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HOW DOES FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH AFFECT ENERGY CONSUMPTION; THE PANEL VAR ANALYSIS OF 5 TURK COUNTRIES

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Abstract

In this study, the linkage among energy consumption, financial development, foreign direct investments and economic growth in 5 Turkic countries (Turkey, Azerbaijan, Kazakhstan, Kyrgyz Republic and Tajikistan) were examined during the 1992-2017 observation period. Panel Var methodology was applied by using 3 different financial development indicators. According to analysis results, the increase in bank deposits, which is one of the financial development indicators, positively affects the energy demand, while the increase in private loans negatively affects the energy demand. On the other hand, energy consumption increases have a negative impact on financial development. When the economic growth and energy consumption relation are examined, the increase in energy consumption affects economic growth positively, foreign direct investment has an inverse relationship with energy consumption. The causality results suggest that there is two-way causality between energy consumption and all other variables except liquid liabilities, and there is one-way causality running from energy consumption to liquid liabilities. An increase in energy consumption, foreign direct investments and, liquid liabilities are the drivers of economic growth. However, although the increase in energy consumption has a positive effect on economic growth, it has a negative effect on financial development. Therefore, reducing foreign dependency and turning to renewable energy sources and energy-efficient technologies will reduce energy costs on the financial market and increase the welfare of the country in the long run.

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FİNANSAL GELİŞME VE EKONOMİK BÜYÜME, ENERJİ TÜKETİMİNİ NASIL ETKİLEMEKTEDİR; 5 TÜRK CUMHURİYETİ İÇİN PANEL VAR ANALİZİ

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Volkan HAN[2]

Öz

Bu çalışmada, beş Türk Cumhuriyeti için (Türkiye, Azerbaycan, Kazakistan, Kırgızistan ve Tacikitan) enerji tüketimi, finansal gelişme, doğrudan yabancı sermaye ve ekonomik büyüme değişkenleri arasındaki ilişki 1992-2017 dönemi verileri kullanılarak incelenmiştir. Çalışmada 5 Türk Cumhuriyetinde enerji tüketimini etkileyen değişkenleri incelemek amaçlanmıştır. Ekonomik büyüme, doğrudan yabancı sermaye yatırımı ile banka mevduatı, özel krediler ve likit yükümlülükler olmak üzere 3 farklı finansal gelişme indikatörü de kullanılarak Panel VAR metodu uygulanmıştır. Analiz sonuçlarına göre finansal gelişmenin göstergelerinden biri olan banka mevduatındaki artış enerji talebini olumlu etkilerken, özel kredilerdeki artış enerji talebini negatif etkilemektedir. Diğer taraftan enerji tüketimi artışı finansal gelişme üzerinde negatif bir etkiye sahiptir. Ekonomik büyüme enerji tüketimi ilişkisi incelendiğinde, enerji tüketimindeki artış ekonomik büyümeyi pozitif etkilerken, doğrudan yabancı sermaye yatırımları enerji tüketimi ile tersi bir ilişkiye sahiptir. Nedensellik sonuçları, enerji tüketimi ile likit yükümlülükler dışındaki tüm değişkenler arasında çift yönlü nedensel bir ilişkiyi desteklerken, enerji tüketiminden likit yükümlülüklere doğru tek yönlü bir nedensel ilişkiyi desteklemektedir. Enerji tüketimi, doğrudan yabancı sermaye yatırımı ve likit yükümlülüklerdeki artışlar ekonomik büyümenin itici gücüdür. Ama enerji tüketimindeki artış ekonomik büyümeyi olumlu etkilerken, finansal gelişmeyi olumsuz etkilemektedir. Bu yüzden dışa bağımlılığı azaltmak, yenilebilir enerji kaynaklarına ve enerji etkin teknolojilere yönelmek, finansal piyasalardaki enerji maliyetlerini azaltarak, kısa döneme nazaran uzun dönemde ülke refahını artıracak faktörlerdir.

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1. INTRODUCTION

Energy is a vital problem for countries all over the World. Therefore, it's a precious issue that to perfectly understand the factors which affect energy consumption (EC) in developing countries (Sadorsky, 2010). In energy literature there have been lots of studies that examined the economic growth (EG) and EC relationships with different methods, variables, periods, and country samples. The obtained results show differences. There is no consensus among researchers not only about the existence of a relationship but also about the causality between these variables.

Energy use determinants are also crucial in transitional economies. Transitional countries have similar characteristics as economic systems, financial development (FD) level, and production methods. Turkey is definitely not a transition country. However, within the framework of being a developing country and its close relations with these Turkish republics in Central Asia, a panel in the form of 5 Turk Countries was formed. All of these countries need much energy cause of the growing fast (Hussaini and Majid, 2015). International Energy Agency (IEA) reports that from 2010 to 2030 energy demand will grow nearly 1.7% and the energy demand of transitional countries will account for more than 30% of this.

The linkage between EC and FD is different from other countries due to the general characteristics of transition economies. These economies undertake regulatory reform in many areas like markets, international trade, wages, property laws in the transition period. In fact, they are changing the economic systems from centrally-planned to a market economy. To compare with the previous literature, we consider FD for 5 Turkish countries using 3 key variables, and also include foreign direct investment (FDI) and economic growth (EG) in this relationship.

To our knowledge, any studies don't examine these questions in the empirical literature that has researched the EC, FD, FDI, and EG relation and that accounts for both the simultaneous effects of these variables on EC. Hence, to fill these gaps, in this study, we used Panel VAR methodology to investigate these relationships in 5 Turk's Republics for the period 1992-2017. The aim of this study for these 5 developing countries which aims to grow fast, is to reveal the developments in energy consumption, in the process of economic growth and financial development by re-examining the linkage among EC, EG, FDI, bank deposits, liquid liabilities, and private loans.

This article is organized as follows. Chapter 2 contains the literature review, section 3 includes the model and methodology which used in the article. Chapter 4 presents the empirical results and discusses the main findings. In the conclusion part, the empirical findings obtained in the article and the literature are evaluated together and policy recommendations are provided.

2. LITERATURE REVIEW

The empirical literature which examined the relationship between EC and EG is large enough. Especially in developing countries, generally, EG is the main determinant of primary EC. On the other hand, providing EG also causes FD. Therefore, one country's FD level is likely to affect its energy demand (Sadorsky, 2011). Moreover, positive developments in basic macroeconomic variables, encourage FDI to reach this country. In the growth literature, the link between EG-EC and FD-EG and FD-EC are studied intensively.

The energy-growth relation can be categorized into four hypotheses (Ozturk, 2010; Narayan, 2016). First, is the growth hypothesis supporting that EC increases EG (Glasure and Le, 1997; Soytas ve Sarı, 2006; Masih and Masih, 2008; Lee and Chang, 2008; Chontanawat et al.

2008; Lean and Smyth, 2010). The second is the conservation hypothesis supporting that EC decreases do not affect EG (Narayan et al. 2010; Ozturk et al. 2010). The third is the feedback hypothesis support that two-way causality between variables (Tang, 2008; Belke et al. 2011; Islam et al. 2013). And the last is the neutrality hypothesis suggests that there is no causality between variables (Yu and Choi 1985; Narayan et al. 2008). Unlike the literature in this study, we will investigate the EC determinants for 5 Turk countries. There are certain factors that directly or indirectly affect the EC of countries. Determining the factors affecting the energy use of a country is important both in terms of energy policies and economic and financial development. Based on literature it can be said that EG and FD are the vital factors of EC affected by increasing economic efficiency because of affecting economic activity and also subsequently energy demand (Karanfil, 2009; Sadorsky 2010, 2011; Chang, 2015; Gaies et al., 2019).

In the literature, from the seminal work of King and Levine (1993) the analysis of the relationship between FD and EG has been done well enough. However for transition economies like Azerbaijan, Kyrgyzstan, Kazakhstan, Tajikistan, it had little attention to date, especially FD-EC and FD-EG relationship. FD includes increasing banking and financial activities in a country, accessing FDI and stock market activities, such as credit to the private sector that affects economic efficiency, economic activity, and energy demand. FD-EG linkage can be grouped in two patterns; supply-led and demand-led. Supply-led can explain with EG follows FD, and also for demand-led EG support FD with additional activity by financial resources and financial system (Djalilov and Piesse, 2011).

The EC and FD nexus can be explained in four different approaches. If there is one-way causality from FD to EC we can say FD increases EC in three ways (Zhang 2011; Aslan et al. 2014). First, the direct effect (because the energy-consuming goods will be more bought by people), second the business effect (if the number of businesses increases, the energy demand will also increase) and the third wealth effect (if economic confidence increases, it will lead to increase energy demand) (Sadorsky, 2011). But also in the second approach, modern technologies may be enhanced by FD and this can reduce energy demand with the help of using durable goods that consume less energy, and also in the production processes using energy-efficient technologies. In this way, FD can be supported while energy savings increase (Jalil and Feridun 2011; Mahalik and Mallick, 2014). In the third approach, the terms of EC and FD have bidirectional causality and lastly, in the fourth approach, no effect on EC is found by some studies (Ozturk and Acaravci, 2013; Coban and Topcu, 2013).

In existing literature there have been lots of studies that investigated the energy demand determinants with different methods, variables, periods and country sample. Table 1 shows that a little summary of these literature.

Table 1: A Summary of the Literature Reviews on the FD-EC-EG

Writers	Methodology	Time Range	Countries	Finding
Djalilov & Piesse (2011)	Granger causality	1992-2008	27 transition economies	There is negative effect FD-EG relationship.
Shahbaz & Lean (2012)	ARDL-VECM	1971-2008	Tunisia	There is an L-run relationship among EC, EG, FD, industrialization, and urbanization. L-run two-way causality found between FD and EC, FD and industrialization, industrialization and EC.
Islam et al. (2013)	ARLD-VECM	1971-2009	Malaysia	Both in the short and the long run EC is affected by EG and FD, but the population–energy relation holds only in the L-run.
Shahbaz et al. (2013a)	ARLD VECM	1975Q1–2011Q4	Indonesia	EG and EC increase CO2 emissions, while FD and trade openness compact it.
Shahbaz et al. (2013b)	ARDL Granger causality	1971–2011	China	Energy use, FD, capital and international trade have a positive impact on EG. Also bidirectional causality exists between capital and ED, FD and EG and, international trade and EG.
Shahbaz et al. (2013c)	ARLD ECM	1965–2008	South Africa	A rise in EG increases CO2, while FD decreases it. Trade openness supports environmental quality by reducing energy pollutants.
Komal & Abbas (2015)	GMM	1972-2012	Pakistan	FD has positive and significant effects on EC through the EG channel.
Gökmenoğlu & Taspinar (2016)	ARDL Toda Yamamoto causality test.	1974-2010	Turkey	EG, EC, and FDI are L-run determinants of air pollution.
Burakov & Freidin (2017)	VEC Approach	1990-2014	Russia	Results show no statistically significant causality.
Bekhet et al. (2017)	ARDL	1980-2011	Gulf countries	The results suggest L-run and causal relationships among CO2, FD, EG, and EU in all GCC countries but not in the United Arab Emirates.
Ouyang and Li (2018)	GMM Panel VAR	1966-2015	China	FD has a negative impact on EG, EC has a positive impact on EG, FD decrease EC
Khan et al. (2019)	SUR, 3SLS	1990-2017	193 Countries	FD and EG increases EC.
Eren et al. (2019)	DOLS Granger Causality	1971–2015	Indıa	The DOLS estimation shows the positive impacts of EG and FD on REC in the long run. Also, the Granger results show a unidirectional causal link that from FD to REC and GDP in the L-run.

Nasir et al. (2019)	DOLS FMOLS	1982-2014	ASEAN	FD, EG, and FDI have a statistically significant long-run co-integrating relationship with CO2 emissions.
Hao et al. (2020)	Granger Causality	1995-2014	29 Chinese province	The causality results show that EC is the cause of EG but FD is not the cause of EG.
Mukhtarov et al. (2020)	VECM	1993-2014	Kazakhstan	There is a positive impact of FD-EG on EC while there is a negative impact of energy prices on EC.

Table 1 suggests the incongruity in the literature about EC, EG, and FD relationship. Against existing literature empirical results, this paper will contribute to the literature in the following ways. Firstly, tries to re-examine the linkage among EC, EG, FD, and FDI in 5 Turkish countries. Secondly, different from the previous studies, the Panel VAR method was used for the first time for this country sample. Undoubtedly, the findings of this study are more believable and have significant implications for policymaking.

3. DATA AND MODEL SPECIFICATION

The aim of this study is to re-examine the linkage among EC, EG, FDI, bank deposits, liquid liabilities, and private loans. Five Turkish countries (Turkey, Azerbaijan, Kazakhstan, Kyrgyz Republic, and Tajikistan) were examined during the 1992-2017 observation period. In the study, all variables are used with their natural logarithm. The variables and sources used in the analysis are given in Table 2.

Table 2: Variable Description and Sources

Abbreviation		**Indicator Name**	**Measurement scale**	**Source**
Economic Growth		GDP per capita	Constant 2010 US$	WB-WDI
EC		Energy use	Kg of oil equivalent per capita	WB-WDI
FDI		Foreign direct investment	Net inflows (BoP, current US$)	WB-WDI
Banking Sector Development Indicator (FD)	Deposıt	Deposit money bank assets	% of GDP	WB-FDSD
	Liquid	Liquid liabilities	% of GDP	WB-FDSD
	Private	Private credit by deposit money banks	% of GDP	WB-FDSD

The panel empirical model used is reported in Eq.1:

$$EC_{it} = \gamma_0 + \gamma_1 gdp_{it} + \gamma_2 fdi_{it} + \gamma_3 prıvate_{it} + \gamma_4 deposit_{it} + \gamma_5 liquid_{it} + \mu_{it} \quad (1)$$

In Eq. 1, i and t point out the country group (five countries) and the observation range (1992-2017), respectively. Each γ represents the slope coefficient of the corresponding variable and finally μ_{it} indicates the estimation residual. The dependent variable in the model is energy consumption (EC). The independent variables are; growth (gdp), foreign investments (fdi), credibility (credit), deposit and liquidity.

4. EMPIRICAL RESULTS

The starting point of the study is the investigation of the unit root stationary of variables. Table 3 shows the stationary of 6 variables at the first difference using the unit root analysis method developed by Im-Pesaran-Shın (2003) (IPS). After determining the stationary of all variables, the second phase of the application can be reached.

Table 3: Unit Root Test Results.

Variables	IPS (L.)		IPS (1.DF)	
	Trend	No Trend	Trend	No Trend
EC	-1.9870**	-3.6564***	-4.0026***	-5.2288***
Gdp	-0.9053	-3.4438***	-6.8626***	-6.8236***
Fdi	-0.2047	-1.0802	-2.9796***	-4.3018***
Deposit	0.1679	-0.3268	-2.7488***	-3.7558***
Liquid	0.3336	-0.1649	-4.2747***	-5.2339***
Prıvate	-1.2418	-2.2611**	-3.7684***	-5.4524***
Statistical significance: ***=1%, **=5% and *=10%.				

Table 4 is intended to determine the optimal delay to be used in the analysis. The delay with which the MBIC, MAIC, and MQIC values are the smallest shows the most appropriate latency. Accordingly, the first delay in PVAR application is the most optimal.

Table 4: Panel VAR Lag Order Selection

Lag	**CD**	**J**	**J pvalue**	**MBIC**	**MAIC**	**MQIC**
1	0.9520885	92.61717	0.0818742	-263.2527	-57.38283	-140.9444
2	0.9640246	54.74166	0.2993831	-182.5049	-45.25834	-100.966
3	0.7069202	21.35273	0.6727854	-97.27057	-28.64727	-56.50112

After determining the most appropriate delay, PVAR regression analysis can be started. The PVAR method is an improved version of the standard VAR implementation. The first VAR model applied by Sims (1980) was used by Holtz-Eakin, Newey, and Rosen (1988) in macroeconomic multi-panel groups. The first PVAR model we use today was created by Love and Zicchino (2006) and was finalized by Abrigo and Inessa Love (2016). Generally, the PVAR equation is as follows;

$$H_{it} = H_{it-1}P_1 + H_{it-2}P_2 + H_{it-3}P_3 + ... + H_{it-a+1}P_{a-1} + H_{it-a}P_a + K_{it}M + u_i + e_{it} \quad (2)$$

Equation 2 H_{it} expresses the vectors of the dependent variables to be used in the analysis. K_{it} is a vector of exogenous covariates. u_i is vectors of dependent variable-specific panel fixed-effects. e_{it} is idiosyncratic errors. P and M are parameters to be estimated (Abrigo and Inessa Love, 2016).

Table 5 shows PVAR regression results. Variables on the horizontal axis express dependent variables (EC, GDP, Fdi, Deposit, Liquid and Private), while values on the vertical axis indicate delayed and descriptive variables (L.EC, L.GDP, L.Fdi, L.Deposit, L.Liquid and L.Private). In addition, the results of the Panel Var methodology (GMM) are tabulated in a way that allows all variables to be included as dependent and independent. Therefore, a single model has been established and it is seen what effect it has on other variables besides financial development indicators on energy consumption. Therefore, the main purpose of the study is to express the variables affecting energy consumption, a single model was created.

Table 5: Panel VAR Model Regression Results (GMM Style)

	EC	**GDP**	**Fdi**	**deposit**	**liquid**	**Prıvate**
L.EC	-.015178 (0.008)***	.0053078 (0.040)**	-.255855 (0.000)***	-.2976285 (0.000)***	-.349857 (0.000)***	-.2011433 (0.000)***
L.GDP	-1.11901 (0.000)***	.8712699 (0.000)***	-12.40629 (0.000)***	-2.234146 (0.000)***	-.5272848 (0.018)**	1.760742 (0.000)***
L.Fdi	-.0362119 (0.000)***	.002844 (0.004)***	-.2917252 (0.000)***	.1110027 (0.000)***	-.0002942 (0.981)	.1140071 (0.000)***
L. deposit	2.559932 (0.000)***	-.0045086 (0.620)	-.6395779 (0.009)***	-1.244034 (0.000)***	.1670284 (0.004)***	-8046892 (0.000)***
L. liquid	.0445226 (0.137)	.044522 (0.000)***	.5271971 (0.000)***	1.822036 (0.000)***	.1875195 (0.006)***	1.204718 (0.000)***
L.prıvate	-.3791386 (0.000)***	-.0324745 (0.014)**	-.3440623 (0.202)	.2837054 (0.011)**	-.3690786 (0.000)***	-.2701677 (0.001)***
Statistical significance**:** ***=1%, **=5% and *=10%.						

When the VAR results for the five Turkish countries (Turkey, Azerbaijan, Kazakhstan, Kyrgyz Republic, and Tajikistan) are analyzed, for the EC equation, the results reported show that GDP, FDI, deposit, and private credits are statistically significant for the selected countries. According to this, when the assets (deposit) and private loans (private) of deposit banks, which are considered as FD indicators, are evaluated, the increase in the assets of deposit banks increases EC similar to Sadorsky (2010, 2011), Shahbaz and Lean (2012), Coban and Topcu (2013), Tang and Tan (2014) Islam et al. (2013) and Mukhtarov et al. (2020). But if the private loans given by banks increase EC decreases. In addition, the Var results show that the increase in EC positively affects

EG under the growth hypothesis (Glasure and Le, 1997; Soytas ve Sarı, 2006; Masih and Masih, 2008; Lee and Chang, 2008; Chontanawat et al. 2008; Lean and Smyth, 2010). On the other hand, increasing EG reduces EC. There is a negative relationship between FDI and EC. An increase in FDI reduces EC, while an increase in EC reduces FDI. Experiencing EG increases private loans. This positive development reduces EC. We can deduce from this that the EG of countries depends on private loans and EG enables them to turn to technologies that will save EC. The increase in private loans given by deposit banks negatively affects EC, EG and FDI. The increase in liquid liabilities has a positive effect on EG, and FDI. The increase in financial system deposits increases energy demand and negatively affects foreign investments. Basically, an increase in EC increases EG, but EG reduces the energy demand. This, of course, can be explained by turning to alternative energy sources. Finally, the increase in EC negatively affects FDI. After the regression analysis, the causal relationship between variables should be investigated. The Panel Granger causality models have been estimated in a GMM framework. Table 6 shows the causal relationships.

Table 6: Panel Granger Causality Test Results

	EC	**gdp**	**fdi**	**deposit**	**liquid**	**Prıvate**
EC		4.238 (0.040)**	56.939 (0.000)***	35.398 (0.000)***	104.250 (0.000)***	22.512 (0.000)***
gdp	83.311 (0.000)***		211.389 (0.000)***	37.343 (0.000)***	5.623 (0.018)**	56.325 (0.000)***
fdi	27.147 (0.000)***	8.123 (0.004)***		98.488 (0.000)***	0.001 (0.981)	229.549 (0.000)***
deposit	130.838 (0.000)***	0.247 (0.620)	6.913 (0.009)***		8.494 (0.004)***	464.665 (0.000)***
liquid	2.211 (0.137)	91.247 (0.000)***	15.679 (0.000)***	316.023 (0.000)***		304.326 (0.000)***
Prıvate	43.328 (0.000)***	6.086 (0.014)**	1.626 (0.202)	6.490 (0.011)**	20.443 (0.000)***	

*** and ** denotes 1% and 5% statistically significance level, respectively.
Ho: Excluded variable does not Granger-cause Equation variable

According to Table 6, there is bidirectional causality between EC and all selected variables except Liquid. Only liquid liabilities are not the cause of EC, while EC is found to be the cause of liquid. EG is the cause of FDI, EC, and FD. The causality results show that the feedback hypothesis is valid for the EC-EG relationship (Tang, 2008; Belke et al. 2011; Islam et al. 2013). Following the regression and causality investigation, the validity of the PVAR application should be checked. Figure 1 shows the PVAR stationarity.

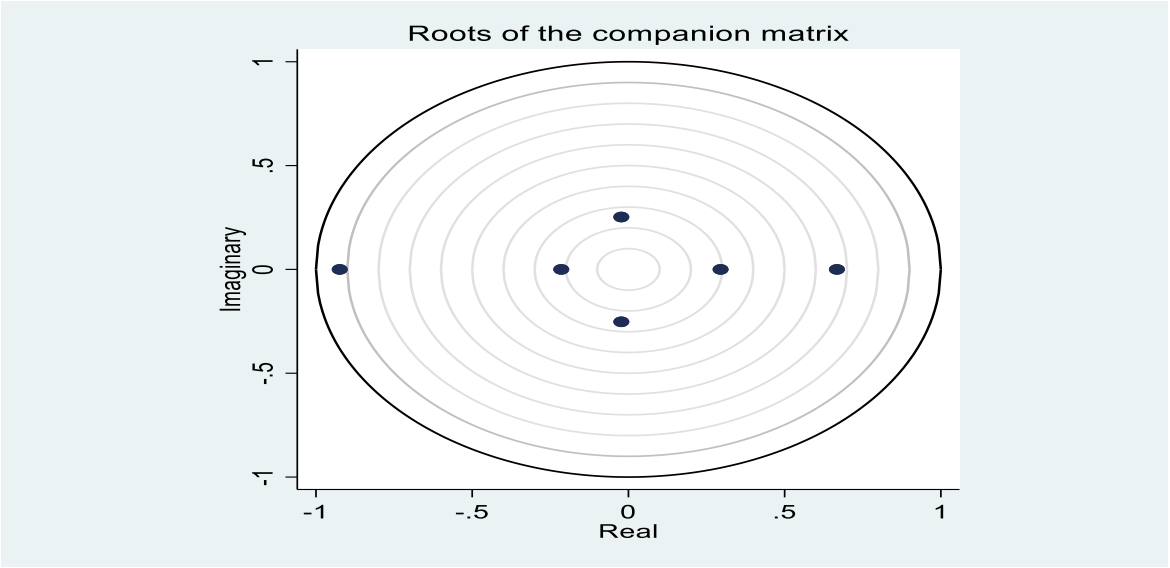

Figure 1: Roots of Companion Matrix.

Figure 1 shows PVAR application stationary. Six variables are shown as a point. At this stage, all expected points are in the circle. As seen in Figure 1, although all points are inside the circle, the stability of the PVAR analysis emerges. Figure 2 is impulse-response analysis, a medium-term timely analysis of variables. These results, shown as shapes, show the state of the variables affecting each other in the medium term and the state of return to its original state.

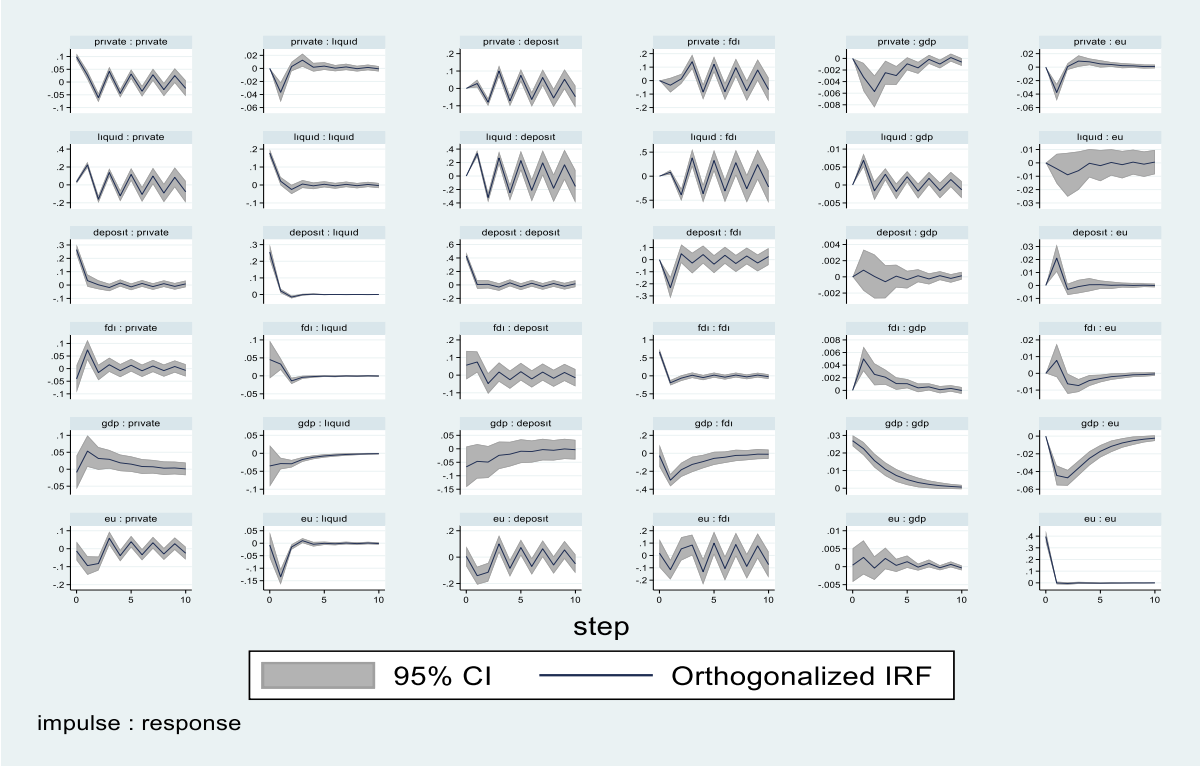

Figure 2: Impulse-Response Graph.

According to this, private credit, liquid, and economic growth are first negatively affected against shocks and then stabilize in the long run. But FDI and deposits are affected positively before shocks and then stabilize in the long run. Table 7 indicates the variance decomposition formed from the average variable variances of the variables. This analysis shows how affected variables are by shocks in themselves and the variability of other variables. This analysis also shows how much variables affect themselves and other variables with shocks.

Table 7: Variance Decomposition

EC (Response)	**Impulse**					
Forecast horizon (years)	**EC**	**gdp**	**fdi**	**Deposıt**	**Lıguıd**	**prıvate**
0	0	0	0	0	0	0
1	1	0	0	0	0	0
2	.9757742	.0122547	.0003719	.0027518	.0001182	.0087292
3	.9617733	.0256438	.0006045	.0027692	.0006027	.0086066
4	.9531776	.0333299	.000921	.0027491	.0008023	.0090201
5	.9490887	.0369867	.0010269	.0027392	.0007994	.0093591
6	.947199	.0386798	.0010819	.0027356	.000823	.0094806
7	.9463295	.0394455	.0011041	.0027332	.008228	.009565
8	.9459375	.0397901	.0011166	.0027325	.0008332	.0095898
9	.9457589	.0399431	.0011207	.02732	.000835	.0096103
10	.9456784	.0400118	.0011235	.02732	.0008405	.009614

Table 7 shows that EC affects itself in a decreasing way over 10 - years. This suggests that EC is more affected by shocks from other variables than it is. EG affects EC by an average of 4% at the end of 10 years. After the GDP variable, the other variable that most describes EC appears as bank deposits.

5. CONCLUSION

This study aims to investigate variables that affect EC in five Turk economies. For this purpose, EG, FDI, deposits, liquidity, and private credit variables have been used as arguments. In this study, the 1992-2017 observation period was examined by the PVAR method. In addition, the causality among the variables was investigated.

According to the results of the Panel VAR analysis, a significant linkage was found between two FD variables and energy demand. The increase in deposit bank assets provides an increase in funds, which positively affects FD and energy demand. On the other hand, when private loans are evaluated, the increase in loans given by banks reduces the energy demand. When the relationship between EG and EC is examined, it is seen that an increase in EC affects EG positively, but the increase in economic growth reduces EC. The causality results support the panel var results and show that the two-way causality for the EC-EG relationship. Therefore, we can say that EC is the driving force of growth and that EG provides energy savings by increasing energy efficiency.

The increase in private loans given by deposit banks negatively affects bank liquidity, EC, EG, and FDI. According to this result, we can say that if the credit mechanism is not tightly controlled and credits are not distributed effectively, it will adversely affect the economy. The increase in liquidity has a positive effect on EG and FDI. The increase in bank asset deposits, on the other hand, affects energy demand positively, while negatively affecting FDI. Basically, an increase in EC increases EG, but EG reduces the EC. This can be explained by turning to alternative energy sources. Finally, the increase in EC negatively affects FD. This shows the negative impact of high energy costs on FD. If less EC can be supported by higher efficiency, it can be expected to support FD and thus not lead to a reduction in EG. This will contribute positively to the ecological quality of the environment. Liquidity positively affects growth, as expected. As a result, liquidity could have a more positive impact on EG and FDI in these five countries if efficiency in EC is achieved.

The results highlight the necessity of executing tight monetary policy in the selected country sample. Increasing EC, FDI and liquid liabilities are the drivers of EG. However, although the increase in EC has a positive effect on EG, it has a negative effect on FD. Therefore, turning to renewable energy sources by reducing foreign dependency and turning to technologies that will save EC will reduce energy costs that put pressure on the financial market and increase the welfare of the country in the long run.

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EXTENDED ABSTRACT

Energy is a vital problem for countries all over the World. Therefore, it's a precious issue that to perfectly understand the factors which affect energy consumption (EC) in developing countries (Sadorsky, 2010). In energy literature, there have been lots of studies that examined the EC determinants with different methods, variables, periods, and country samples. One of the factors is financial development (FD) to increase economic efficiency because of affects economic activity and also subsequently energy demand (Karanfil, 2009; Sadorsky 2010, 2011; Chang, 2015; Gaies et al., 2019).

Energy use determinants are also crucial in transitional economies. Transitional countries have similar characteristics as economic systems, FD level, and production methods. These countries need much energy cause of the growing fast (Hussaini and Majid, 2015). Energy and International Energy Agency (IEA) report that from 2010 to 2030 energy demand will grow nearly 1.7% and the energy demand of transitional countries will account for more than 30% of this.

The linkage between EC and FD is different from other countries due to the general characteristics of transition economies. These economies undertake regulatory reform in many areas like markets, international trade, wages, property laws in the transition period. In fact, they are changing the economic systems from centrally-planned to a market economy. To compare with the previous literature, we consider FD for 5 Turkish countries using 3 key variables, and also include foreign direct investment (FDI) and economic growth (EG) in this relationship.

To our knowledge, any studies don't examine these questions in the empirical literature that has researched the EC, FD, FDI, and EG relation and that accounts for both the simultaneous effects of these variables on EG. Hence, to fill these gaps, in this study, we used Panel VAR methodology to investigate these relationships in 5 Turkish Republics for the period 1992-2017.

Especially in developing countries, generally, EG is the main determinant of primary EC. On the other hand, providing EG also causes FD. Therefore, one country's FD level is likely to affect its energy demand (Sadorsky, 2011). Moreover, positive developments in basic macroeconomic variables, encourage FDI to reach this country. In the growth literature, the link between EG-EC and FD-EG and FD-EC are studied intensively.

The EC and FD nexus can be explained in four different approaches. If there is one-way causality from FD to EC we can say FD increases EC in three ways (Zhang 2011; Aslan et al. 2014). First, the direct effect (because the energy-consuming goods will be more bought by people), second the business effect (if the number of businesses increases, the energy demand will also increase) and the third wealth effect (if economic confidence increases, it will lead to increase energy demand) (Sadorsky, 2011). But also in the second approach, modern technologies may be enhanced by FD and this can reduce energy demand with the help of using durable goods that consume less energy, and also in the production processes using energy-efficient technologies. In this way, FD can be supported while energy savings increase (Jalil and Feridun 2011; Mahalik and Mallick, 2014). In the third approach, the terms of EC and FD have bidirectional causality and lastly, in the fourth approach, no effect on EC is found by some studies (Ozturk and Acaravci, 2013; Coban and Topcu, 2013).

This study aims to investigate variables that affect EC in five Turk economies. For this purpose, EG, FDI, deposits, liquidity, and private credit variables have been used as arguments. In this study, the 1992-2017 observation period was examined by the PVAR method. In addition, the causality among the variables was investigated.

According to the results of the panel var analysis, a significant linkage was found between two FD variables and energy demand. The increase in deposit bank assets provides an increase in funds, which positively affects FD and energy demand. On the other hand, when private loans are evaluated, the increase in loans given by banks reduces the energy demand. When the relationship between EG and EC is examined, it is seen that an increase in EC affects EG positively, but the increase in economic growth reduces EC. The causality results support the panel var results and show that the two-way causality for the EC-EG relationship. Therefore, we can say that EC is the driving force of growth and that EG provides energy savings by increasing energy efficiency.

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The results highlight the necessity of executing tight monetary policy in the selected country sample. Increasing EC, FDI, and liquid liabilities are the drivers of EG. However, although the increase in EC has a positive effect on EG, it has a negative effect on FD. Therefore, turning to renewable energy sources by reducing foreign dependency and turning to technologies that will save EC will reduce energy costs that put pressure on the financial market and increase the welfare of the country in the long run.

This article is organized as follows. Chapter 2 contains the literature review, section 3 includes the model and methodology which used in the article. Chapter 4 presents the empirical results and discusses the main findings.