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THE EFFECT OF GLOBAL AND LOCAL FACTORS IN AZERBAIJAN REEL EXCHANGE RATE: EVIDENCE FROM QUANTILE REGRESSION

Azerbaycan Reel Döviz Kurunda Küresel ve Yerel Faktörlerin Etkisi: Kantil Regresyondan Kanıt

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The Effect of Global and Local Factors in Azerbaijan Reel Exchange Rate: Evidence from Quantile Regression

Abstract

This article examines how certain local and global factors impacted the real Exchange Rate (RER) of Azerbaijan from January 2013 to April 2021, utilizing a quantile regression technique that considers asymmetry. The results showed that all variables (Oil Price (OILP), International Reserves (RESV), Consumer Price Index (CPI), Global Political Risk (GPR)) generally influence the real exchange rate at lower quantiles. To be more precise, at the quantile levels of Q1-Q5, an upsurge in OILP results in a decline in RER, while an increase in CPI leads to a reduction in RER at the quantile levels of Q1-Q2. Furthermore, an increase in RESV and GPR leads to a decrease in RER at Q1-Q2 and Q1, respectively. The effect of the coefficients also decreases as the quantiles increase.

Keywords: Real ER, Azerbaijan, Oil Prices, Global Factors, Quantile Regression

Özet

Bu çalışmada, Ocak 2013'ten Nisan 2021'e kadar olan dönemde, Azerbaycan'ın reel döviz kuru üzerinde seçilmiş yerel ve küresel faktörlerin etkisi, asimetriyi dikkate alan quantile regresyon yöntemi kullanılarak analiz edilmiştir. Sonuçlar, tüm değişkenlerin genellikle düşük kantillerde reel döviz kuru üzerinde bir etkiye sahip olduğunu göstermektedir. Özellikle, OILP ve CPI'daki bir artış sırasıyla Q1-Q5 ve Q1-Q2'de RER'de bir azalmaya neden olmaktadır. Ayrıca, RESV ve GPR'deki bir artış sırasıyla Q1-Q2 ve Q1'de RER'de bir azalmaya neden olmaktadır. Katsayıların etkisi de quantile'ler arttıkça azalmaktadır.

Anahtar Kelimeler: Reel Döviz Kuru, Azerbaycan, Petrol Fiyatları, Küresel Faktörler, Quantile Regresyon

Introduction

Following the dissolution of the Soviet Union in 1991, Azerbaijan encountered significant economic difficulties during the period from 1991 to 1995 due to the transitional phase and the Karabakh conflict, resulting in a considerable decline in macroeconomic indicators. During this period, GDP decreased by 70% and annual inflation reached 1000%. Although macroeconomic data have been stabilized with the comprehensive stabilization program signed with the IMF in 1995, it is inevitable that the Azerbaijani economy will be affected by global economic and political factors as well as local factors due to its dependence on oil and natural gas exports.

While previous academic research on Azerbaijan has predominantly focused on investigating the influence of fluctuations in oil prices on GDP and the real exchange rate (ER), the potential impact of other local and global economic and political risks on the real ER has been overlooked. It is worth noting that since the supply, demand, and prices of oil are influenced by global factors, the real ER of Azerbaijan is also susceptible to the impact of global factors.

Studies on the factors affecting the ER for Azerbaijan have mainly used VAR, causality and GARCH models, while asymmetric forecasting models have been neglected. The impact or intensity of the explanatory variables may vary during periods characterized by low, moderate, or high volatility of the real ER.

This research is anticipated to make two significant contributions to existing literature. Firstly, it will examine the influence of Global Political Risk (GPR) on Azerbaijan's real ER, in addition to the variables of oil prices, local foreign exchange reserves, and inflation. Secondly, the study will utilize quantile regression (QR) analysis to examine the asymmetric impact of the explanatory variables on the real ER.

The literature review will be presented in the second section, while the third section will outline the dataset and econometric analyses. The findings will be presented in the final section.

1. Literature Review

Azerbaijan's economy relies heavily on the export of oil and is therefore sensitive to fluctuations in oil prices. If the price of oil rises, it will have a positive impact on the

country's foreign trade balance and foreign exchange reserves, leading to an increase in the value of the national currency.

Studies conducted on countries that export oil have revealed a notable correlation between oil prices and ERs (Mohammadi and Jahan, 2012; Turhan, Hacıhasanoğlu & Soytaş, 2013). Hasanov (2010) examined the connection between oil prices and real ERs in Azerbaijan between 2000 and 2007, utilizing quarterly data.The results from VECM and Johansen co-integration test indicate the presence of a positive and significant tie between them. Zulfigarov and Neuenkirch (2020) conducted a study on the connection between real ER and oil prices in Azerbaijan using quarterly data from 2002-2018. They found that an increase in oil prices leads to a decrease in the ER. Another study by Mukhtarov, Aliyev, and Zeynalov (2020) used monthly data from 2005-2019 to examine the relationship between oil prices and ERs in Azerbaijan, and found a significant negative relationship between the two variables. Agazade (2018) also studied the connection between the real ER and world real oil prices for Azerbaijan using monthly data from January 1995 to September 2017. The study found that the real ER is weakly supported and that the real ER is affected differently by changes in oil prices below and above a certain level (threshold value). Rahimli and Nazirov (2020) used quarterly data from 2001Q1 to 2020Q1 to investigate the relationship between oil prices and the real effective ER for Azerbaijan's economy. They found that a shock to oil prices causes significant changes in the real ER. Mukhtarov, Humbatova, Mammadli, and Hajiyev (2021) investigated the influence of oil price shocks on the ER in Azerbaijan using data from 1992 to 2019. The results from the SVAR method showed that a rise in oil prices affects the ER negatively. An increase in inflation can affect the ER through two channels: the increase in prices of domestic products, and an increase in interest rates. High interest rates will attract foreign investors to the country and hence decrease the ER. Studies by Pettinger (2017), Engel & Rogers (2001), and Kulkarni & Ishizaki (2002) support this notion.

Hasanov (2013) conducted an empirical study on the Dutch disease phenomenon in Azerbaijan using data from 2000 to 2007. The study found that the appreciation of the real ER was caused by rapid increases in non-tradable good prices. Meanwhile, Davudova (2020) examined the connection between GDP, CPI and the ER in Azerbaijan, from January 2015 to July 2020. The result from the dynamic VEC model showed that the real

ER is negatively influenced by CPI. Petkov (2017) analyzed the impact of productivity and inflation on the real ER for Azerbaijan for the period 1995-2013 using the Balassa and Samuelson hypotheses. The ARDL model's findings suggest that there exists a persistent relationship between the real ER and inflation.

According to Aizenman and Lee (2007), the international reserve positions of the country's central banks are important in two respects. The first is to promote an export-based economy by controlling the ER. The second is to be prudent or deterrent against external shocks which can cause foreign financial shortfalls. Empirical studies have found that international reserves have a positive effect on the real ER against external shocks (Aizenman and Riera-Crichton, 2008; Aizenman, Ho, Huynh, Saadaoui, & Uddin , 2023; Cabezas & De Gregorio, 2019; Şit & Karadağ, 2019).

Recent studies in literature have shown that geopolitical risks may influence the ER. The hypothesis that unexpected changes in variables will affect the ER has received wide coverage in literature (Benigno, Benigno, & Nistico, 2012; Caldara & Iacoviello, 2018; Frenkel, 1981; Hodrick, 1989; MacDonald & Taylor, 1992). Empirical studies show that especially unexpected GPR is an important determinant of the ER (Narayan, 2020, Salisu, Lasisi, & Olaniran, 2021). Salisu, Cunado and Gupta (2022) analyzed the effect GPR on ER volatility for BRICS countries using both historical and recent GPR data. Results from the GARCH-MIDAS-X model showed that ERs are more affected by recent GPR data. Hui (2020) examined the impact of GPR on the ER for 4 Asian countries. The results from the ARDL model show that an increase in GPR leads to a depreciation in the ER in all 4 countries. Since an increase in geopolitical risks will lead to uncertainty in economies, investors will favor foreign currency-denominated assets over domestic currency-denominated assets. Therefore, the ER will depreciate.

2. Data and Descriptive Statistics

In this study, we use monthly data. The data set for Azerbaijan covers the period from January 2013 to April 2021. The log difference of all variables has been taken. Data sources and descriptions are presented in table 1 and 2.

Table 1: Abbreviations

ABBREVİATİON	VARİABLE	DATA SOURCES
RER	REAL ER	THE STATE STATİSTİCAL COMMİTTEE OF THE REPUBLİC OF AZERBAİJAN
OILP	OİL PRİCE	US ENERGY INFORMATİON ADMİNİSTRATİON
RESV	INTERNATİONAL RESERVES	THE STATE STATİSTİCAL COMMİTTEE OF THE REPUBLİC OF AZERBAİJAN
CPI	CONSUMER PRİCE INDEX	THE STATE STATİSTİCAL COMMİTTEE OF THE REPUBLİC OF AZERBAİJAN
GPR	GLOPAL POLİTİCAL RİSK	HTTPS://WWW.MATTEOİACOVİELLO.COM/GPR.HTM

Table 2: Descriptive Statistics

Variable	Mean	Std.dev	Max	Min	Kurtosis	Skewness	J.B.
RER	-0.002	0.032	0.049	-0.1767	18.869	-3.406	1242.729*** (0.000)
OILP	-0.005	0.113	0.331	-0.633	11.589	-1.491	344.525*** (0.000)
RESV	-0.006	0.044	0.085	-0.219	9.991	-2.512	308.866*** (0.000)
CPI	0.004	0.007	0.044	-0.013	11.562	1.9933	371.689*** (0.000)
GPR	-0.001	0.512	1.327	-1.498	3.988	-0.106	4.263 (0.118)

Note: *, **, and *** denote for 10%, 5%, and 1%, respectively.

As table 2 shows, the real ER of Azerbaijan averages at (-0.002) with standard deviation (0.032). Oil prices has the highest standard deviation, followed by foreigner reserves and real ER. All variables except the inflation (CPI) have negative skewness. The normality assumption of all series, except for GPR, is rejected as indicated by the Jarque-Bera test.

3. Methodology

The present investigation employs a specification as outlined in recent studies conducted by Hasanov (2013) and Czech & Niftiyev (2021), to examine the impact of both local and global factors on the fluctuation of Azerbaijan's real ER. The model is expressed as follows:

$$RER_t = \alpha_0 + \sum_{i=1}^{N} \beta_i LF_{it} + \sum_{j=1}^{M} \delta_j GF_{jt} + \varepsilon_t \quad (1)$$

In this model, the indices i and j are used to represent local and global factors, respectively. The intercept and disturbance are denoted by α_0 and ε_t ,respectively. Additionally, the sensitivity of Azerbaijan's real ER to the i[th] local factor is reflected by β_i, while δ_j denotes the sensitivity of Azerbaijan's real ER to the j[th] global factor.

The model we used utilizes the following variables:

RER_t, which represents the real ER of Azerbaijan at time t.

LF_{it}: which refers to the occurrence of the i[th] LF at time t.

GF_{jt}: which refers to the occurrence of the j[th] GF at time t.

In order to evaluate the impact of local and global factors, we employ the OLS, ordinary least square regression technique. Yet, it is crucial to mention that the OLS estimation can be vulnerable to the influence of outlying observations, particularly when analyzing financial data. Such problems tend to distort the robustness of OLS and render it more susceptible to outliers when data deviates from its mean or approaches its extreme values.

To address the limitations of OLS, we utilize the QR model developed by Koenker & Bassett (1978). This methodology has primarily been used in financial markets research to investigate dependence patterns and asymmetries (Baur, 2013; Zhu, Guo, You, & Xu, 2016). Unlike OLS, the QR is non-parametric and does not require extensive information about the distribution of Y|x or its conditional variance. One of the basic advantages of this method is that it provides a comprehensive understanding of the conditional distribution, revealing how financial markets movements differ throughout the different states of the market. It also highlights any asymmetric dependence structures (Joo & Park, 2021).

The QR model by Koenker & Bassett (1978) is defined as follows:

$$Q_y(\frac{\tau}{x}) = x'\beta(\tau) \tag{2}$$

This model supposes the linear connection of x on y and $Q_y(\frac{\tau}{x})$ dpresents the Y's conditional quantile.

$$Q_y(\frac{\tau}{x}) = inf\left\{\frac{d}{F_y(d/x)} \geq \tau\right\} = \sum_k^t \beta_k(\tau)x_k \tag{3}$$

In this study, we use LF (foreign reserves, RESV, and inflation, CPI) and GF (oil price, OILP, and global geopolitical risk, GPR) as variables to capture the determinants impacting changes in the real ER. The conditional probability distribution of Y|x is denoted by $F_y(d/x)$. We study the dynamics of the real ER changes across three phases-lower quantile level (0.1, 0.2, 0.3) that reflects the lowest changes in the real ER , medium quantile level (0.4, 0.5, 0.6) that reflect the moderate changes in the real ER , and upper quantile level (0.7, 0.8, 0.9) that reflects the highest changes in ER . Our analysis employs the quantile regression model where β(τ) represents the degree of dependence between x and the τ^{th} conditional quantile of y. β(τ)'s values indicate whether the dependence structure is identical across quantiles or not. A higher value of β(τ) implies a stronger dependence structure, while a lower value of β(τ) implies a weaker dependence structure. Additionally, the structure of dependence indicates symmetry or asymmetry depending on similarity or dissimilarity for high and low quantiles (Koenker, 2005). Furthermore, the presence or absence of an exogenous variable in x indicates conditional or unconditional dependency.

Regression coefficients are obtained by minimizing the weighted absolute difference between y and x for a specific τ, as following:

$$\hat{\beta}(\tau) = \sum_{l=1} \quad (\tau - 1_{\{y_l < x_l \beta(\tau)\}}) \, |Y_l - x_l' \beta(\tau)| \tag{4}$$

In Eq (4), the usual indicator function is defined by $1_{\{y_l < x_l \beta(\tau)\}}$.

4. Results

Table 3: Unit Root Test

	ADF	PP
RER	-7.105*** (0.000)	-6.926***(0.000)
OILP	-8.256*** (0.000)	-8.111*** (0.000)
RESV	-4.403*** (0.000)	-4.368*** (0.000)
CPI	-7.194*** (0.000)	-7.172*** (0.000)
GPR	-9.473*** (0.000)	-55.653*** (0.000)

Note: *, **, and *** denote for 10%, 5%, and 1%, respectively

The stationary characteristics of the series were assessed through the implementation of Phillips-Perron and the Augmented Dickey-Fuller tests, with the corresponding outcomes

presented in Table 3. All of the series were found to reject the null hypothesis according to the Unit Root tests.

Table 4 shows the estimation results of the OLS and QR. The OLS estimation results show that while oil prices and foreign reserves have a positive effecton Azerbaijan's real ER, inflation has a negative impact. However, global GPR has no effect on Azerbaijan's real ER.

Table 4: Estimation Results

	Q1	Q2	Q3	Q4	Q5
C	-0.020 (0.000)	-0.009 (0.001)	-0.005 (0.185)	-0.003 (0.240)	0.001 (0.539)
OILP	**-0.082***** **(0.001)**	**-0.060***** **(0.000)**	**-0.049***** **(0.001)**	**-0.043**** **(0.019)**	**-0.036*** **(0.096)**
RESV	**0.533**** **(0.020)**	**0.296***** **(0.000)**	0.257 (0.570)	0.143 (0.167)	0.106 (0.323)
CPI	**-2.192***** **(0.000)**	**-1.621**** **(0.013)**	-1.077 (0.311)	-0.555 (0.294)	-0.594 (0.261)
GPR	**0.015**** **(0.048)**	0.006 (0.220)	0.001 (0.683)	-0.003 (0.925)	-0.002 (0.554)
	Q6	Q7	Q8	Q9	OLS
C	-0.002 (0.600)	-0.005 (0.271)	-0.006 (0.244)	-0.003 (0.624)	0.004 (0.125)
OILP	0.004 (0.1049)	0.010 (0.002)	0.014 (0.000)	0.020 (0.000)	**-0.064***** **(0.009)**
RESV	-0.031 (0.162)	-0.018 (0.348)	-0.025 (0.272)	-0.053 (0.293)	**0.297***** **(0.000)**
CPI	-0.028 (0.845)	-0.002 (0.981)	-0.109 (0.490)	-0.217 (0.418)	**-1.299***** **(0.000)**
GPR	-0.490 (0.548)	0.021 (0.973)	0.152 (0.816)	0.880 (0.342)	0.002 (0.621)

Note: *, **, and *** denote for 10%, 5%, and 1%, respectively

The quantile regression provides us with more detailed results. The OILP impacts the real ER changes negatively across the lower quantiles (Q1, Q2, Q3) and the medium quantile level (Q4, Q5). Its impact had a stronger impact across lower quantiles, and it decreased across the medium quantile level as the ER changes increased. This outcome is consistent with what has been documented in the literature (Hasanov, 2013; Czech & Niftiyev, 2021). Regarding the foreign reserves, RESV impacts Azerbaijan real ER changes positively only during at the most lower quantiles (Q1 and Q2). This outcome is consistent with what has been documented in the literature (Lin & Wang, 2005; Kydland & Prescott, 1977). This

implies that it only has a significant impact only in extreme conditions. Inflation display a negative effect on the real ER and it's only significant in the most lower quantiles (Q1 and Q2). The global GPR is only positively significant in Q1.

Overall, the OILP and CPI impacts Azerbaijan real ER changes negatively while CPI and GPR affect it positively. We observe that all variables impact the real ER changes at the lower quantiles (Q1 and Q2) except for OILS its effect extend to the medium quantile level. This indicates that our selected local and global factors only affect the real ER changes when the ER performance is at its best – the lowest level of real ER changes. Furthermore, GPR only impacts Azerbaijan real ER changes at one level (Q1), this shows the resilience of Azerbaijan currency to tensions in the global geopolitical sphere.

Conclusion

While academic studies on Azerbaijan have mainly examined the impact of oil price changes on the real ER, the impact of other local and especially global political risk factors on the real ER has been neglected. Also, studies related to the variables impacting the ER for Azerbaijan have mainly used VAR, causality and GARCH models where asymmetry is neglected. However, the sign or strength of the effect of explanatory variables may differ in periods when the volatility of the real ER is low, normal and high and therefore, use of the quantile regression model will be appropriate that takes into account the asymmetry. Our study has attempted to fill this gap for Azerbaijan.

The findings from QR model demonstrated that the OILP impacts the real ER changes negatively across the lower quantiles (Q1, Q2, Q3) and the medium quantile level (Q4, Q5). The effect of the OILP coefficient decreases with higher quantiles. Regarding the foreign reserves, RESV impacts Azerbaijan real ER changes positively only during at the lowest quantiles (Q1 and Q2). Inflation has a negative effect on the real ER in the lowest quantiles (Q1 and Q2) and GPR is only positively significant in Q1. This implies that RESV, Inflation and GPR only have a significant impact in extreme conditions.

This indicates that our selected local and global factors only affect the real ER changes when the ER performance is at its best – the lowest level of real ER volatility. Furthermore, GPR only impacts Azerbaijan real ER changes at one level (Q1), this shows the resilience of Azerbaijan currency to tensions in the global geopolitical sphere.

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