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The Impact of Interest Rate and Inflation on Real Exchange Rate across Emerging Countries 1993-2015: A Panel Data Analysis

Cansu ÜNVER ERBAŞ¹, Ahmet Gökhan SÖKMEN² & Süreyya YILMAZ³

Keywords

Real interest rate,
Exchange rate,
Inflation, Panel data,
Pooled mean group.

Abstract

One of the problems economically experienced by developing countries is the uncertainty in exchange rates. This uncertainty in exchange rates puts pressure on the country's economy and is particularly hampered by the long-term plans of sectors that are importing ultimate products or importing raw materials. Looking at the central banks of developing countries, it is observed that in cases where the exchange rates are extremely volatile, they tend to increase or decrease the interest rates in general and thus prefer the way to keep the exchange rates in balance. In this paper, we focus on whether the change in the interest rates has any effect on the exchange rate. For this aim of motivation, we have investigated; the interest rates, exchange rates and inflation data of Turkey, South Africa, Brazil, China, Malaysia, Nigeria, Romania, Russia and Indonesia for the time period 1993-2015 are analysed by panel data analysis method.

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1. Introduction

The market foreign exchange is the largest financial market in the world. It is open somewhere else in the world 365 days a year, 24 hours a day. The 2016 Triennial central bank survey compiled by the Bank for International Settlements (BIS) places worldwide daily trading of spot and forward foreign exchange at \$ 5.1 trillion per day on April 2016. It is important for companies and investors to understand factors that affect exchange rate changes. Because these changes would affect investment and financing decisions. Currency's exchange rate with other currencies is determined by interrelated variables that reflect the overall financial conditions of countries. These variables; interest rate, inflation rate, current-account deficit, public debt, foreign trade deficit and political stability may drive the currency value volatility. Among the variables listed above interest rate and inflation rate are the major factors that affect the country's currency value.

In recent years, many researchers have extensively studied the link between interest rates, inflation rate and exchange rate in both developed and developing countries. Inflation, interest rate and exchange rate are highly correlated. Central banks change interest rates and this impacts inflation and currency values.

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Generally higher interest rate in a country increases the value of that country's currency relative to nations offering lower interest rate without an accompanying increase in inflation.

In order to deal with some sources of endogeneity and to provide long-run panel estimations, we applied pooled mean group (PMG), mean group (MG) and dynamic fixed effect (DFE). The results confirm the existing theory and the empirical findings as such both inflation and interest rate have a significant adverse impact on real exchange rate among developing countries. The paper proceed as follows: Section 2 reviews the literature, Section 3 presents the source of data and the descriptive statistics, Section 4 provides insights on the econometric model applied, Section 5 delivers results and finally Section 6 concludes the paper. Hausman test to distinguish amongst dynamic panel estimators are presented in Appendix 1, and some robustness checks are reported in Appendix 2.

2. Literature Review

As well-known exchange rate plays a vital role in country's economy, also has a critical impact on interest rate of the country both in the short run and long run. The relationship between interest rate and exchange rate has been on a debate amongst economists both theoretically and empirically. Amoateng (1995) investigated relationship between real long-short interest spread differentials and real exchange rates for the integrated financial markets in the industrialized world from the 1980s and the early 1990s. The consistent evidence is that there is a long-run relationship between real exchange rates and real long-short interest spread differentials and vice versa for the UK/US markets. Chortareas & Driver (2001) investigated a relationship between real exchange rates and real interest rate differentials. The tests are conducted on a panel of 18 OECD economies using the United States as a numeraire for the post-Bretton Woods era. The results showing a long-run relationship between real exchange rates and real interest rate differentials appear to be more positive. Such studies concentrated on G7 economies. To investigate this further the panel was split into two groups: the G7 and eleven small open economies. For the panel of small open economies strong evidence in favour of co integration is found. In contrast, there is no evidence of co integration in a panel that consists purely of the G7 economies. Reinhart & Reinhart (2001) investigated for G3 and developing countries and Pattanoik & Mitra (2001) studied India and they found the same results. On the other hand, Goldfajn & Baig (1998) analyzed the relationship between nominal interest rates and nominal exchange rates in the aftermath of currency crises, (the Asian crisis) found no evidence for the weakening impact of higher interest rates on exchange rates. Kraay (1999) examined the usefulness of higher interest rates across speculative attacks. He failed to find very strong positive or negative association between raising interest rates and the outcome of the speculative attack. Dekle, Hsiao, & Wang (2002) determined whether high interest rates have had the effect of appreciating nominal exchange rates in three Asian countries. The authors use high-frequency data for Korea, Malaysia, and Thailand during the recent crisis and its aftermath to examine the relationship between the increase in interest rates and the behaviour of exchange rates. It is found that raising interest rates has had a small impact on nominal exchange rates during the crisis period. Gümüő (2002)

evaluated the relationship between interest rates and exchange rates during the 1994 currency crisis in Turkey in order to explain whether high interest rates had the effect of appreciating the nominal exchange rates. Findings show that raising interest rates had the significant long-run effect of depreciating the nominal exchange rates in contrast with the conventional wisdom. Gül, Ekinçi & Özer (2007) evaluated relationship between the exchange rate and the interest rate in the Turkey and data spanning period 1984-2006. Their analyzing result, exchange rate is Granger causality interest rate. Uysal, Mucuk & Alptekin (2008) analyzed to investigate causality between the exchange rate and the nominal interest rate in Turkey. The findings revealed that there is a relationship between the foregoing variables; however the direction of the causality is from exchange rate to interest. Saraç & Karagöz (2016) determined the efficient level of short-term interest rates on dollar rate. Evaluating the results, has no evidence that higher interest rates cause to a weakening of exchange rate, by the frequency domain Granger causality test. On the other hand, Karaca (2005) analyzed the relationship between the exchange rate and the interest rate for Turkey. Findings show that, there is no significant co integration between variables. And findings supporting the view of the Turkish Central Bank have been reached.

Sollis & Wohar (2006) investigated the existence of threshold co integration between real exchange rates and real interest rate differentials. For six of the countries in their sample our analysis reveals some evidence of a nonlinear long-run relationship between real exchange rates and real interest rate differentials. When threshold co integration is found to exist, they find stronger mean reversion when the equilibrium error is negative relative to when it is positive. MacDonald & Nagayasu (2000) investigated the long-run relationship between real exchange rate and interest rate differentials across 14 industrialized countries by applying Johansen technique and co integration tests and found mixed results. Yet, they claimed the variation on the mixed results is caused by the estimation method used, otherwise, there is definite long-run relationship confirmed by Johansen technique as well. Hoffman & McDonalds (2009) investigated the RERI relationship using bilateral US real exchange rate data spanning the period 1978–2007. Evaluating their empirical results provide robust evidence that the RERI link is economically significant and that the real interest rate differential is a reasonable approximation of the expected rate of depreciation over longer horizons. Byrne & Nagayasu (2010) examined the relationship between the real exchange rate and the real interest rate differential using recent econometric methods robust to potential structural breaks. Their samples of countries include Austria, Belgium, Canada, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden and Switzerland data spanning the period 1978-1998. Their analyzing result that the real interest rate differential is an important determinant of the real exchange rate. However, Kayhan, Bayat & Uğur (2013) examined the dynamic relationships between the real exchange rate and the real interest rate in the BRIC-T (Brazil, Russia, India, China and Turkey) countries by employing monthly data from the beginning of flexible exchange rate regime to July 2011. Findings show that, interest rate affects exchange rate in only China and this effect exist only in the long run. On the other hand, exchange rate shocks induce changes in interest rate in the shorter period. Hacker, Karlsson & Mansson (2014) analyzed to investigate causality

between the spot exchange rate and the nominal interest rate differential for seven country pairs, which includes Sweden. Impulse response functions are also utilized to examine the signs of how one of these variables affects the other over time. One key empirical finding from the causality tests is that there is strengthening evidence of the nominal interest rate differential Granger causing the exchange rate as the wavelet time scale increases. When considering impulse responses on how the interest rate differential affects the exchange rate, there appears to be some evidence of more negative relationships at the shorter time scales and more positive relationships at the longer time scales.

3. Data and Descriptive Statistics

Since the impact of inflation and interest rate are to be discovered on country's exchange rate, our dependent variable is real exchange rate (RER), and independent variables are inflation (based on consumer price: INF_CP and based on GDP deflator: INF_GDP) and interest rate (INT). We obtained inflation variable INF_CP from International Monetary Fund which is measured as the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals. Additionally we used inflation INF_GDP as GDP deflator (annual %) measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole, obtained from World Bank. Our interest rate variable (INT) is the real interest rate as percentage, that is, the lending interest rate adjusted for inflation as measured by the GDP deflator. This variable is obtained from World Bank, for Turkey however, it is obtained from IMF. Finally, our depended variable, real exchange rate is obtained from World Bank, for Turkey, it is obtained from Federal Reserve Bank of St. Louis. It is the real effective exchange rate index (2010 = 100), measured by the nominal effective exchange rate over a price deflator or index of costs. We applied normality test (i.e. Skewwnes/kurtosis) for RER which suggests that it deviates from normality so we take the natural logarithm of RER in our model. As both inflation variables include negative values, and interest rate is a ratio, we include them in the model without taking logarithms. Descriptive statistics of these variables are presented in Table.1:

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RER	182	91.44367	26.29216	47.16392	272.34
INF_CP	184	45.94827	218.6853	-1.407892	2075.887
INF_GDP	184	48.55927	233.8078	-5.991948	2302.841
INT	177	12.36502	20.79118	-43.57266	77.61726

Both inflation variables, those are INF_CP and INF_GDP , perform similar descriptive statistics ranging around mean of 46 and 49, respectively. This is also confirmed by the high percentage of correlation 0.92 between these two variables (output is available upon request). We will run separate regressions to check the robustness of the results and present them in Section 5.

3.1. Stationary Test

All application with real exchange rate naturally has unit roots. To ensure, we applied Im-Pesaran Shin unit root test and presented it in Table 2. As can be seen from Table 1, *RER* has a unit root, since the p-val is 0.4018 so we cannot reject the null hypothesis of “all panels contain unit-root test”. Taking the natural logarithm has not solved the stationary issue as can be seen from the p-val of 0.2152. Taking the first difference both for *RER* and *log_RER* however, appears to deal with the non-stationary. Applying dynamic panel estimator- PMG which will be covered in section 4 in more detail- will tackle this issue when estimating our model.

Table 2: Im-Pesaran-Shin Unit-Root Tests

Variables	Statistics (z-t-tilda-bar)	p-val	Number of panels	Number of periods
INF_CP	-4.6654	0.0000	8	23
INT	-3.7531	0.0001	8	22.13
INF_GDP	-6.1216	0.0000	8	23
RER	-0.2486	0.4018	8	22.75
log_RER	-0.7884	0.2152	8	22.75
d.RER	-6.0336	0.0000	8	21.75
d_log_RER	-6.3023	0.0000	8	21.75

H₀: All panels contain unit-root test for the specified variable; H_a: Some panels are stationary

4. Econometric Model

We are looking whether inflation and interest rate have any impact on real exchange rate for eight developing countries namely; Brazil, China, Malaysia, Nigeria, Romania, Russia, South Africa and Turkey from 1993 to 2015. Due to data limitation most scholars such as; Meese & Rogoff (1988), Edison & Pauls (1993), Uysal et. al. (2008), Gül et. al. (2007) Gümüş (2002), Keminsky & Schumukler (1998), Goldfajn & Baig (1998) have looked at this relationship for a specific country and so applied time series analysis. Such relationship however, could have been portrayed well by the use of panel data since it involves multi-dimensional data with measurements over time. Also, as discussed earlier the impact of both inflation and interest rate on real exchange rate might vary depending upon Torun & Karanfil (2016) country's well-being based on GDP and/or a country's economic and political stability.

In this paper we specifically focused on developing countries for the reasons 1) the availability of data and 2) the limited number of panel studies in this regard. Similar approaches have been used elsewhere. Goldfajn & Gupta (1999), Kraay (1998), Furman & Stiglitz (1998), Gould & Kamin (2000), Chortareas & Driver (2001), Reinhart & Reinhart (2001). However, our sample size captures more time dimensions, and we include many more countries in the data and also we adopt the Pooled Mean Group estimator of model by Pesaran et al. (1999, 2012) as it lends itself well to panel datasets where neither the cross-section dimension *N* nor the time-series dimension *T* are particularly small. Not to mention, it provides both short run and long run estimations. PMG is characterised as an estimator where

long-run parameters are homogenous across individuals (i.e. countries) but short-run parameters are heterogeneous thus allowing dynamics to differ.

In order to investigate the long-run dynamics of the impact of interest rate and inflation on real exchange rate across developing countries, we apply the Pooled Mean Group (PMG) variant for the autoregressive distributed-lag (ARDL) estimator. The PMG estimator has been shown to deliver consistent results if the lag order is specified correctly (Pesaran *et al.*, 2012). We use both Akaike's information criterion (AIC) to determine the number of lag, but due to the number of observation we currently have, we could not go any further than 1 lag. With the general econometric specification below:

$$Y = f(X_i) \quad (1)$$

where Y is dependent and X_i 's are independent variables (inflation rate, INF and interest rate INT) for each i subscript, we write down the following model:

$$\log Y = \beta_1 INF + \beta_2 INT + \alpha_t T + \sum_{i=1}^N \alpha_i C_i + \varepsilon \quad (2)$$

where T is a linear time-trend, and the C_i are country fixed effect dummies for each N country.

In order to specify model (2) into PMG model, it is re-specified into ARDL parameterization to give us equation (3) as follows:

$$\log Y_t = \sum_{k=1}^q \beta_{0k} \log Y_{t-k} + \sum_{k=0}^q \beta_{1k} X_{1k-t} + \sum_{k=0}^q \beta_{2k} X_{2t-k} + \alpha_t T + \sum_{j=1}^N \alpha_j C_j + \varepsilon \quad (3)$$

with q lags which accommodates the possible dynamics as well as mitigating any error autocorrelation in the error term, ε . Equation (3) is then re-parameterised as an Error Correction Model (ECM) as specified by Johansen (1988) and others that allows us to separate out the short-run and long-run effects by stacking the time series observations for each country:

$$\log \Delta Y_t = \Omega(Y_{t-1} - \Pi X_{t-1}) + \sum_{j=1}^p \lambda_j \Delta Y_{t-j} + \sum_{j=0}^p \delta_j \Delta X_{t-j} + \mu + \varepsilon_t \quad (4)$$

This is a standard form of ARDL. This is to make the notation more compact X_{t-1} which is a vector containing the one-lag of dependent variables INT and INF , as well as fixed effects. The vector Π contains the long-run parameters and Ω is the error term that is the average speed of adjustment toward the long-run equilibrium each year. ΔX_{t-k} is the vector of independent variables dependent variables INT and INF , with m number of lags that has been first differenced. By differencing, the model specification allow us to insert dynamic variables with sufficient lags (i.e. p) to ensure there is no autocorrelation in error term, ε . To make equation (4) in an error-correction equation in panel-data form we included i subscripts in the equation and re-write it as follows:

$$\log \Delta Y_{it} = \Omega_i (Y_{i,t-1} - \Pi_i X_{i,t-1}) + \sum_{j=1}^p \lambda_{ij} \Delta Y_{i,t-j} + \sum_{k=0}^p \delta_{ik} \Delta X_{i,t-k} + \mu_i + \varepsilon_{it} \quad (5)$$

This estimation is known as dynamic panel estimators- these are- pooled mean group (PMG), mean group (MG), and dynamic fixed effects (DFE). We used Stata 14's implementation under the `xtpmg...`, `pmg` command. PMG estimator allow for heterogeneous short-run dynamics, homogeneous long-run dynamics; with the MG estimator the long-run parameters (i.e. Π_i) are not restricted across countries; finally with DFE estimator allow for homogeneous short-run and long-run dynamics and restricts the speed of adjustment coefficients (i.e. Ω_i)(Blackburne & Frank, 2007). Amongst all dynamic panel estimators, we will apply DFE as suggested by Hausman test in our model. (Hausman test results are presented in Table 5 and 6 of Appendix1)

5. Results

Before applying Pooled mean group estimator, let us see few results for ordinary least square (OLS), random effect (RE) and fixed effect (FE) for the consistency of these results, and to be able to compare these results with PMG, MG and DFE results. Table 3, represents the first group of estimation results where *INF_CP* is used as an inflation variable as multiple number of scholars did so. Inflation has been found to have an adverse impact on real exchange rate. As well known, the higher the prices of goods or services the higher the inflation rate which result in a decrease in the value of local currency against other currencies resulting exchange rate to rise. In fact, inflation appears to be quite significant in all cases. Interest rate operates the demand for money, thus in the long run a decrease in the demand for money will result in an increase in inflation which eventually will end up increasing the real exchange rate.

When it comes to interest rate (*INT*), it is known to soar the finance charge for the investors that ends up for the investors to search for countries with lower finance charge. Ultimately, this causes capital outflows from the country which eventually results in the decrease in the value of local currency. The negative sign in the output table confirms the theory.

Similarly, Table 7 in Appendix 2 shows the second group of estimation results where *INF_GDP* is taken as inflation variable as robustness checks. In comparison to Table 3, both the signs and the magnitudes of the coefficients in Table 7 show almost alike patterns. The very high significance in inflation verifies the importance of it over real exchange rate comparing to interest rate, which brings new inspection to the literature because interest rate have been of much central factor on real exchange rate. As discussed in Section 4, to be able to investigate the dynamics of the impact of interest rate and inflation on real exchange rate across developing countries, we apply the Pooled Mean Group (PMG) variant for the autoregressive distributed-lag (ARDL) estimator and presented the results in Table 4.

Table 3: Results for OLS, RE and FE (Inflation Variable is: INF_CP)

Variables	(1)	(2)	(3)
INF_CP	-0.00325*** (0.000741)	-0.00329*** (0.000397)	-0.00337*** (0.000416)
INT	-0.00263*** (0.000999)	-0.00143 (0.00135)	-0.000429 (0.00122)
Constant	4.575*** (0.0189)	4.558*** (0.0371)	4.550*** (0.0172)
Observations	176	176	176
R-squared	0.225		0.154
Number of Country		8	8

Model (1), (2) and (3) presents OLS, RE and FE respectively. Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Column 1 and 2 of Table 4 represents the short and long-run results for PMG. Changes in the interest rate or/and inflation might not play an instant role on the real exchange rate, yet it is helpful to investigate for any possible dynamics for the comparison. Column 3 and 4 of Table 4 show the short and long-run results for MG, and finally column 5 and 6 of Table 4 show the short and long-run results for DFE estimators. To start with, error correction term is found to be negative in all cases consistent with error correcting behaviour, and the significance of it proves the long run relationship between dependent and independent variables. As discussed earlier, PMG estimator allows for homogeneity across all panels (i.e. countries sampled) in the long run, and heterogeneous short-run estimations; MG, is similar to PMG estimator and only is preferred if the true model is not heterogeneous by its nature. DFE, however, similar to PMG estimator, which additionally restricts the coefficients of the co integrating vector to be equal across countries sampled, and restricts the speed of adjustment coefficient (i.e. Ω) and provide homogenous short-run estimations. (Blackburne & Frank, 2007). Stata's Hausman test offers a sigma more option that enables us to specify which dynamic estimator to use based on the estimation model. Table 5 and 6 of Appendix 1 presents the Hausman test results; suggestion DFE is the preferred estimator. Starting with PMG results, both inflation and interest rate found to be positive and significant in the short run. This could be explained by the followings: (1) both inflation and interest rate may not have an instant impact on real exchange rate, so long-run results should be taken into consideration, (2) high interest rate allow for cash flows within the country in the short run but it becomes burden on the finance charge for the investors that ends up for the investors to search for countries with lower finance charge. Thus the sudden cash flows will change a direction, which ultimately decreases the value of local currency. This is more or less similar in all short-run results. Looking at the long-run results, however, tell the real story about the relationship between inflation-interest rate and real exchange rate arise. In view of the fact that it might take several years to play out the inflation and interest rate impact on the real exchange rate, interpretations should be carried out as precise as possible. Starting with long-run PMG results, both inflation and interest rate appear to have an adverse impact on the real exchange rate, where only the former is significant at one per cent, and no significance is observed in the error correction coefficient. Moving to the long-run

MG results, again both independent variables oppose with real exchange rate, and based on the significant value of error correction coefficient that they have a long run relationship. With the confirmation of Hausman test (please see Appendix 1) or main estimator is DFE. One per cent increase in inflation will decrease real exchange rate by 0.1 percentage point, and one per cent increase in the interest rate will decrease real exchange rate by 0.2 percentage point.

Table 4: Dynamic Panel Estimators (inflation variable is: INF_CP)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
ec		-0.0128 (0.0605)		-0.256*** (0.0784)		-0.303*** (0.0555)
D.INF_CP		-0.0113*** (0.00337)		-0.00888** (0.00410)		-0.00108* (0.000603)
D.INT		-0.00104 (0.00160)		-4.23e-08 (0.00213)		-0.00175* (0.00104)
INF_GDP	0.0606** (0.0242)		-0.0104 (0.0132)		0.000132 (0.00208)	
INT	0.0932*** (0.0361)		0.00596 (0.0166)		-0.00761** (0.00344)	
Constant		0.0127 (0.202)		1.203*** (0.343)		1.391*** (0.254)
Observations	168	168	168	168	.	.

Model (1) and (2) presents short run and long run PMG estimator; (3) and (4) short run and long run MG estimator and (5) and (6) represents short run and long run DFE estimator. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Few robustness checks are provided in Table 7 and 8 of Appendix 2 confirming the almost alike coefficients only insignificant in DFE results.

6. Conclusion Remarks

This paper investigates the – mainly long-run impact of interest rate and inflation on the real exchange rate by applying dynamic panel estimators namely; PMG, MG and DFE. In the view of the fact that increasing prices of goods or services increases the inflation rate which eventually result in a decrease in the value of local currency against other currencies resulting exchange rate to rise. Also it is known that the increase in the interest rate surges the finance charge for the investors that ends up for the investors to seek for countries with lower finance charge which causes capital outflows from the country resulting in a decrease in the value of local currency. Interest rate and inflation is directly and highly correlated in the sense that, if inflation increases interest rate rises. Interest rate operates the demand for money, thus in the long run a decrease in the demand for money will result in an increase in inflation which eventually will end up increasing the real exchange rate. This is one source of endogeneity in our model, though it expresses the importance of how related all these variables are.

Our panel data estimations confirm the existing theory and empirical finding as such, both interest rate and inflation have an adverse and significant impact on the real exchange rate amongst developing countries for the period from 1993 to 2015- by far the latest data sampled in an empirical model- in the long run. Although short-run results vary, it especially confirms the crucial impact of

inflation rather. Unlike most of the studies, inflation has been of more central key on the variation of exchange rate, this is either by the use of data sample, or methodology used for the first time in this regard. The significance in the error correction term confirms the long-run relationship that dependent and independent variables have.

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Appendix 1

Table 5: HausmanTest Results between MG and PMG

```
. hausman mg pmg, sigmamore
```

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) mg	(B) pmg		
INF_GDP	-.0426732	.0648202	-.1074934	.
INT	-.0445145	.0875597	-.1320742	.

b = consistent under Ho and Ha; obtained from xtpmg

B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

```
chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
          = 81.53
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)
```

The calculated Hausman statistics is 81.53 and is distributed $\chi^2(2)$. Thus, the efficient estimator under the null hypothesis is MG over PMG.

Table 6: HausmanTest Results between MG and DFE

```
. hausman mg dfe, sigmamore
```

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) mg	(B) dfe		
INF_GDP	-.0426732	.0006914	-.0433646	.2202582
INT	-.0445145	-.0073115	-.037203	.2501129

b = consistent under Ho and Ha; obtained from xtpmg

B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

```
chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
          = 0.05
Prob>chi2 = 0.9765
```


The calculated Hausman statistics is 0.05 and is distributed $\chi^2(2)$. Thus, the efficient estimator under the null hypothesis is DFE over MG.

Appendix 2

Robustness Checks

Table 7: Results for OLS, RE and FE (inflation variable is: INF_GDP)

Variables	(1)	(2)	(3)
INF_GDP	-0.00323*** (0.000843)	-0.00321*** (0.000636)	-0.00320*** (0.000662)
INT	-0.00315*** (0.00102)	-0.00225* (0.00131)	-0.00158 (0.00125)
Constant	4.584*** (0.0189)	4.570*** (0.0352)	4.564*** (0.0120)
Observations	176	176	176
R-squared	0.225		0.145
Number of Country		8	8

Model (1), (2) and (3) presents OLS, RE and FE respectively. Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Dynamic Panel Estimators (inflation variable is: INF_GDP)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
ec		-0.0198 (0.0513)		-0.258*** (0.0545)		-0.299*** (0.0568)
D.INF_GDP		-0.0157*** (0.00486)		-0.0106** (0.00452)		-0.000839 (0.000720)
D.INT		-0.0102*** (0.00360)		-0.00448 (0.00405)		-0.00124 (0.00125)
INF_GDP	0.0648** (0.0315)		-0.0427** (0.0207)		0.000691 (0.00225)	
INT	0.0876* (0.0476)		-0.0445* (0.0236)		-0.00731** (0.00360)	
Constant		0.0381 (0.171)		1.231*** (0.248)		1.371*** (0.260)
Observations	168	168	168	168	.	.

Model (1) and (2) presents short run and long run PMG estimator; (3) and (4) short run and long run MG estimator and (5) and (6) represents short run and long run DFE estimator. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

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Itinerary and Localization Study about Byzantium - Crimea Route (Ottoman's Right-Hand) and Connected Ancillary Roads

Erdener PEHLIVAN¹

Keywords

Roman Road,
Thracia, Byzantium.

Abstract

There are two routes which makes reaching northern regions available, through Eastern Thracian Region. The first of these routes reaches Crimea by following seaside of Black sea shoreline. The other, which was probably used in times when the first route was not available, is the one passes through Vize county of Kırklareli province. It is a tangible reality that both of these routes have utmost importance upon trade of Crimea and thereby northern Black sea. The first mentioned route can be considered as a coastal road provided the commerce of that period is taken into account. Because coastal road passes through more localization. Apart from these routes, other ancillary roads formed vertically from north to south in Thracian region are forming the topic of this study as well. One of the ancillary roads is starting from Hadrianoupolis reaching to Traianoupolis parallel to Hebros (Meriç River). The importance of this road over Aegean Sea trade and logistics of inner parts of Thracian region, contributes to topic of this study too. With the solid data presented by these routes, both Romanization expansion and the commerce structure of the region are aimed to be perceived.

Article History

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1. Introduction

Byzantium – Crimea road, which named as right hand of Ottoman, submits military and commercial attribution (Avramea, 1999: 5; Pehlivan, 2010: 57). It is known that although the roman roads generally were commercial attributed during the Republic period, military side had become heavier since 148 B.C.

After increasing the importance given to regions in the eastern part of Roman Empire around 2nd century A.D., the road became actively in use. Along with the separation of Eastern and Western Rome in 4th century A.D. the management of the road fell under the Eastern Rome. Dating from 7th century A.D. security level of this route was minimized along with other routes. After the existence of Ottoman Empire in the region, security level started to rise up again.

2. Byzantium – Crimea Black Sea Coastal Road (Ottoman Right Hand)

Byzantium (İstanbul), which is located south on Crimea road and at the same time starting point of it, was founded on the peninsula called Sarayburnu today, by Megarians with the leadership of Byzas in 660-658 B.C (Pehlivan, 2010: 57). In

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512 B.C. the city fell under the hegemony of Persians during the Scythian campaign of Darius I. It joined the first Attika – Delos Sea Union founded in 478 B.C. Besieged by Philippos II in the years between 340 and 339 B.C., the city had huge damage. Due to its tuna fish and grain export which took significant importance in the city's economy, they recovered from that damage in no time. After 146 B.C. city has become Roman and in 74 B.C. it became a part of Bithynia state. In the Vespasianus period (69-79 A.D.) it had to pay tribute to Roman governor. In 193 A.D. the city was besieged by Septimius Severus and after 2.5 years of siege surrendered. After huge destruction, city fell under command of Perinthos (Marmara Ereğlisi). In 324 A.D. after Constantinus took the throne, city became to return its former glory and became presidential center of Eastern Roman Empire in 328 A.D. (Pehlivan, 2010: 57).

The following settlement on the route is Timaea (Foss, 1995: 792). There is not enough data to prove localization in this settlement which called Rumeli Kavağı (probably meant border control point at Ottoman period) today. The next localization on the route to the north is Panion (Rumeli Lighthouse) (Sayar, 2002: 99). Bosphorus is located at the far north end of Thrakios. Many architectural elements have been found in the region. It is known that there is Apollon Temple across the Kyanei crag (Atasoy, 2007: 1180). Route follows Pontos Eukseinos shore towards northwest and reaches Delkos (Terkos/ Durusu). Around this localization a settlement surrounded by fortification is detected (Sayar, 2002: 99). This fortress most probably was an outpost of Thrakia region defense. The following location on the route to the northwest is Phileia (Karaburun). This settlement is emporion of Delkos (Sayar, 2002: 101). No archeological finding detected (Atasoy, 2007: 1180). Following the route Scylla and Podima (Yalıköy) can be reached. These two settlement were probably mutatio (horse changing station). After this point the route goes towards north till Salmydessos/Midea (Kıyıköy/Midyе). Here at the shore of Black Sea a rock monastery, dated back to early Byzantium, is found. This localization were under hegemony of Thracians for a long time. The route reaches Thynias (İğneada), the last settlement inside Turkey borders, while following north. One of the strong clans of Thracians, Thynias lived in this region. The route follows north after this point and reaches Crimea.

3. Byzantium- Crimea Road (Bizye Road)

This route follows more terrestrial line and ignores the sea line. From starting point of Byzantium, it goes to west and reaches Yarumburgaz Cave named Melantias. This localization is located inside of Küçükçekmece County of Istanbul. Located north of Küçükçekmece Lake, this settlement consists of two caves. Inside of the caves settlements from lower paleolithic age to Byzantium age can be seen. Upper cave used as a chapel in the medieval age. 2 km towards northwest from the caves, an Ottoman bridge helps us to have thoughts about Roman age route (Bar. Atl., 2000: pl. 52).

Following the northwest on the route, location named Ad Statuas is reached. Ad Statuas is located in 7 km northwest of today's Çatalca County of İstanbul. In this settlement salvage excavations were carried out by Istanbul Archeology Museum Directorate. As a result of these excavations Roman age graves, aqueducts and some parts belong to road paving (Özdoğan – Koyunlu, 1986: 11; Sevin, 2003: 8,

Pehlivan, 2010: 59). When grave foundlings evaluated contextually, we can say that Ad Statuas had settlement since 3rd century B.C.(Pasinli, 1997: 77; Pehlivan, 2010: 59).

Route reaches Caenophrurium, following the northwest. Caenophrurium can be located in the vicinity of Sinekli Town, located northwest of Silivri (Bar. Atl., 2000: pl. 52). Since there are no deep archeological researches made in the area, any archeological material couldn't be detected.

Following northwest on the route the next settlement is Utsurgae. It is a localization near Saray County of Kırklareli Province (Bar. Atl., 2000: pl. 52). Like the previous one there are no researches made deeply in the area, exact location of the settlement couldn't be detected.

After this location route slightly turn to north and reaches Bizye. Bizye is a settlement located inside Vize County of Kırklareli Province and was the center of Ast clan of Thracians. It fell under the command of Romans in 144 A.D (Sayar, 1993: 159). Owing to archeological researches in Vize many tumulus dated back to late Roman Era and many archeological foundlings were came across dated back to Byzantium and Ottoman Era(Ertuğrul, 1999: 475-480).

Qaranta Eklissies is another settlement we came across along the route. Also called as Sarantha Eklissies, this settlement is correspond to Kırklareli City center today. The meaning of the name is forty churches. After 1923 the settlement has been named as Kırklareli (Akın, 1997: 9-10). In archeological studies carried out in various periods, some tumulus belong to 5-4th century B.C. were detected (Atasoy, 2007: 1190).

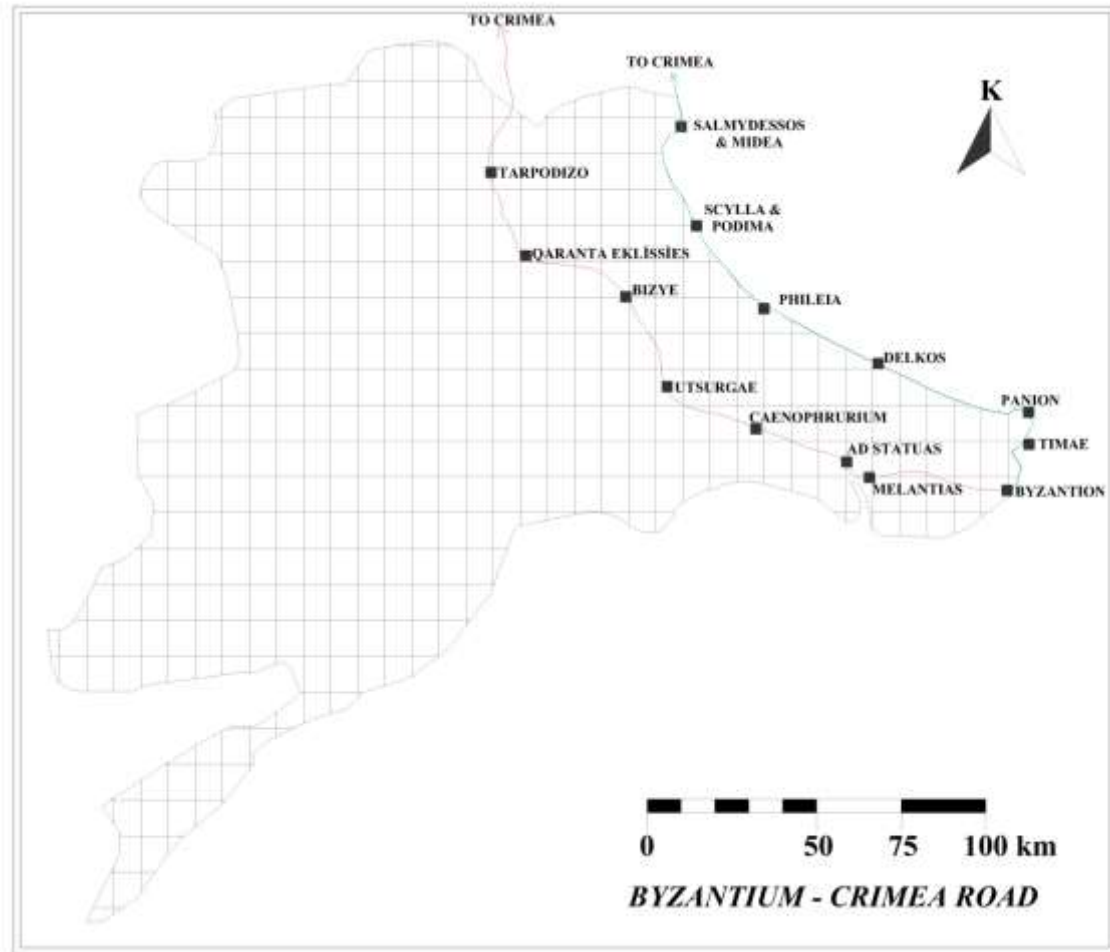
The route heads to north from this point and reaches Torpodizo located on the Istranca Mountains. It is in the vicinity of Kofçaz, however, due to the density of forest in the area and lack of archeological researches, the exact location of the settlement couldn't be confirmed. From this location going to north, route intersects the shore-line route right outside of the Bulgarian border and goes on towards Crimea (Atasoy, 2007: 1190).

Along with these two route which follow southeast to northwest direction, there are other ancillary roads from south to north inside Thracian region.

The first one of these roads is the route that connects Via Militaris and Via Egnatia. This route begins from Hadrianoupolis and reaches to Traianoupolis. Settlements along the route in the order from north to south, Plationoupolis is located at south of Hadrianoupolis. This settlement is located in Dimetoka in today's Greece borders (Pehlivan, 2010: 62). South of Plationoupolis Zervae/Zirnae is located. This settlement is located in Kornofolea in today's Greece borders as well (Pehlivan, 2010: 62). At south Dymae and Droikos can be reached but their locations are not exact (Pehlivan, 2010: 62). Route reaches Ainos after this point and Ainos corresponds to Enez town center, located south of Edirne Province. Owing to its geopolitic location, Ainos is an important location which has always been settled since 6500 B.C. The city has two harbors. This only along with other features provides us essential data about city's importance on sea trade. Textile products, vine and fish from Gala Lake, which is in the hinterland of the city, were

main export products. Another important point of the geopolitics of the city is its location over the estuary of Hebros River. This shows us that the river is also used for transportation of the products from north to south, alternatively to the land route. Herodotus narrates that the city were colonized by Aiolis in 7th century B.C. Fell under the hegemony of Persians in 5th century B.C., the city joined Attika – Delos Sea Union in 4th century B.C. (Borza, 1995: 779).

Map 1. Byzantium – Crimea Road



4. Conclusion

The routes in this study which connect Thracian Region and thus Byzantium to an important location north of Black Sea, Crimea, essentially targeted trading raw materials and end products, yet another ancient mission of the road networks is carrying ideas. Therefore it won't be a mistake to say that this regional road network played an important role in carrying Romanization idea to the capillary points of empire. We can exemplify this importance with the existence of two different route connection with Crimea and when the one follows the shore line of Black Sea couldn't be used in winter periods, it makes the other interior route available which goes all the way inside of Thracian region. Moreover the routes had huge traffic in Roman period and used afterwards, then the shore line route called as right hand in Ottoman Empire period.

Thracian geography, where many great empires prevailed, witnessed many battles (Halaçođlu, 2002: 113). It is possible for us to say that in archeological point of view many data lost as a result of these battles. Besides, as a result of urbanization with intense immigration after 1970s, İstanbul and vicinity faced another threat to lose archeological foundlings which survived aforementioned battles. Urban archeology implementations in the region will provide opportunity to obtain more data about its history and this will strengthen the tangible data about the region's history.

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A Research on the Lute and Lute Family Members

Cem ÇELIKSIRT¹

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Theorbo, Oud.

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Abstract

Through this reserch I will give out information about „Ancient Music“ and groups who decided to perform those music with Lute and It's hybrid family members. Lute used to be an irreplaceable part of the orchestra where the lute player sat right next to the conductor (in front of Cello or besides Singers). In course of time lute players lost their jobs to Harpsichord ond Organ. Modern instruments and large concert halls caused lute to be excluded from the orchestras. With it's rich solo and chamber music repertoire lute has never been forgotten or sunk into oblivion. Through „ancient music“ movements especially in the recent century instruments like Lute and Mandoline has again had the chance to came to light.

Lavta Ailesi ve Üyeleri Üzerine Bir Araştırma

Anahtar Kelimeler

Lavta, Eski, Müzik,
Theorbo, Ud.

Makale Geçmişi

Alınan Tarih
07 Ağustos 2019
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Özet

Bu araştırmada özellikle son yıllarda hareketlenen „eski müzik“ ve bu müzikleri çalmak için oluşan müzik topluluklarında yer almaya başlayan Lavta ve çeşitleri üzerine bilgiler veriyorum. Eski dönemlerde orkestraların vazgeçilmez bir üyesi olan ve genelde orkestra şefinin sağ yanında oturan (viyolonsel için önünde veya şancıların yanında) Lavtacılar zamanla klavsen ve org gibi enstrümanlara işlerini kaptırmışlardır. Modern enstrümanlar ve büyük konser salonları ile birlikte tınısal yetersizlikleri de orkestralardan yavaşça dışlanmalarına sebep olmuştur. Çok köklü bir solo ve oda müziği repertuarına sahip olan Lavta hiçbir zaman unutulmamış ve tarihe gömülmemiştir. Özellikle 2000'li yıllarda ön plana çıkan „eski müzik“ hareketlenmeleri sayesinde Mandolin ve Lavta gibi enstrümanların tekrar gün ışığına çıkmasına fırsat doğmuştur.

1. Giriş

Lavta, her ne kadar bir Avrupa enstrümanı olarak bilinse de temelini Türk ve Arap ülkelerine dayandığı bilinmektedir. Türk Sanat Müziği çalgısı olarak da benimsenmiş olan Ud'dan türediği ve hatta Fransızca'da „L'Oud“ olarak adlandırılmış olup Avrupa'daki bugünkü adını da bu kelimedenden aldığına inanan teoriler vardır.

Ud (Türkçe) + L'Oud (Fransızca) = Lute (İngilizce), Laute (Almanca), Liuto (İtalyanca), Alaud (İspanyolca)

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Çok basit düşünülduğünde, Lavta, ses araklarını sabitlemek için Ud'un perde eklenmiş halidir. Elbette hem yapım hem de armonik fikir ve temel olarak çok farklı kültür ve geçmişe ait enstrumanlar olduklarından ötürü bu şekilde basit bir genelleme yapmak doğru olmaz.

Gösterim 1: Lavta ve Ud



Lavta

Ud

2. Ud

Mızrap adı verilen ve uzun yumuşak bir plastik yardımı ile çalınan Ud, 1 tek ve 5 çift telli olacak şekilde toplamda 6 telli bir çalgıdır. En kalın teli dışında (La teli) çift tellidir (Yani her telden iki adet bulunur ve aynı anda çalınır), telleri 4'lü aralıklar oluşturacak şekilde tasarlanmıştır. İsiminden ötürü Arap enstrumanı olduğuna inanılır. Farklı bir teoriye göre Arapların, 7. yüzyılda Horasan'dan Bağdat'a çalışmak için gelen Türk işçilerin ellerinde gördükleri ve göğsünün yapılmış olduğu sarısabır ağacından ötürü 'el Oud' adını verdikleri fakat enstrumanın kökünün Türklere ve Kopuz'a uzandığı düşünülmektedir. Buna benzer ve kökenine inmanın neredeyse imkansız olacağı tartışmalar Yunan-Türk veya Arap-Türk mutfağında da karşımıza çıkar. (Örneğin Döner-Gyros-Schwarma)

3. Lavta ve Türevleri

Lavta'nın kesin çıkış tarihi tam olarak belirlenemese de 1095 - 1272 yıllarında gerçekleşen haçlı seferleri sırasında Türk veya Araplar'dan, Ud olarak Avrupa'ya ulaşmış olabileceği ve sonrasında kendi evrimini yaşamış olabileceği düşünülmektedir.

Ud'un Avrupa'daki ilk görsel kanıtları 9. yüzyılda Moors adı verilen Arap Müslümanları tarafından İspanyollara takdim edilirken görülmektedir. Lakin 13. yüzyıldan önce kendisini fiziki olarak Arap Ud'undan ayıran Avrupa Lavta'sına dair herhangi görsel bir kanıt bulunamamıştır. 1283 yılında Alfonso X tarafından sipariş edilen Libro de Juegos (Oyunlar Kitabı) isimli kitapla ilk Avrupa Lavtası örneği sayılabilecek bir illüstrasyon bulunmaktadır. Bu örnekte perdeli ve Ud'dan çok Lavta'yı anımsatan bir burgulukla resmedilmiş Hristiyan bir kadını bu enstrumanı çalarken görüyoruz. Halbuki tarihte bulunan önceki örneklerde bu tarz enstrumanları Müslüman kadınlar çalarken resmedilmişlerdir.

Gösterim 2: Enstrüman Çalan Kadınlar



Oyunlar Kitabı, 1283

Lavta, Avrupa'da ilk ortaya çıkışından beri süregelen bir değişim ve gelişim içerisinde olmuştur. Bu değişiklikler genellikle tel uzunluğu ve tel sayısı üzerinde yoğunlaşmıştır. Orta çağlarda 4 telli iken Barok dönemde 13 – 14 tele kadar uzanan değişiklikler yaşamıştır. Ortaçağ döneminden kalan enstrüman ne yazık ki olmadığından ötürü tarihte bulunan yazılı tanımlamalar sayesinde bu enstrümanın Ud gibi sert bir mızrap ile çalındığı düşünülmektedir.

Gösterim 3: Lavta Görselleri



4 Course Lavta, Ortaçağ



8 Course Lavta, Rönesans Dönemi

15.yüzyılda çoğunlukla 5 telli Lavtalar karşımıza çıkıyor. Bu dönemde Lavta'nın temel görevi şarkıcılara eşlik etmektir. Rönesans döneminde gelişen Polifoni ile birlikte Lavtalara 6. bir tel daha eklenmiş ve bu dönemde Lavtacılar mızrap yerine sağ el parmaklarını kullanmaya başlamışlardır. 16. yüzyılın sonlarına doğru 7 telli lavtalar daha popüler olmuştur ve yine aynı dönemde 8 hatta 10 telli lavtalara sıkça rastlanır olmuştur.

Lavta'nın „Continuo“ (Sürekli Bas) enstrumanı olarak kullanılmaya başlanması bu enstruman üzerinde çeşitli deneysel değişiklikler başlamasına yol açtı. Aşağıdaki görsel örnekte Lavta'yı, Klavsen ve Kontrbas'a sürekli bas desteği yaparken görüyoruz.

Gösterim 4: Barok Orkestra Üyeleri



Seslerin daha uzun ve gür çıkması için tel uzunluğu ve gövde genişliği gibi değişiklikler yapılmaya başlandı. Lavta ailesinin hızla genişlemesine sebep veren bu yeni enstrumandan günümüze kadar ulaşmayı başaranlara örnek verebileceklerimiz arasında Arcilute ve Theorbo gelmektedir.

Gösterim 5: Theorbo ve Archilute



Theorbo



Archilute

17.yüzyıl sonlarında Lavta, Fransa'da şancılar için öngörülen eşlik enstrumanı olmasının yanı sıra solo enstruman olarak da kendisini ispatlamıştır.

10 telli lavta Rönesans döneminin ve erken Barok dönemin zirvesini temsil edebilecek bir enstruman olarak kabul edilmiştir. Hollanda, Fransa, İngiltere ve diğer pek çok Avrupa ülkesinde bu enstruman önde tutulurken İtalyanlar Theorbo'yu tercih etmişlerdir. Ne yazık ki solo enstruman olarak hiçbir zaman Lavta'ya yaklaşamamış ve eserleri modern gitar repertuarında yerini alamadığı için sadece dönem enstrumanlarıyla ilgilenen uzmanlar arasında kalmış fakat unutulmamıştır.

Gösterim 6: 10 Course Lavta



4. COURSE nedir?

Course, lavta'da kullanılan tel sayısı ve akort sistemine verilen isimdir. Chantarelle adı verilen en ince tel genellikle tek ve geriye kalan tüm teller çifttir. (Archilute ve Theorbo bu genellemenin dışında kalan enstrumanlardır). Aşağıda en çok

kullanılır lavta akort sistemini görebilirsiniz. 2., 3. 4. ve 5. course'lar unison olarak akort edilmiştir yani teller aynı oktavda tınlarlar. 6. course ve sonrası iki tel arasında 1 oktav olacak şekilde akort edilir.

Gösterim 7: 10 Course Lavta akort sistemi



5. TABLATUR nedir?

Tablatur, telli çalgılarda kullanılan bir notasyon sistemidir. Notalardan oldukça farklı olmasına rağmen neredeyse aynı sistemle çalışır. Telli ve yaylı çalgılarda bir nota aynı oktavda kalmak suretiyle 3 veya daha pozisyondan çalınabilir. Bu durum deşifre ve tercih süresini uzatmakla beraber yorumcu için zorlayıcı bir süreç olabilir. Çoğu modern müzik notasında „duate“ adını verdiğimiz ve „parmak numarası“ olarak bilinen, hangi parmakla hangi notaları çalacağımızı gösteren sayılar bulunmaktadır. Fakat eski el yazmalarında ve edisyonlarda böyle bir yardım çoğunlula mevcut değildir. Lavtacılarının günümüzde dahi kullandığı sistemi tablatur olarak genellemek hiç de yanlış sayılmaz.

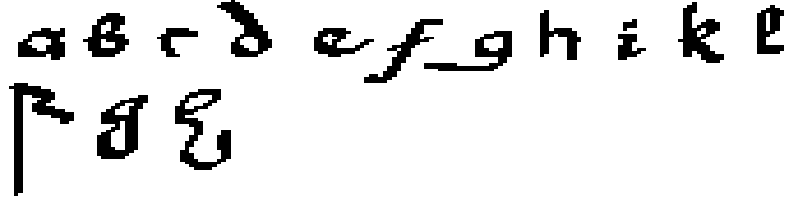
Tablatur, aslında porte edini verdiğimiz müzik çizgilerinin üzerine nota yerine sayı veya harf yazılarak lavta'nın hangi telinde hangi perdeyi çalacağımızı gösteren basit bir sistemdir. Sonradan 6 çizgili sadece Tablatur yazmak için tasarlanmış sistemler de geliştirilmiştir.

Gösterim 7: Şan ve Lavta Tablatur Sistemi

A historical manuscript page showing a lute piece. The page features a large, ornate initial 'L' on the left. The main text is written in a medieval script. Below the text, there are two systems of tablatur notation. Each system consists of a single staff with a treble clef and a key signature of one flat. The tablatur notation is written in a simple, blocky font. The first system of tablatur is for the first system of the piece, and the second system is for the second system. The text between the two systems of tablatur is: "no and a haye nonic nonic no , That o're the green comè fields did passe in spring ti".

Elbette farklı ülkelerde farklı enstrümanlar kullanıldığı gibi farklı tablatur sistemleri de geliştirilmiştir. Yukarıdaki Tablatur'da görmüş olduğumuz harflerden en üstteki çizgide yer alanlar lavta'nın en ince yani 1. telini (Fransız Sistemi) veya 6. telini (İtalyan Sistemi) ifade ediyor olabilir. Elimizdeki tablaturun kaynağından emin değilsek iki sistem arasındaki farkı anlamamanın en hızlı yolu denemektir. Her iki sistemde de harfler aynı şeyi ifade etmektedir;

Gösterim 8: Tablatur sisteminde kullanılan harfler

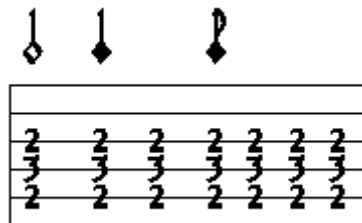


„a“ harfi boş teli ifade etmek için kullanılır. Ardından sırasıyla „b“ (1. perde), „c“ (2. perde), „d“ (3. perde), „e“ (4. perde), „f“ (5. perde), „g“ (6. perde), „h“ (7. perde), „i“ (8. Perde), „k“ (9. Perde) ve „l“ (10. perde) harfleri gelir. „j“ harfi kullanılmaz ve „c“ harfi genellikle modern „r“ gibi görünür fakat „r“ harfi değildir. Rönesans döneminde bu şekilde yazıldığında, „e“ harfinden daha iyi ayırt edilebildiği için tercih edilmiştir. Yukarıdaki şekilde, ilk sıra a'dan l'ye kadar olan harfleri ve ikinci satırdakiler ise „f“, „g“ ve „h“ harflerinin eski el yazmalarında bulunun varyantlarını gösteriyor.

Notaların çalım süresi ise Tablatur sisteminin üzerinde modern nota sistemindeki gibi yer alır. Eğer yazılan notanın süresi değişmiyorsa ardından gelen notanın üzerine süre belirtisi yazılmaz. Yukarıdaki Tablatur örneğinin 2. satırının 2. ölçüsüne bakarsak ilk „a“nın üzerinde 16'lık süre ifadesi görebiliriz. Fakat ardından gelen e, f, e ve c notalarında süre belirtilmemiştir. Bu hepsinin 16'lık olarak çalınacağını ifade eder. Tablatur'da polifonik ritm yoktur. Uzaması gereken notalar bağ şeklinde görünün zigillerle ifade edilir ve süre ifadeleri dikey olarak aynı sıra üzerindeki tüm harfler (notalar) için geçerlidir.

İtalya Sistemi'nin tek farkı herşeyin ters düz olması dışında harfler yerine sayılar kullanılmasıdır. Yani boş teli ifade etmek için 0 ve 3. perdeyi ifade etmek için 3 sayısı kullanılır. En alt çizgiye yazılan sayılar lavta'nın en tiz telini ifade eder.

Gösterim 9: İtalyan Tablatur Sistemi



Bunların dışında kalan ve nadir kullanılan bir tab sistemi ise Alman Org Tablatur adı verilen daha karışık bir tablatur sistemidir. Lavta repertuarında bunun örneği Johann Sebastian Bach'ın Prelüd, Füg ve Allego isimli BWV 998 numaralı eserinde karşımıza çıkar. Bach bu eserin son bölümünde sayfada yer kalmadığı için eserin finalini Alman Org Tablatur sistemi ile tamamlamıştır. Notaların Almanca isimleri, oktavlarını ve sürelerini belirleyici simgeler kullanarak yazılır.



6. Sonuç

Günümüzde hala barok orkestralarda ve solo enstruman olarak kullanılmakta olan bu tarihi müzik aleti hem eşsiz tınısı hem de kafa karıştırıcı görüntüsü ile „eski müzik severleri“ etkilemeye devam etmektedir. Türkiye'de de yavaş yavaş yayılmaya başlayan lavta kullanımı küçük barok gruplar kurulmasını ve temelde gitaristlerin bu enstrumana daha fazla ilgi duymalarını sağlamaktadır. Bir öğretim üyesi olarak konservatuvarlarımızda bu enstruman için özel kontenjanlar açılabilmesi en büyük arzularım arasında yer almaktadır.

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The Effect of Electricity Consumption on Economic Growth in Turkey

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Keywords

Electricity
Consumption,
Economic Growth,
Sustainability.

Abstract

The energy consumption rate of the developed countries, is high compared to other countries, the economic growth of countries such as Turkey aims, electricity generation and give weight to use, will facilitate the achievement of the desired economic growth. Over time, the use of renewable secondary energy sources is increasing due to increased sensitivity to the environment and sustainability. It is observed that there is a significant increase in the use of electricity, which is one of the renewable secondary energy types. In developing countries in which Turkey is also, of electricity revealed that increasing the use of many studies, literature is added to every day. Thanks to the increase in the use of electric energy in the industry, goods and services produced by the use of electric energy within the national income also increase and the use of electric energy, a renewable secondary energy source, increases the national income. Thus, the increase in the use of electrical energy contributes to the increase in economic growth. In this study, the increase in electricity consumption in Turkey has tried to expose the relationship between economic growth. In 2000-2014 period, the relationship between electricity consumption and economic growth in Turkey were examined. As determined in many studies on this subject; a remarkable relationship was found between electricity consumption and economic growth.

Article History

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1. Introduction

Today, an important indicator of development is the increase in energy use. While industries are trying to respond to increasing demand by using more energy, people live in brighter cities and prefer a more energy-dependent lifestyle. It is one of the most important factors that increase people's dependence on energy in the developments in the field of computer and communication.

However, the most fundamental problem is the energy we achieve with a more comfortable lifestyle with the increase in usage, how we obtain it and whether it has sustainability. This important problem has made energy and the sources from which energy is obtained become the most important issue of today's world. As a result of this situation, it is observed that the countries that control energy

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resources have become more important both economically and politically and they are effective and determinative in drawing the world's eco-political route.

Today's societies, besides giving importance to energy, are also conscious about the selection of energy resources. Contemporary societies do not have the magic of a more comfortable and enlightened life, but also attach importance to the choice of environmentally sensitive and renewable energy sources and technologies in the selection of energy sources. The awareness that economic growth that can be achieved in this way is more valuable is increasing with each passing day. In fact, in many studies conducted within the field of energy economics, which has become a sub-discipline of the science of economics, it is also believed that it is a condition for countries to have renewable and environmentally sensitive, sustainable energy sources and to use this energy efficiently and to achieve a higher standard of living.

In the world, ecological balance is at risk because industries do not pay enough attention to the use of renewable energy sources. Primarily, primary energy sources are used which are indisputable to the environment. As a result of this situation; resource and environmental balance; and endangering sustainability. However, renewable energy sources, including electricity, do not harm the ecological balance and contribute to the transfer of resources to future generations.

Energy sources can be classified as primary and secondary energy sources. Primary energy sources are coal, crude oil, natural gas, wind, sunlight, water power, while secondary energy sources are energy sources obtained or transformed by using primary energy sources, one of the most characteristic examples of which is electrical energy.

Primary energy sources are divided into two subgroups according to whether they are renewable or not. While species such as solar, wind, wave, geothermal energies are renewable energy types, energy types such as crude oil and natural gas are non-renewable.

A significant part of the basic energy resources used by industries today are non-renewable primary energy sources such as crude oil and natural gas.

The fact that should not be forgotten is that; It is also time for renewable and secondary energy sources to take into account the necessity of being an alternative to fossil fuels and to make the necessary transformations. Although the use of hybrid systems in many sectors can be regarded as pioneering steps in this process, it is difficult to argue that these efforts are sufficient. Nowadays, the importance of electrical energy, which is a secondary energy source with its environmental sensitivities and its size as an alternative to fossil fuels, is increasing day by day.

The use of electrical energy, which is the secondary energy source obtained from renewable energy sources, in both industry, leads to economic growth; and it will contribute to economic development by spreading its use in daily life.

In this regard, many scientific studies have been conducted for many countries and the relationship between economic growth and the use of electrical energy has

been tried to be put forward. The relationship between the use of electrical energy and economic growth has been investigated for our country in many periods.

2. Literature

R. Ferguson is the first of many studies on the relationship between economic growth and electricity consumption. It examined the relationship between electricity consumption and economic development in many countries and showed that there is a strong relationship between these two variables (Ferguson, et al., 2000).

Studies in this field are different from each other, either in terms of the period of time in which they are dealt, or in terms of differences in the place of use of electrical energy (residential, industrial, etc.). For example, in some studies, the relationship between electrical energy consumption and economic growth used in housing has been examined, and in some, the relationship between electrical energy consumption and economic growth in industry has been examined. In many of them, no such distinction has been made, and the relationship between total electricity consumption and economic growth has been examined in a holistic manner over a period of time.

Akarca and Long (1980) followed the study by Kraft and Kraft (1978), which revealed the relationship between energy use and economic growth. Stern (1993) added energy to production function in his study and made an important contribution to the studies in this field.

Ghosh (2002), in his study for India for 1957-1997, examined the relationship between economic growth and electricity consumption, from economic growth to electricity consumption, has identified a one-way causality.

Many researchers, such as Shiu and Lam (2004), Thoma (2004), Morimoto and Hope (2004), have conducted similar studies, and have obtained conclusions that the use of electric energy affects economic growth.

In a study published in 2007 for Bangladesh, Mozumder and Marate and Squalli (2007) concluded that economic growth affects the use of electricity for 11 OPEC countries. However, there are fewer studies in this direction than others. Studies mostly show that electricity use affects economic growth.

When viewed between 1950 and 2000 for Turkey, Altınay and Karagöl (2005) has dealt with the relationship of GDP and electricity consumption, electricity consumption from GDP to have found one-way causality.

When viewed between 1970 and 1990, Murry and Nan (1996), Turkey has been studied in 15 countries that also.

Terzi (1998), who examined the Engle-Granger cointegration method between 1950 and 1991, for Turkey, examined electricity consumption individually in terms of various consumer groups (housing, industry, etc.) and found a long-term relationship between these variables.

In addition to the study of Yamak and Güngör (1998) between 1951 and 1994, Bakırtaş et al. (2000) the period of 1962-1996, Sarı, Soytaş and Özdemir (2001) of the period of 1960-1995, Nişancı (2005) of the period of 1970-2003, Erdoğan

(2006) of the period of 1984-2004, Halıcıoğlu (2007) of the period of 1968-2005, Karagöl, Erbaykal and Ertuğrul (2007) discussed the periods of 1974-2000 in their studies.

Turkey, until the 2000s, the economy is performing an average 4 percent growth, electricity consumption increased on average by 8%. While electricity consumption per capita has been 452 kWh since 1980, this figure was 1687 kWh in 2004, compared to 8600 kWh, which is the average of OECD countries. (Karagöl et al., 2007)

For Turkey, the common determination of all the work, total dwellings and the industry electricity consumption is a long-term relationship between economic growth and the electric energy consumption in the industry is that it acted with economic growth. However, the relationship between electricity consumption and economic growth is only a two-way causality. (Kar, 2001)

In almost all studies in the literature, the existence of the long-term relationship between electrical energy consumption and economic growth was determined by Johansen Cointegration Test, and the causality and direction were determined by Granger and Vector Error Correction Mechanism (VECM).

3. Method and Data

In this study, Total Electricity Consumption (ELEK) and GDP (BUY) data were taken from TUIK database. The annual data used in the study covers the period 2000-2014.

Table1. Sectoral share of electricity consumption in Turkey

Year	Total GWh	Residential	Commercial	Official	Industrial	Lighting	Other
2000	98296	24,3	9,5	4,2	49,7	4,6	7,7
2001	97070	24,3	10,2	4,5	48,4	5	7,6
2002	102948	22,9	10,6	4,4	49	5	8,1
2003	111766	22,5	11,5	4,1	49,3	4,5	8,1
2004	121142	22,8	12,9	3,7	49,2	3,7	7,7
2005	130263	23,7	14,2	3,6	47,8	3,2	7,5
2006	143071	24,1	14,2	4,2	47,5	2,8	7,2
2007	155135	23,5	14,9	4,5	47,6	2,6	6,9
2008	161948	24,4	14,8	4,5	46,2	2,5	7,6
2009	156894	25	15,9	4,5	44,9	2,5	7,2
2010	172051	24,1	16,1	4,1	46,1	2,2	7,4
2011	186100	23,8	16,4	3,9	47,3	2,1	6,5
2012	194923	23,3	16,3	4,5	47,4	2	6,5
2013	198045	22,7	18,9	4,1	47,1	1,9	5,3
2014	207375	22,3	19,2	3,9	47,2	1,9	5,5

Source : www.tuik.gov.tr. 2019

Table 2. Total Electricity Consumption (GWh)

Total Electricity Consumption (GWh)	
2000	98295,7
2001	97070,0
2002	102947,9
2003	111766,1
2004	121141,9
2005	130262,8
2006	143070,5
2007	155135,3
2008	161647,5
2009	156894,1
2010	172050,6
2011	186099,6
2012	194923,3
2013	198045,2
2014	207375,1

Source : www.tuik.gov.tr. 2019

Economic growth is the positive increase in the national income generated per country and the amount per capita from one year to the next. In other words, GDP is the real increase in one year period.

Economic Growth is calculated as the annual rate of change of GDP. Economic growth increases as a result of the increase in production of national income (Arrow, 1995). Economic growth can also be in the form of increasing the limited resources of countries and expanding the limits of production opportunities (Üstünel, 1975: 64).

Table 3. Real Gross Domestic Product (Turkey) (2000-2014)

AR	Constant prices		Current prices		Deflator	Economic Growth (%)
	(National currency) (Billions)	(Percent change)	(National currency) (Billions)	(U.S. Dollars) (Billions)	(Index)	
2000	731.577	6.640	170.667	273.085	23.329	6,8
2001	687.958	-5.962	245.429	200.305	35.675	-5,7
2002	732.195	6.430	359.359	238.342	49.080	6,2
2003	773.259	5.608	468.015	311.944	60.525	5,3
2004	847.834	9.644	577.024	404.853	68.059	9,4
2005	924.223	9.010	673.703	501.163	72.894	8,4
2006	989.933	7.110	789.228	550.796	79.725	6,9
2007	1,039.731	5.030	880.461	675.010	84.682	4,6
2008	1,048.519	0.845	994.783	764.643	94.875	0,7
2009	999.192	-4.704	999.192	644.470	100.000	-4,7
2010	1,083.997	8.487	1,160.014	772.290	107.013	9,2
2011	1,204.467	11.113	1,394.477	832.497	115.775	8,8
2012	1,262.160	4.790	1,569.672	873.696	124.364	2,2
2013	1,369.334	8.491	1,809.713	950.328	132.160	3,3
2014	1,440.083	5.167	2,044.466	934.075	141.969	5,2

Source : www.imf.org., World Economic Outlook (April 2019) Real GNP Growth.

Stability and causality tests were conducted using eViews. Generalized Dickey-Fuller (ADF) test was used for stationary analysis of variables. Total Electricity Consumption and GDP data from variables I (1) were also stabilized.

Failure to maintain stability in the series used in similar studies poses the risk of encountering situations such as false regression. Therefore, the stability of the series must first be determined.

Granger causality shows the correlation between the current value of one variable and the historical values of other variables. This does not mean that changes in one variable are the cause of the change in the other.

The Granger causality test was calculated in the E-Views program using the following equations.

$$LBuy_t = \sum_{i=1}^n a_i LBuy_{t-1} + \sum_{i=1}^n a_i LElek_{t-1} + \varepsilon_i$$

$$LElek_t = \sum_{i=1}^n a_i LElek_{t-1} + \sum_{i=1}^n a_i LBuy_{t-1} + \varepsilon_i$$

The direction of causality relationship was measured by Granger causality analysis. The increase in GDP can be explained by Total Electricity Consumption.

In the F Test, the significance of the delay in the independent variable is demonstrated by comparison with the others. This assessment is important for Granger causality.

The explanatory power of the installed model is measured with R². R² value of the established model was found to be 0.917911. Accordingly, approximately 92% of the changes in GDP are explained by the independent variables included in the model. The remaining 8% concentrates on the error term. The overall significance of the model is understood by the Probe (F-Stat) value. If this value is less than 0.1, the model is completely significant. Since the probe (F-Stat) = 0.0148 is output in the regression output, the model is completely meaningful. Since it is smaller than 0.05, the series is considered stationary. In this case, the existence of a long-term relationship between the dependent variable and independent variables can be mentioned. Estimated parameters are long-term parameters.

Pairwise Granger Causality Tests

Date: 10/06/19 Time: 09:50

Sample: 2000 2014

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DBUY does not Granger Cause DELEK	15	1.1137	0.1870
DELEK does not Granger Cause DBUY		6.2354	0.0148

In the model, Augmented Dickey Fuller Unit Root Stability Test was performed in case of false regression. Stability can be mentioned at 5% significance level.

ADF Unit Root test of electric consumption series; It was measured as -4.680001 at 1% level, -3.492317 at 5% level and -3,21048 at 10% level. The probability value was found to be 0.0354 and since this value is less than 0.05, the series is assumed to be stationary.

The ADF Unit Root test of the GDP series was measured as -4.786366 at 1%, -3.77705 at 5%, and -3,355547 at 10%. The probability value was found to be 0.0096 and since this value was less than 0.05, the series was assumed to be stationary and the first difference was taken.

In the Engle-Granger Causality test, the probability of electricity consumption was found to be less than 0.05 when it was considered to be the cause of GDP. Therefore, « H_0 = electricity consumption is not the cause of GDP », the hypothesis is rejected.

When we look at whether GDP is the cause of electricity consumption, it is concluded that since the probability value is 0.7209 and this value is greater than 0.05, GDP is not the cause of electricity consumption.

As a result, the correlation between the independent variable and the dependent variable was positive. From electricity consumption to GDP, a one-way causality has been identified.

4. Relationship between Electricity Use and Economic Growth

The relationship that can be established between the economic growth of countries and energy consumption can undoubtedly be established between the use of electricity and the increase in production capacity and the economic growth of countries.

Electrical energy, which is a secondary energy source obtained from renewable sources, is one of the most important factors in the economic growth of the countries in terms of being one of the inputs of the industry and being used widely in daily life.

Although the energy demand of OECD countries has increased by about 2% in the last decade, it is known that the world demand for electricity has been realized about 1 point above this figure.

According to the findings of the Annual Energy Outlook(2018), electricity production of OECD countries increased approximately twice in the last quarter-

century period. However, most of this increase is met by fossil fuels and nuclear energy. The share of electricity generation, which is one of the renewable energy sources, is around 20%. It is also noteworthy that the use of nuclear energy has more than doubled in the last twenty years. (Uçak, 2010: 56)

In OECD countries, economic growth was at an average of 2% per annum. As such, although the world and developing countries lagged behind the average, electricity production also lagged behind growth figures by about 1.5%.

A similar situation in terms of electricity production and consumption in Turkey is valid. As in the world, in our country, electrical energy is an important production input of many sectors. Economic growth depends on meeting the energy needs.

After 2011, in parallel with the increase in the demand for electricity, import method was applied mainly. Especially after 2009, with the change in Turkey's growth performance in economic growth between the ranking of world economies rise and show parallels to this situation, with electricity use is proof of the close relationship between economic growth.

Turkey is now using natural gas to obtain a significant portion of electricity needs. Considering that natural gas is also a non-renewable energy source, this situation is inevitable to change.

Turkey has been supplying a large portion of its energy needs with imports. There is a particular case with respect to the place of use of electrical energy used in industry. In industry, the amount of energy it consumes is relatively high compared to the value added it produces; iron and steel, aluminum, cement and paper. This is an issue that cannot be ignored in terms of energy density. (Uçak, 2010) In this respect, increasing energy efficiency is of great importance. Although developed countries, in particular, produce more with lower energy input, this is in contrast to the low intensity of advanced technology use in developing countries.

Turkey, in the long-term energy policy, energy efficiency, rather than the approach that ignores the priority is the safe and cost-effective approach to providing continuity of energy must change the prioritization approach.

In studies that show a strong relationship between electrical energy consumption and economic growth, the importance of energy efficiency and the relationship between economic growth is also emphasized.

In studies conducted in the last fifty year period, to Turkey and the countries of Latin America, a one-way causality between electricity consumption and economic growth it has been identified. (Altınay and Karagöl, 2005) In contrast, studies conducted for the same period for some countries called the Asian Tigers have found a bi-directional causality bond. (Yang, 2000)

5. Results

Although developed countries are moving towards renewable secondary energy sources along with energy efficiency, unfortunately developing countries do the opposite. They overlook the concepts of environment, ecological balance and sustainability in the production and supply of energy. The developing countries to

which Turkey is included in the energy supply issue, give importance to cheap supplies and continuity issues.

Nowadays, associating economic growth and development with consumption has become a trendy approach. In order to make consumption, the share of renewable energy sources or the energy sources obtained by using these sources should be increased. In this respect, dissemination of the use of electricity in industry for economic growth is important in terms of countries' economic growth targets.

In view of environmental threats, it has become a necessity to turn to renewable energy sources and / or secondary energy sources rather than to fossil sources. The use of electrical energy, which ranks first among these energy types, also maintains its importance as an indicator of development.

Today, the increase in the consumption of electricity, a secondary energy source from renewable energy sources, contributes to economic development as well as economic growth. It is indisputable that with the increase in electricity consumption, economic growth will increase and the industry will create more production and employment. In fact, the issue that needs to be addressed is not the fossil fuels, but the efficiency and sustainability of electricity production.

In this study, between 2014 and 2000 for Turkey, electricity was confirmed to be a close relationship between economic growth and the increase in use. Moreover, both Turkey and are a big part and all the time for power consumption of numerous academic studies showing that increased economic growth in parallel to increase the economic aspect with the similar profile countries and even almost world countries. According to the results of causality tests, total electricity consumption is the cause of growth between total electricity consumption and economic growth. In other words, the increase in electricity consumption contributes to the increase in growth, but no results can be obtained to confirm the opposite.

The expectation between the two variables is that electricity consumption increases while growth increases. The results were in line with the expectations.

It can be concluded that, as the electrical energy used increases especially during the production process, this will lead to an increase in production and increases in production will support economic growth.

Within the framework of many international legal regulations, energy choice plays an important role in the protection of ecological balance and selection of environmentally friendly production techniques. It should be recognized that, both during its production and use, electrical energy is a type of energy that is compatible with environmental sensitivities. The use of electrical energy in production and consumption is also of great importance in terms of leaving an intact environment for future generations.

However, the fact that energy production from renewable sources requires a high budget in terms of the initial establishment costs leads countries to fossil fuels, ignoring the environmental realities. This choice is a long-term goal of economic development and a strategic mistake in terms of sustainability.

Sustainable development and the move away from the environment without compromising sensitivity and world economic conjuncture we live in the real, to ensure economic growth, Turkey and all countries of the world, renewable energy sources or to turn to secondary sources of energy obtained from renewable energy sources and the industrialization perform in this perspective of great importance It is.

Turkey's economic growth and national income ranking among the world countries to be raised to a higher order, increase in the total consumption of electricity used in the country is a positive references towards achieving these goals.

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