, investment, and ultimately labor market dynamics. This study investigates the nonlinear impact of Iranian light crude oil price uncertainty on unemployment dynamics in Iran over the quarterly period 2001–2023. The research innovates by combining an Exponential GARCH (EGARCH) model to capture oil price volatility with a Logistic Smooth Transition Autoregressive (LSTAR) model that uses the estimated volatility series as a threshold variable to examine regime-dependent unemployment persistence, especially during periods of high oil price uncertainty.

2. Theoretical framework

The study builds on several established channels through which oil price shocks and uncertainty affect macroeconomic variables and the labor market. Key mechanisms include: (i) supply-side effects (higher oil prices raise production costs and reduce output); (ii) income and wealth transfer effects; (iii) real balance and monetary policy responses; (iv) sectoral reallocation and structural frictions in the labor market (Loungani, 1986); and (v) precautionary saving and investment delays caused by uncertainty. In oil-exporting countries, positive oil price shocks may temporarily boost government spending and employment, whereas negative shocks or heightened volatility tend to exacerbate fiscal constraints and prolong unemployment persistence. The theoretical expectation of asymmetry (positive shocks having stronger effects than negative ones) and nonlinearity (high-volatility regimes amplifying persistence) motivates the use of EGARCH and LSTAR models.

3. Methodology

Quarterly data on Iranian light crude oil prices (Central Bank of Iran) and the unemployment rate (Statistical Center of Iran) for 2001Q1–2023Q4 were employed. Oil price uncertainty was modeled using an EGARCH (1,2) specification, which allows for leverage effects and ensures positive conditional variance without parameter restrictions. The estimated conditional variance series served as the transition (threshold) variable in a Logistic Smooth Transition Autoregressive (LSTAR) model of unemployment dynamics:

$$\Delta UR_t = [\alpha_0 + \sum \alpha_i \Delta UR_{(t-i)}] \times (1 - G(\sigma_t^2; \gamma, c)) + [\beta_0 + \sum \beta_i \Delta UR_{(t-i)}] \times G(\sigma_t^2; \gamma, c) + \varepsilon$$

where ΔUR is the first difference of the unemployment rate (capturing dynamics/

persistence), σ_t^2 is oil price uncertainty from EGARCH, $G(\cdot)$ is the logistic transition function, γ determines transition smoothness, and c is the threshold value. Stationarity was confirmed via Augmented Dickey–Fuller tests after first differencing. Linearity against LSTAR was tested using the Teräsvirta (1994) approach, and the model was estimated by nonlinear least squares.

4. Discussion

The EGARCH (1,2) results reveal strong persistence ($\alpha + |\beta| \approx 0.98$) and significant asymmetry: the leverage coefficient is positive and statistically significant, indicating that positive oil price shocks generate larger volatility spikes than negative shocks of the same magnitude. The LSTAR estimation identifies a clear regime-switching behavior with a threshold of approximately 104.50 in the oil-price uncertainty series. In the low-uncertainty regime (linear part), unemployment dynamics are driven primarily by the first and second lags. In the high-uncertainty regime (nonlinear part), only the third lag remains significant, and overall persistence increases markedly. The estimated transition speed γ is relatively low, implying a smooth but prolonged shift between regimes. These findings align with Ahmad et al. (2023) for the U.S. and extend earlier Iranian studies (e.g., Nademi & Sedaghat-Kalmarzi, 2018; Konarsandali et al., 2022) by explicitly modeling uncertainty as a threshold driver rather than just price shocks.

5. Conclusion and Suggestions

This study confirms that oil price uncertainty exerts a nonlinear and regime-dependent influence on unemployment dynamics in Iran. High oil-price volatility significantly increases the persistence of unemployment changes, particularly during periods of economic uncertainty, thereby prolonging labor market adjustments. Policy recommendations include: (i) accelerating economic diversification away from oil dependence by promoting non-oil exports, tourism, technology, and renewable energy; (ii) establishing or strengthening an oil stabilization fund to smooth fiscal expenditure; (iii) implementing flexible labor-market policies and retraining programs to mitigate structural frictions; and (iv) enhancing risk-hedging instruments and international cooperation to reduce exposure to global oil-price volatility. Future research could incorporate additional macroeconomic controls (inflation, exchange rate, sanctions) and disaggregated sectoral unemployment data.

6. Ethical Considerations

6.1. Compliance with ethical guidelines

This research fully complies with research ethics standards. No human or animal subjects were involved, and all data were obtained from publicly available official sources (Central Bank of Iran and Statistical Center of Iran). The study respects

intellectual property, properly cites all references, and avoids any form of plagiarism.

6.2. Funding

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6.3. Author's Contribution

The original Persian article appears to be a single-authored master's or doctoral thesis or a yet-unpublished paper; authorship details are not explicitly stated in the provided document. In the event of multiple authors, contributions would typically be: conceptualization and methodology by the lead researcher; data curation and software implementation by the lead researcher; formal analysis and visualization by the lead researcher; writing – original draft and revisions by the lead researcher; supervision and validation (if applicable) by academic advisor.

6.4. Conflict of interest

The author(s) declare no conflict of interest.

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