

ECONOMIC SCIENCES

AN ECONOMETRIC ANALYSIS OF THE IMPACT OF FLUCTUATING ELECTRICITY PRICES ON CONSUMER SPENDING AND INFLATION (CASE OF AZERBAIJAN)

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ABSTRACT

This article, based on data from 1995 to 2022, considers the impact of fluctuating electricity prices on consumer spending and inflation in Azerbaijan republic. In research have created multiply regression model and adequacy of the model was determined using the F-Fisher test, Student's t test, and the stability of the parameters of the regression model was checked using the CUSUM test. Stationarity of the time series was checked by the Dickey-Fuller test. As a result, econometrically sound recommendations are developed, which allows to conduct dynamic analyzes to effectively regulate economic process. The Granger causality of the relationship was investigated in research.

Keywords: Electricity, price, inflation, consumer spending, Azerbaijan, energy.

The successful policy of independent Azerbaijan has made it the leading state of the region, as well as being recognized as a designer and implementer of large-scale projects. The state of Azerbaijan, which has become a regional power, has achieved great success in the field of regional cooperation in two days. Today, Azerbaijan, the project of the Southern Gas Corridor, which has changed the energy address of Europe as a whole, plays the role of supplying strong electricity. Possessing rich natural energy resources provides ample opportunity for Azerbaijan to act as an important actor among the world countries in the field of energy security. Today, Azerbaijan is a reliable partner in the world, a state with sincere friendship. Factors such as combining the efforts put forward in the country's economic progress and exchanging experience are still the basis of our energy policy today.

Abundant production of electricity in Azerbaijan allows it not only to meet domestic demand, but also to export to neighboring countries. According to the latest data of the State Statistics Committee, 24.3 billion kWh of electricity was produced in the country in 2017, however, domestic consumption was 23 ,1 billion kW/h, and export was 1.3 billion kW/h. The largest consumer of electricity in Azerbaijan remains the housing sector.

In the Republic of Azerbaijan, sustainable electricity and efficient use of energy resources are matters of state control. In the price of hydrocarbon resources, the possibilities of using electricity and consumers in the market, which is a locally important type of energy, are also carried out in international markets. Thus, the increase in the rates of electricity and natural fuel types in the domestic market in recent years has brought up the issue of optimal use of electricity production capacities, in addition to demanding efficient consumption of electricity and natural fuel in the country. In addition to the mentioned issues, the relevance of the research is conditioned by the following factors.

Methodology. The multifactor regression model of was built in research. Based on 28-year statistical indicators of stock indexes, an econometric approach of dependence was conducted in the period 1998-2022 [6,7]. Adequacy of the model was determined using the F-Fisher test, Student's t test, and the stability of the parameters of the regression model was checked using the CUSUM test and the CUSUM of Squares test. Heteroskedasticity of the residuals checked by White test. Stationarity of the time series was checked by the Dickey-Fuller test. Causality analyses of stationarity time series is defined by the Granger test.

Recent publications. In recent times, the impact of energy prices on the economy has been studied by Azerbaijani and foreign researchers [1-5]. Mammadov Fariz is examined the impact of electricity tariff changes to other economic sectors, as well as to potential changes of price levels in the overall economy. In this regard, the authors have applied the Inter Industry Balance Model and its modification, i.e. Equilibrium Price Multiplier Model. The authors have also empirically built the inter-industry balance and equilibrium price models for the case of Azerbaijan's economy, and conducted analysis and assessments for this case. The inter-industry balance tables of production and distribution of products and services, officially published by the State Statistical Committee of the Republic of Azerbaijan, were taken as the primary database for this study. It should be noted that the inter-industry balance model for Azerbaijan was built based on 96 sectors of the economy. The model was used to assess the economic impact of electricity price changes in the national economy. Finally, simulations relevant to 10, 20 and 30 % increase of electricity prices were conducted and potential impacts to Azerbaijan's economy were assessed [1]. Zokirov S. examines the structural changes in electricity production in Uzbekistan in 2001-2019, its sources, as well as electricity consumption by sectors. The indicators of electricity consump-

tion per capita in Uzbekistan and the world are analyzed, proposals and recommendations for improving the indicators of electricity supply in our country are developed.[3]. Nevena Petrova is analyzed electricity in the context of its pricing for household customers both in the regulated and the free markets. In the course of the theoretical review it is concluded that the mechanisms used in the pricing of the electricity market for household customers correspond to the law and that the electricity price should be as determined by the market, but at this stage the lack of maturity of the electricity market does not allow it to operate solely by market principles, which requires systemic regulation either through specialized legislation or through the intervention of a regulatory authority [4]. Kozlova A. used various technics that could be applied for the estimation of energy demand equation. Nevertheless one should take into account some issues concerning presented data. First of all addition of lagged dependent variable into equation could raise endogeneity problem since lagged

energy consumption could be correlated with the error term. This makes estimation using fixed or random effects inappropriate. Possible solution to this problem is using GMM estimators. Also in this case we are able not take into account oblast' specific effects such as amount of households using electric stoves.[5]

In this study, the impact of fluctuating electricity prices on consumer spending and inflation in the Republic of Azerbaijan was studied. All statistical data for econometric analysis are taken from official sources such as the State Statistics Committee of Azerbaijan and the Central Bank of Azerbaijan. Annual data from 1995 to 2022 were used as the observation period. In the study, a multivariable linear regression model of the effect of fluctuating electricity prices on consumer spending and inflation in the Republic of Azerbaijan was constructed. A dynamic representation of the time series included in the multivariate linear regression model is shown in Figure 1:

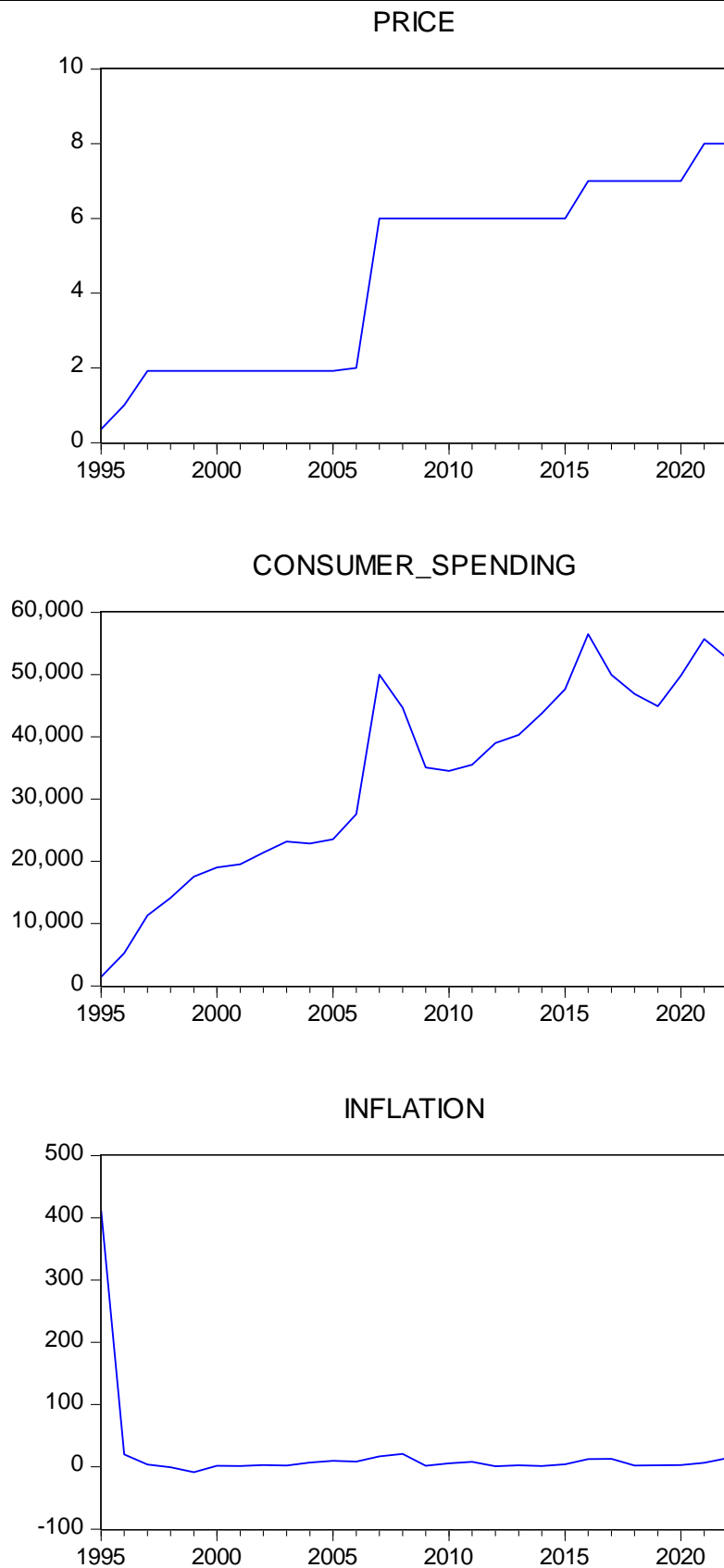


Figure 1. Dynamical representation of time series (Author's work)

The evaluation of descriptive statistics of the time series in the research is given in the table below.

	Price	Consumer spending	Inflation
Mean	4.487143	33344.90	20.50046
Median	6.000000	35291.10	3.854719
Maximum	8.000000	56500.50	411.8000
Minimum	0.360000	1467.000	-8.500000
Std. Dev.	2.520601	15945.27	76.96276
Skewness	-0.195839	-0.301826	4.946443
Kurtosis	1.349447	1.926946	25.66803
Jarque-Bera	3.357360	1.768480	713.6601
Probability	0.186620	0.413028	0.000000
Sum	125.6400	933657.2	574.0128
Sum Sq. Dev.	171.5426	6.86E+09	159928.2
Observations	28	28	28

Figure 1.Descriptive statistics of variables(Author's work)

We created linear multiply regression model for analyzing how impact the price of elasticity energy to consumer spending and inflation. The estimated least squares multiple regression model implemented in custom software Eviews is described in Table 2:

Table 2.

Multiple regression model (Author's work)

Dependent Variable: Price				
Method: Least Squares				
Date: 02/15/24 Time: 15:54				
Sample: 1995 2022				
Included observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Consumer spending	0.000153	1.08E-05	14.22281	0.0000
Inflation	0.001797	0.002228	0.806442	0.4276
C	-0.650647	0.409051	-1.590624	0.1243
R-squared	0.900148	Mean dependent var		4.487143
Adjusted R-squared	0.892160	S.D. dependent var		2.520601
S.E. of regression	0.827739	Akaike info criterion		2.560719
Sum squared resid	17.12879	Schwarz criterion		2.703455
Log likelihood	-32.85007	Hannan-Quinn criter.		2.604355
F-statistic	112.6858	Durbin-Watson stat		0.466892
Prob(F-statistic)	0.000000			

The coefficient of determination of the established multifactor regression model is 90%, which means that it explains 90% of the change of the outcome sign due to the change of the factor characteristics. Since the coefficient of determination of the multifactor regression model in Table 2 is 90%, the model is significant, and the density of the relationship between the regressors and the predictor is strong. is being.

One of the tests that check the damage of the multifactor regression model is the Fisher test. If the calculated value of the F-statistic is greater than the critical value, $F_{\text{calculated}} > F_{\text{table}}$, the model is considered significant. Let's look at the tables at the 5% significance level of the model, $k_1=2$, $k_2=28$ and the price of 112.6858 was taken in Table 2. $112.6858 > 3.34$. A multifactor regression model can be considered as the main one, and a great result is obtained from the calculated price table of exact F-statistics.

The Darbin-Watson criterion is used to perform autocorrelation. The number of the multifactor regression model is 28. Accordingly, we make the program $d_L = 1.18$ $d_U = 1.65$, which divides the segment $[0,4]$ into five parts according to the table of critical boundaries for the Darbin-Watson criterion. The observed value in Table 2 is $d_{obs} = 0.46$. Since $0.46 < d_L$, d_U there is autocorrelation of the residuals.

Heteroskedasticity of the residuals of the multifactor regression model was checked by means of the White test. $nR^2 = Obs * determination coefficient$, here number of observation $n=28$, $R^2 = 0.900148$ determination coefficient in Table 3 equal 9.073471. These values is defined by the Excel program. The $\chi^2_{0.10}(5) = 9.23$ value is greater than $Obs * determination coefficient = 9.07$, it means that, we can canceled hetroskedasticity.

Table 3.

Result of White test (Author's work)			
F-statistic	2.109382	Prob. F(5,22)	0.1025
Obs*R-squared	9.073471	Prob. Chi-Square(5)	0.1062
Scaled explained SS	3.903094	Prob. Chi-Square(5)	0.5635

The stability of the parameters of the Multifactor Regression model is checked by the CUSUM test. If the recursive estimates of the residuals as a result of the

CUSUM test deviate from the critical margins, then this indicates the instability of the model parameters, otherwise the parameters remain stable.

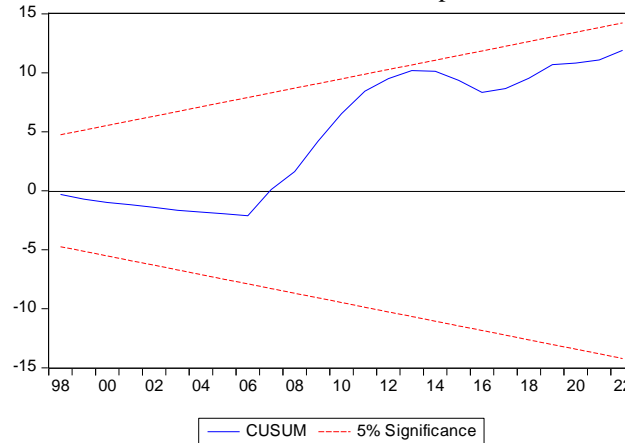


Figure 2. Graphical representation of CUSUM test (Author's work)

From Figure 2, it can be seen that the blue line does not intersect the lines, which means that the stability of the parameters of the multifactor regression model does not require the CUSUM test.

The results of the Dickey-Füller test results of the stationarity of the equipment of the regression models we built during the test using the Eviews 8 software

package are econometrically analyzed. the null hypothesis that it has a single root is rejected. That is, the alternative hypothesis about the stationarity of time is accepted. Also, for the time series to be stationary, the value of the Dickey Fuller test should be smaller than the critical values at the 1%, 5%, 10% price level. Based on the results of Table 4, let's check the stationarity of the time series.

Table 4.

Result of Dickey-Füller test (Author's work)					
Variables	Critical statistics	Critical value 1%	Critical value 5%	Critical value 10%	Prob.
First difference, trend and intercept					
Price	-5.141747	-4.356068	-3.595026	-3.233456	0.0017
inflation	-5.398144	-4.374307	-3.603202	-3.238054	0.0010
Consumer spending	-4.827494	-4.374307	-3.603202	-3.238054	0.0037

The high level of the price time series is less than 0.05, and the value of the additional t-statistic is also less than the high level of 1%, 5%, 10%. According to this result, the series search is stationary in the case of the second difference in time trend and intercept.

Let us test the stationarity of the inflation time series. Because it is smaller than 0.05 according to the value corresponding to this value, in addition, it is smaller than the value of 1%, 5%, 10%, so the H_0 -hypothesis is cleaned and made stationary.

Consumer spending analyzes time series results. According to the result, the probability of the corresponding value is less than 0.05. But the value of t-statistic is greater than the value of 1% significance level. In this case, the value of 5%, 10% of the Consumption expenditure time series is considered highly stationary.

Thus, by analyzing the stationarity of all time series for the considered issue, it was determined that they are stationary in the case of first difference trend and intercept.

After finding the stationarity time series by the Dickey Fuller test we should analyse the cause effect relationship between the time series. The result of Granger test is shown that Dprice is a cause of dconsumer spending when lag operator equal 1, Dinflation is a cause of Dprice and Dinflation is a cause of Dconsumer spending when lag operator equal 2, where D denotes the difference operator of the corresponding variable

Result. Annual data from 1995 to 2022 were used as the impact of fluctuating electricity prices on consumer spending and inflation in the Republic of Azerbaijan. Multiple regression model between the electricity prices to consumer spending and inflation adequacy is defined by the determination coefficient, F-test and Student test. Result of CUSUM test show us stability of parameters of regression model. Stationarity of time series is defined by Dickey Fuller test. Result of the test time series is a stationary in first difference intercept and trend case. Analyses of causality relationship between

the stationar time series has cause effect relation. This result will help us to apply cointegration instruments to model and get long term relationship between the variables.

References

1. MAMMADOV, F. (2021). EVALUATION OF THE ECONOMIC IMPACT OF ELECTRICITY PRICES CHANGE (AZERBAIJAN CASE). РЕДАКЦІЙНА КОЛЕГІЯ, 34.
2. Mammadov, F., Valiyev, V., & Mehdiyev, M. (2019, October). Assessment Of The Impact Of Electricity Tariff Change For Azerbaijan. In Energy Resources of the Caspian and Central Asia: Regional and Global Outlook, 4th IAEE Eurasian Conference, October 17-19, 2019. International Association for Energy

Economics.

3. Zokirov, S. E. (2021). ISSUES OF IMPROVING ELECTRICITY SUPPLY INDICATORS IN UZBEKISTAN. Экономика: анализы и прогнозы, (3), 75-83.

4. Nevena Petrova, 2019. "Pricing of the Electricity Market for Household Customers in Bulgaria," Izvestia Journal of the Union of Scientists - Varna. Economic Sciences Series, Union of Scientists - Varna, Economic Sciences Section, vol. 8(1), pages 18-26, April.

5. Kozlova, A. (2012). Response of residential electricity demand to price changes in Ukraine. Kyiv School of Economics.

6. www.stat.gov.az

7. www.cbar.az